Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	HINDI I
Course Code	AEC II (T)

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Ability Enhancement Courses							
Pre-Requisite/s	हिंदी भाषा का मूल गया ज्ञान होना आवश्यक है			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** संपर्क भाषा के रूप में हिंदी को समझना। सांस्कृतिक, एवं राष्ट्रिय एकता बनाये रखना भाषा के माध्यम से संम्भव है। पाठ्यक्रम में व्याकरण ,एवं लेखन परम्परा का बोध करना **(BL1-Remember)** **CO2-** ज्ञान को अर्थपूर्णता देने में भाषा एक सशक्त आधार है।**(BL2-Understand)** **CO3-** छात्र , भाषा को सुन कर अर्थ ग्रहण कर सकें ,शुद्ध -स्पष्ट लिख सकें एवं वक्ता के मनोभावों को समझकर भावानुभूति कर सकें। **(BL3-Apply)** **CO4-** हिंदी भाषा एवं नैतिक मूल्यों को समझना।**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
I	स्वतंत्रता पुकारती {कविता} ---जयशंकर प्रसाद पुष्प की अभिलाषा {कविता} --- माखनलाल चतुर्वेदी वाक्य संरचना और अशुद्धियाँ {संकलित }	lecture method, group discussion, story telling,	8
II	एक थे राजा भोज { निबंध } --त्रिभुवननाथ शुक्ल २ पर्यायवाची , विलोम , एकार्थी ,अनेकार्थी एवं शब्दयुग्म शब्द {संकलित } ३ वह तोड़ती पत्थर -सूर्यकान्त त्रिपाठी निराला ४ वर्ण -विचार {स्वर ,व्यंजन ,वर्गीकरण ,उच्चारण स्थान }	lecture method, group discussion, story telling, role play	6
III	१ भगवान् बुद्ध} { निबंध } ---स्वामी विवेकानंद २ लोकतंत्र एक धर्म है{ निबंध --डॉ सर्वपल्ली राधा कृष्णन ३ पल्लवन	lecture method, group discussion, story telling, role play	6
IV	अफसर{ निबंध -शरद जोशी २ संक्षेपण {संकलित } ३ नारीत्व का अभिशाप ४ विराम -चिह्न {संकलित }	lecture method, group discussion, story telling, role play	6
V	नैतिक मूल्य परिचय एवं वर्गीकरण{ आलेख } --डॉ शशि राय २ अंतर्ज्ञान और नैतिक जीवन{लेख --डॉ सर्वपल्ली राधाक ३ अप्प दीपोभव {लेख } -स्वामी श्रद्धा	lecture method, group discussion, story telling, role play	6

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	हिंदी भाषा और नैतिक मूल्य : मध्य प्रदेश शासन
Articles	https://www.cvs.edu.in/upload/IMG-20200323-WA0003.pdf
References Books	
MOOC Courses	https://onlinecourses.swayam2.ac.in/cec20_lg05/preview
Videos	https://onlinecourses.swayam2.ac.in/cec20_lg05/preview

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	2	2	-	-	-	-	-	-	-	-	2	-
CO2	2	3	1	2	2	-	-	-	-	-	-	-	-	2	-
CO3	2	2	1	1	1	-	-	-	-	-	-	-	-	2	-
CO4	1	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO5	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Analytical Chemistry
Course Code	BSBT 203 (T)

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Interdisciplinary Minor							
Pre-Requisite/s	Knowledge of Fundamentals of Analytical Chemistry			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember basic concept and principle of analytical techniques**(BL1-Remember)** **CO2-** To understand the difference between the analytical techniques**(BL2-Understand)** **CO3-** To use/apply the basic statistical treatment of the analytical data for getting a correct result and analytical methods**(BL3-Apply)** **CO4-** To Analyse Qualitative and Quantitative aspects**(BL4-Analyze)** **CO5-** To Evaluate the data obtained from the analysis**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
Module 1	General purification techniques Purification of solid organic compounds, recrystallisation, use of miscible solvents, use of drying agents and their properties, sublimation. Purification of liquids. Different types of extraction: use of immiscible solvents solvent extraction, efficiency of extraction, selectivity of extraction, liquid phase and solid phase extraction systems, methods of extraction, applications. Chemical methods of purification and test of purity	Problem solving sessions, Experienced examples, Quizzes Summarizing, Leaving Questions Hand on Experience ,Tutorials	8
Module 2	Titrimetric Methods of Analysis General Introduction General principle. Types of titrations. Requirements for titrimetric Analysis. Concentration systems: Molarity, formality, normality, wt % ppm, milliequivalents and millimoles-problems Primary and secondary standards, criteria for primary standards, preparation of standard solutions, standardization of solutions. Limitation of volumetric analysis, end point, equivalence point	Learn by doing, Simulations/ Virtual labs, Videos	8
Module 3	Chromatography, Introduction, Principle of chromatography, Classifications of chromatography, Techniques of paper and column chromatography, Thin Layer Chromatography(TLC) Partition chromatography, Ion exchange chromatography	Tutorials, Virtual labs, Demonstrations, Experiments	8
Module 4	Thermal Analysis Thermal analytical methods, principle involved in thermogravimetric analysis differential gravimetric analysis and differential scanning calorimeter, discussion of various components with block diagram, characteristics of TG and DTA, Factors affecting TG, DTA and DSC Curves	Problem solving sessions, Expeienced examples,	8
Module 5	Evaluation and procession of analytical data, Precision and accuracy, Types of errors, Normal distribution curve, Standard deviation, Confidence limit, Graphical presentation of result-method of average, Method of linear list square, Significant figures, Statistical aid to hypothesis testing: t–test & F-test, Correlation coefficient, Rejection of data	. Problem solving sessions, Expeienced examples,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Complexometric titration	Experiments	BL3-Apply	4
VIII	Qualitative Analysis using Thin Layer Chromatography	PBL	BL4-Analyze	6
IX	Purification of sample by Crystallization technique	PBL	BL6-Create	7
IV	To determine the Percentage of Copper in copper alloy solution	Experiments	BL3-Apply	2
V	To determine the percentage of Chromium in chrome alloy	Experiments	BL3-Apply	2
VI	To purify the given sample Ammonium Chloride	Experiments	BL3-Apply	
VII	Qualitative Analysis using Paper, Chromatography	PBL	BL4-Analyze	6

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Y Anjaneyulu Textbook of Analytical Chemistry 2008
Articles	https://nptel.ac.in/courses/104105084
References Books	Skoog D.A. and West D.M. Saunders Fundamental of Analytical Chemistry Ninth Edition
MOOC Courses	https://nptel.ac.in/courses/104105084
Videos	https://nptel.ac.in/courses/104105084

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	3	2	1
CO3	3	1	-	2	-	-	-	-	-	-	-	-	1	1	2
CO4	2	3	-	-	-	-	-	-	-	-	-	-	1	1	2
CO5	2	2	-	-	-	-	-	-	-	-	-	-	2	2	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	NCC*
Course Code	BSBT 204 (T)

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					2	0	2	4
Course Type	Theory only							
Course Category	Generic Elective							
Pre-Requisite/s	Should be acquainted with the basics knowledge of General Awareness about Leadership Quality, Personality Development, Defense system etc.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Define thinking, reasoning, critical thinking and creative thinking. **(BL1-Remember)** **CO2-** To think critically about different life related issues.**(BL2-Understand)** **CO3-** Think divergently and will try to break functional fixedness.**(BL3-Apply)** **CO4-** Creatively in their real-life problems.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG5(Gender equality) SDG8(Decent work and economic growth)				

Part B

Modules	Contents	Pedagogy	Hours
Unit 1. Personality Development-I	Thinking- Meaning and Concept of thinking, Reasoning, Process of thinking. Critical Thinking- Meaning & concept of critical thinking, Features of critical thinking, Process of critical thinking.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 2. Personality Development-II	Creative thinking- Meaning & concept of creative thinking, Features of creative thinking, Process of creative thinking, levels of Creativity, Characteristics of creative person.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 3. Leadership Development-I	Leadership capsule. Important Leadership traits, Indicators of leadership and evaluation.	Whiteboard, PPT, Video Case Study, Project Based Activity, Application Based Activity	5
Unit 4. Leadership Development-II	Motivation- Meaning & concept, Types of motivation. Factors affecting motivation. Ethics and Honor codes.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 5. Social Service and Community Development	(i) Protection of Children & Women Safety. (ii) Road/Rail Safety. (iii) New Government Initiatives. (iv) Cyber and mobile Security Awareness.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	R Gupta ; NCC National Cadet Corps A, B & C Certificate Examination Book; Ramesh Publishing House, 2018.
Articles	https://indiancc.mygov.in/activity/snehahoro/article-on-ncc-camp-and-training/
References Books	Cadets training handbook common subjects (2017), D.G NCC Delhi-110030
MOOC Courses	
Videos	https://www.youtube.com/watch?v=N7nNupMdS6c

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Plant tissue culture
Course Code	BSBT 302 (T)

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Should be acquainted with the basic knowledge of plants, cell biology, botany and genetics.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To understand and recall the basic terms, techniques, historical landmarks of plant tissue culture**(BL1-Remember)** **CO2-** To prepare the plant tissue culture media using sterilization techniques for inoculation**(BL2-Understand)** **CO3-** To observe and differentiate the behavior of various explants towards the different types of nutrient media.**(BL4-Analyze)** **CO4-** To standardize the techniques and nutrient media for the growth and development of in vitro cultures.**(BL3-Apply)** **CO5-** To develop in vitro regenerated and transgenic plantlets using various tools and techniques of plant tissue culture.**(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
I	History: Important events and landmarks in the history of plant tissue culture. Introduction to cell and tissue culture, terms and definitions. Cellular Totipotency: Introduction cytodifferentiation, organ genic differentiation. Laboratory requirements and general techniques.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
II	Tissue culture media: Introduction, media constituents, types, selection, media preparation. Callus culture and its maintenance. Plant growth regulators. Cell and Suspension cultures, Somatic embryogenesis :Technique and application	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
III	Micropropagation in Plants, Acclimatization : Process and challenges. Haploid production:: Anther culture and embryo culture: Introduction, techniques, culture requirements and applications. Protoplast Culture: Protoplast isolation, culture and regeneration. Soma clonal Variation	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
IV	Somatic hybridization: technique and application.. Elicitors, Secondary metabolites and their production. Cryopreservation: technique and application	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
V	Plant cloning vectors and their applications. Agrobacterium mediated transformation in plants. Transgenic plants: technique and application. Application of plant tissue culture in agriculture and forestry. Concept of Intellectual property right (IPR)	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Plant tissue culture: Applications and commercial importance	Experiments	BL2-Understand	2
II	Laboratory design and set up of plant tissue culture unit.	Experiments	BL2-Understand	2
III	Preparation of culture media.	Experiments	BL3-Apply	2
IV	Surface sterilization, sealing of culture, sources of contamination and their check measures	Experiments	BL3-Apply	3
V	Sterilization of media and apparatus.	Experiments	BL3-Apply	2
VI	Collection and preparation of explants	Experiments	BL4-Analyze	2
VII	Preparation of MS media for the inoculation of seeds.	Experiments	BL3-Apply	2
VIII	To establish seeds cultures	PBL	BL6-Create	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Razdan M.K.;An Introduction to Plant Tissue Culture;3rd Edition Smith.R, Plant Tissue Culture: Techniques and Experiments. Academic Press, 2012
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7356144/ https://link.springer.com/article/10.1007/s11627-022-10301-9
References Books	Bhojwani.S.S & Razdan.M.K;Plant Tissue Culture; 5th Edition Kole, C., Michler, C., Abbott, A.G., Hall, T.C. (Eds.) Transgenic Crop Plants: Volume 1: Principles and Development. Springer. 2010. Kole, C., Michler, C., Abbott, A.G., Hall, T.C. (Eds.) Transgenic Crop Plants: Volume 2: Utilization and Biosafety. Springer. 2010.
MOOC Courses	https://nptel.ac.in/courses/102103016
Videos	https://nptel.ac.in/courses/102103016

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	-	2	2	-	-	-	2	-	-	1	1	1
CO2	3	3	2	2	2	2	-	-	-	2	-	-	1	-	3
CO3	3	1	1	-	1	1	-	-	-	-	-	-	3	2	3
CO4	2	2	-	2	1	1	-	-	-	-	-	-	2	3	3
CO5	3	2	-	2	1	-	-	-	-	-	-	-	2	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	NCC*
Course Code	BSBT 304 (T)

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					2	0	2	4
Course Type	Theory only							
Course Category	Generic Elective							
Pre-Requisite/s	Should be acquainted with the basics knowledge of General Awareness about Leadership Quality, Personality Development, Defense system etc			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Define thinking, reasoning, critical thinking and creative thinking.() **CO2-** To think critically about different life related issues.() **CO3-** Think divergently and will try to break functional fixedness.() **CO4-** Creatively in their real-life problems() **CO5-** Understand the organizations related to disaster management and Their functioning.() **CO6-** Appreciate the role of NCC cadets in disaster management.()							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✓	**SDG (Goals)**	SDG4(Quality education) SDG6(Clean water and sanitation) SDG13(Climate action) SDG15(Life on land)					

Part B

Modules	Contents	Pedagogy	Hours
Unit 1. Personality Development	(i) Group Discussions - Change your Mindset (ii) Public Speaking.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 2. Leadership Development	Case Studies – APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murthy.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 3. Disaster management	(i) Disaster Management Capsule. (ii) Organisation. (iii) Types of Disasters. (iv) Essential Services. (v) Assistance. (vi) Civil Defence Organisation.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 4. Border & Coastal Areas	History, Geography & Topography of Border/ Coastal Areas.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 5. Adventure	Adventure activities.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	R Gupta ; NCC National Cadet Corps A, B & C Certificate Examination Book; Ramesh Publishing House, 2018.
Articles	
References Books	Singh, Neeraj; A Hand Book of NCC; Kanti Prakashan Publisher
MOOC Courses	
Videos	https://www.youtube.com/watch?v=kvdDHFALpTw

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Genetic Engineering
Course Code	BSBT 401 (T)

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Student must have the detailed knowledge of Gene expression and hereditary information			**Co-Requisite/s**	Detailed study of genomics, proteomics and metabolomics tool			
Course Outcomes & Bloom's Level	**CO1-** To remember the role of all the enzymes used in the DNA editing**(BL1-Remember)** **CO2-** To understand the method of creating new molecules such as DNA & RNA**(BL2-Understand)** **CO3-** To understand the importance Nucleic acid editing tools**(BL2-Understand)** **CO4-** To evaluate the applications of in various fields such as research, Agriculture, Pharmaceutical industries**(BL5-Evaluate)** **CO5-** To apply the understanding of creation of new DNA , RNA & Protein and its use in different Fields.**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to gene cloning and its necessity: DNA modifying enzymes: Restriction enzymes (RE)- structure function and types, polymerase, kinases, ligase, alkaline phosphatase, exonuclease etc.. Cloning methods. linkers and adaptors.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Methods of introduction of DNA into living cells, E.coli, plant and animal cells, Genetic transformation in plants:Agrobacterium mediated transformation in plants,structure and features of Ti and Ri plasmids.Genomic libraries and cDNA libraries.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Cloning vectors: Plasmids and Bacteriophages, Phagemids, Cosmids, Artificial chromosomes (BAC and YAC) for E.coli, yeast. Strategies for identification of recombinant clones containing cloned genes: Nucleic acid hybridization, immune screening etc. Expression vectors for E.coli andYeast.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	Tools for RDT: Restriction mapping, Southern and northern blotting, Forensic application of biotechnology: DNA fingerprinting and its applications, forensic medicine Molecular Pharming: Application	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Applications of RDT, Production of recombinant protein (Insulin, Growth hormone), production of Recombinant vaccine. Golden rice, Artifical seed production, biofertilizers and biopesticide production GM crops and GM food	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Preparation of stock and buffer solutions for DNA isolation	Experiments	BL3-Apply	2
2	Isolation of DNA from yeast cells.	Experiments	BL3-Apply	2
3	Isolation of DNA from Plant cell.	Experiments	BL3-Apply	2
4	Isolation of plasmid DNA	Experiments	BL3-Apply	2
5	Agarose gel electrophoresis of Genomic DNA	Experiments	BL4-Analyze	2
6	Isolation of RNA	Experiments	BL4-Analyze	2
7	Quantification of DNA by spectrophotometer(260/280nm)	Experiments	BL4-Analyze	2
8	To isolate the Auxotrophic mutants from the mixed culture sample of Microorganism	PBL	BL5-Evaluate	3 days

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	TA Brown, Gene cloning 4 edition
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3078015/
References Books	James D watson.Molecular Biology Of gene, 4 edition
MOOC Courses	https://nptel.ac.in/courses/102103074
Videos	https://nptel.ac.in/courses/102103074

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	-	-	2	-	-	-	-	-	-	1	-	3
CO2	1	2	3	-	-	1	-	-	-	-	-	-	1	-	2
CO3	1	2	3	-	-	-	3	-	-	-	-	-	3	1	-
CO4	1	2	3	-	-	-	-	-	-	-	-	-	2	-	-
CO5	1	2	3	-	-	2	-	-	-	-	-	-	-	-	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Bioprocess Engineering
Course Code	BSBT 402 (P)

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	The student should have basic understanding of units, use of living organisms for the production of different metabolites			**Co-Requisite/s**	The student should have basic understanding of basic concepts of bioprocesses for the benefit of society			
Course Outcomes & Bloom's Level	**CO1-** The course prepares the student to understand the basic concepts of Bioprocess Engineering, its applications and future prospects.**(BL1-Remember)** **CO2-** The subject Bioprocess Engineering is designed for under graduate students of biotechnology for understanding of basic concepts of each and every division of the subject along with its applications in other fields. **(BL2-Understand)** **CO3-** The course aims to provide experimental basis, and to enable students to acquire a specialized knowledge and understanding.**(BL2-Understand)** **CO4-** The course aims to provide basis of analyzing the applications of Bioprocess Engineering in various fields of research and industries.**(BL3-Apply)** **CO5-** The course aims to provide basis of design, production and purification of bioproducts produced through research and in industries.**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕			**SDG (Goals)**	SDG4(Quality education)			

Part B

Modules	Contents	Pedagogy	Hours
Unit I	Units and dimensions: dimensional analysis, stiochiometric and composition relationship, Newton's law of viscosity and its measurement. Introduction to Bioprocess technology	Class room teaching (chalk-board), Power Point Presentations, Online Classes, Interactive Videos	8
Unit-II	Kinetics of microbial growth, death and product synthesis; Air and media sterilization, Types of bioreactor. Kinetics of batch and continuous reactor.	Class room teaching (chalk-board), Power Point Presentations, Online Classes, Interactive Videos	8
Unit-III	Transport phenomenon in biochemical engineering: Mass transfer, heat transfer, rheology Product recovery processes, centrifugation, chromatography, extraction process, crystallization, drying.	Class room teaching (chalk-board), Power Point Presentations, Online Classes, Interactive Videos	8
Unit-IV	Microbial Production of Vitamin B12, amino acids (Glutamic acid), Microbial production of Organic acids (Citric acid), solvents (Ethanol)	Class room teaching (chalk-board), Power Point Presentations, Online Classes, Interactive Videos	8
Unit-V	Aeration and agitation, Immobilization techniques and their applications, Microbial production of food-SCP, Product recovery processes.	Class room teaching (chalk-board), Power Point Presentations, Online Classes, Interactive Videos	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Media balancing experiments	Experiments	BL2-Understand	2
1	Isolation of industrially important microbes from the environment.	Experiments	BL3-Apply	2
3	Production of alcohol using different substrates and its downstream process	PBL	BL3-Apply	2
4	Microbial production of citric acid using Aspergillus niger	Experiments	BL3-Apply	2
5	Microbial production of acetic acid.	Experiments	BL3-Apply	2
6	9. Organic Solvent production	PBL	BL3-Apply	2
7	Microbial production of different biological products.	PBL	BL6-Create	30 days

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	Bioprocess Engg. Principles, P.M. Doran, Elsevier
Articles	https://www.frontiersin.org/journals/bioengineering-and-biotechnology/sections/bioprocess-engineering
References Books	Principles of Fermentation Technology, Peter F. Stanbury, Allan Whitaker, Stephen Hall, Pergamon.
MOOC Courses	https://nptel.ac.in/courses/102106022 https://nptel.ac.in/courses/102106048
Videos	https://nptel.ac.in/courses/102106022 https://nptel.ac.in/courses/102106048

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	-	-	-	1	1	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	1	1	-	-	-	-	-
CO3	1	1	-	-	-	-	-	-	1	1	-	-	-	-	-
CO4	1	2	-	-	-	-	-	-	1	2	-	-	-	-	-
CO5	1	2	-	-	-	-	-	-	1	2	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	1	2	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Bioprocess Engineering
Course Code	BSBT 402(T)

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Theory only							
Course Category	Disciplinary Major							
Pre-Requisite/s	The student should have basic understanding of units, use of living organisms for the production of different metabolites			**Co-Requisite/s**	The student should have basic understanding of basic concepts of bioprocesses for the benefit of society			
Course Outcomes & Bloom's Level	**CO1-** The course prepares the student to understand the basic concepts of Bioprocess Engineering, its applications and future prospects.**(BL1-Remember)** **CO2-** The subject Bioprocess Engineering is designed for under graduate students of biotechnology for understanding of basic concepts of each and every division of the subject along with its applications in other fields. **(BL2-Understand)** **CO3-** The course aims to provide experimental basis, and to enable students to acquire a specialized knowledge and understanding.**(BL2-Understand)** **CO4-** The course aims to provide basis of analyzing the applications of Bioprocess Engineering in various fields of research and industries.**(BL3-Apply)** **CO5-** The course aims to provide basis of design, production and purification of bioproducts produced through research and in industries.**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕			**SDG (Goals)**	SDG4(Quality education)			

Part B

Modules	Contents	Pedagogy	Hours
Unit I	Units and dimensions: dimensional analysis, stiochiometric and composition relationship, Newton's law of viscosity and its measurement. Introduction to Bioprocess technology	Class room teaching (chalk-board), Power Point Presentations, Online Classes, Interactive Videos	8
Unit-II	Kinetics of microbial growth, death and product synthesis; Air and media sterilization, Types of bioreactor. Kinetics of batch and continuous reactor.	Class room teaching (chalk-board), Power Point Presentations, Online Classes, Interactive Videos	8
Unit-III	Transport phenomenon in biochemical engineering: Mass transfer, heat transfer, rheology Product recovery processes, centrifugation, chromatography, extraction process, crystallization, drying.	Class room teaching (chalk-board), Power Point Presentations, Online Classes, Interactive Videos	8
Unit-IV	Microbial Production of Vitamin B12, amino acids (Glutamic acid), Microbial production of Organic acids (Citric acid), solvents (Ethanol)	Class room teaching (chalk-board), Power Point Presentations, Online Classes, Interactive Videos	8
Unit-V	Aeration and agitation, Immobilization techniques and their applications, Microbial production of food-SCP, Product recovery processes.	Class room teaching (chalk-board), Power Point Presentations, Online Classes, Interactive Videos	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Media balancing experiments	Experiments	BL2-Understand	2
1	Isolation of industrially important microbes from the environment.	Experiments	BL3-Apply	2
3	Production of alcohol using different substrates and its downstream process	PBL	BL3-Apply	2
4	Microbial production of citric acid using Aspergillus niger	Experiments	BL3-Apply	2
5	Microbial production of acetic acid.	Experiments	BL3-Apply	2
6	Organic Solvent production	PBL	BL3-Apply	2
7	Microbial production of different biological products.	PBL	BL6-Create	21 days

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Bioprocess Engg. Principles, P.M. Doran, Elsevier
Articles	https://www.frontiersin.org/journals/bioengineering-and-biotechnology/sections/bioprocess-engineering
References Books	Principles of Fermentation Technology, Peter F. Stanbury, Allan Whitaker, Stephen Hall, Pergamon.
MOOC Courses	https://nptel.ac.in/courses/102106022 https://nptel.ac.in/courses/102106048
Videos	https://nptel.ac.in/courses/102106022 https://nptel.ac.in/courses/102106048

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	-	-	-	1	1	-	-	1	2	-
CO2	2	1	-	-	-	-	-	-	1	1	-	-	1	2	-
CO3	1	1	-	-	-	-	-	-	1	1	-	-	2	1	-
CO4	1	2	-	-	-	-	-	-	1	2	-	-	1	2	-
CO5	1	2	-	-	-	-	-	-	1	2	-	-	1	2	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Enzymology
Course Code	BSBT 403 (T)

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Should be acquainted with the historical aspects and concepts of enzymes and catalysis			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Student will be able to learn the major classes of enzyme and their functions in the cell**(BL1-Remember)** **CO2-** Student will understand the role of co-enzyme cofactor in enzyme catalyzed reaction**(BL2-Understand)** **CO3-** Differentiate between equilibrium and steady state kinetics and analyzed simple kinetic data and estimate important parameter (Km. Vmax, Kcat etc); **(BL2-Understand)** **CO4-** To define and describe the properties of enzymes in and regulates biochemical pathways (inhibition, allosterism)**(BL3-Apply)** **CO5-** To analyze options for applying enzymes and their inhibitors in medicine and various industries**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
I	Introduction to enzymes. Historical aspect of enzymes. Chemical nature and properties of enzymes. Classification and nomenclature of enzymes. Enzyme Commission Number. Enzyme Models: Fischer's Lock and key and Koshland's Induced fit hypothesis. Factors affecting enzyme activity	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
II	Mechanism of enzyme action (active site, chemical modification) and regulation (Zymogens, Isozymes). Enzyme specificity, Coenzymes and Cofactors Allosterism: Allosteric regulation of enzymes, Enzyme catalysis	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
III	Enzyme Catalysis and types. Free energy of activation and effect of catalyst. Enzyme kinetics: Kinetics of enzyme catalysed Reactions: The Michaelis Menten Equation. Line Weaver Burk Plot. Significance of Km and Vmax	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
IV	Enzyme purification, Isolation of enzymes, Homogenization techniques. Purification and large-scale production of enzymes, Stable storage of enzymes.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
V	Immobilization of enzymes, Methods, Advantages and disadvantages. Applications of enzymes in food and beverage industries, leather industries, textile industries. Abzymes and Plastic enzymes	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9

<4d style="border: 1px solid black;">Internships

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	To understand the various enzymes present in the different types of fruits and vegetbales	Experiments	BL2-Understand	3
II	To analyses the effect of substrate concentration on the enzyme activity	Experiments	BL4-Analyze	2
III	To determine the effect of temperature on the reaction rate of peroxidase enzyme	Experiments	BL5-Evaluate	2
IV	To determine the effect of pH on the reaction rate of peroxidase enzyme.	Experiments	BL5-Evaluate	2
V	To prepare the standard curve of protein using Folin Lowry method	Experiments	BL6-Create	2
VI	Immobilization of yeast cells by gel entrapment method	Experiments	BL6-Create	2
VII	To assay the activity of Urease enzyme in the legumes.	Experiments	BL5-Evaluate	2
VIII	Isolation and immobilization of various enzymes from natural resources	BL5-Evaluate	45 days	

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Prasad.N.K ;Enzyme Technology: Pacemaker of Biotechnology;2nd Edition Palmer;Enzymes; Horwood Publishing Series. 2001
Articles	https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/enzyme-activity https://www.jbc.org/article/S0021-9258(20)34049-7/fulltext https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8169242/ https://pubs.acs.org/doi/10.1021/acsomega.2c07560
References Books	Biocatalysts and enzyme technology, Buchholz.K;Kasche.V, Bornscheuer.U.V, Published by Wiley-VCH, 2005. Wiseman, A: Handbook of Enzyme Biotechnology, 3rd Edition, Ellis Horwood Publication,2010 Buchholz.K;Kasche.V;Bornscheuer.U.T.;Biocatalysts and enzyme technology, Published by Wiley-VCH, 2005. Palmer.T; Enzymes: Biochemistry, Biotechnology, Clinical Chemistry ;Horwood Publishing House, Chichester, England, 2001. Bisswanger.H;Practical enzymology.. Wiley Publication. 2nd Edition, 2011
MOOC Courses	https://nptel.ac.in/courses/102103097
Videos	https://nptel.ac.in/courses/102103097

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	1	2	2	2	-	-	-	-	-	-	2	-	1
CO2	3	1	1	2	2	2	-	-	-	-	-	-	1	2	2
CO3	2	1	1	2	1	1	-	-	-	-	-	-	2	3	1
CO4	3	-	-	1	1	1	1	-	-	-	-	-	1	2	2
CO5	-	-	-	-	1	-	1	-	-	-	-	-	2	-	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	NCC*/MOOC*
Course Code	BSBT 404 (T)

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					2	0	2	4
Course Type	Theory only							
Course Category	Generic Elective							
Pre-Requisite/s	Should be acquainted with the basics knowledge of General Awareness about Leadership Quality, Personality Development, Defense system etc			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Develop the qualities of social skills.**()** **CO2-** Imbibe leadership qualities. **()** **CO3-** Be motivated to serve the nation by joining Armed forces. **()** **CO4-** Contribute in environmental awareness and conservation activities**()** **CO5-** Keep abreast of current affairs & general awareness.**()** **CO6-** Effectively contribute in managing disaster relief tasks**()**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✓	**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG6(Clean water and sanitation) SDG13(Climate action) SDG15(Life on land)					

Part B

Modules	Contents	Pedagogy	Hours
Unit 1. Personality Development	Group Discussions – Social Skills & Time management.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 2. Leadership Development	Case Studies – Case Studies – Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965 war.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 3. Disaster management	(i) Initiative Trg, Organising Skills. (ii) Dos and Don'ts. (iii) Natural Disasters. (iv) Man Made Disasters. (v) Fire Services and Fire Fighting.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit-4.Environmental Awareness	Adventure Environmental Awareness and Conservation, Local and global approaches to conserve nature.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 5. General Awareness & Armed Forces	General Awareness, Army, Navy, Air Force and Central Armed Police Forces.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	R Gupta ; NCC National Cadet Corps A, B & C Certificate Examination Book; Ramesh Publishing House, 2018.
Articles	https://indiancc.mygov.in/
References Books	Singh, Neeraj; A Hand Book of NCC; Kanti Prakashan Publisher Cadet training hand book specialised subjects (2017)
MOOC Courses	
Videos	https://www.youtube.com/watch?v=eBA5t4iepAA

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Bioinformatics
Course Code	BSBT 501 (T)

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Should be familiar with the basics of bioinformatics, its databases and search tools, types of sequence alignment, homology modeling and evolutionary prediction of sequences.			**Co-Requisite/s**	The subject bioinformatics is designed to under graduate students of biotechnology for understanding of basic concepts of computational tools, their designing, applications, and their uses in industry and research.			
Course Outcomes & Bloom's Level	**CO1-** The course prepares the student to understand the basic concepts of Bioinformatics, its applications and future prospects.**(BL1-Remember)** **CO2-** The course aims to provide experimental basis, and to enable students to acquire a specialized knowledge and understanding**(BL2-Understand)** **CO3-** The course aims to provide basis of analyzing the applications of Bioinformatics in various fields of research and industries.**(BL3-Apply)** **CO4-** To evaluate the analytical efficiency of each algorithm**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
Unit-I	Overview of Bioinformatics, divisions, scope, tasks and future prospects of bioinformatics, bioinformatics as multidisciplinary domain,	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
Unit-2	Databases and search tools: Types of Databases and their applications, National Centre for Biotechnology Information (NCBI), European Bioinformatics Institute (EBI), DNA Databank of Japan (DDBJ), PDB and SWISSPROT.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
Unit-3	Sequence alignment: Types of sequence alignment, Pairwise sequence alignment and its softwares, BLAST , Types and versions of BLAST, FASTA: Types and versions of FASTA	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
Unit-4	Matrices and algorithms: Dot matrix, BLOSUM, PAM, BLAST algorithm, Needlemann Wunsch algorithm, Smith Watermann algorithm, Fitch Margoliash algorithm.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
Unit-5	Multiple sequence alignment methods and its softwares, Phylogenetic prediction , Maximum parsimony method, Distance method, Maximum likelihood method	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Retrieval of DNA/ sequences from NCBI.	Experiments	BL2-Understand	2
8	Accessing protein sequence from NCBI	Experiments	BL4-Analyze	2
3.	Pairwise alignment and analysis of protein sequences using BLASTp software	Experiments	BL3-Apply	2
4.	Pairwise alignment and analysis of protein sequences using FASTA software	Experiments	BL3-Apply	2
5.	Alignment of protein sequences using dot matrix	Experiments	BL3-Apply	2
6.	Multiple sequence alignment and analysis of protein sequences using CLUSTALW software	Experiments	BL4-Analyze	2
7	Phyologenetic prediction of given set of sequences	Experiments	BL2-Understand	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Introduction to bioinformatics by Cynthia Gibas
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1122955/
References Books	Developing bioinformatics Skills: Hoomann H Rashidi
MOOC Courses	https://nptel.ac.in/courses/102106065 https://nptel.ac.in/courses/102106065
Videos	https://nptel.ac.in/courses/102106065 https://nptel.ac.in/courses/102106065

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	-	-	-	1	1	-	-	1	2	-
CO2	1	2	-	-	-	-	-	-	1	2	-	-	1	2	-
CO3	1	2	-	-	-	-	-	-	1	2	-	-	2	1	-
CO4	1	2	-	-	-	-	3	-	1	2	-	-	1	2	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Genomics & Proteomics
Course Code	BSBT 503 (T)

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Should be acquainted with basic knowledge of genes, genomes and proteins.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To understand the fundamentals of genes, chromosomes and DNA along with their organization in the cell.**(BL1-Remember)** **CO2-** To utilize the knowledge about major genome databases, Genome analysis, Comparative genomics & Functional genomics for the preparation of genomic libraries.**(BL2-Understand)** **CO3-** To analyze the various genes isolated from different samples for their specific characteristics using various techniques.**(BL3-Apply)** **CO4-** To amplify and detect the various genes in different samples for research and development.**(BL4-Analyze)** **CO5-** To develop a genome database or purify the protein in order to develop a specific product at the commercial level**(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕	**SDG (Goals)**	SDG4(Quality education)					

Part B

Modules	Contents	Pedagogy	Hours
I	Genome evolution and structure: Forward genetics and Reverse genetics. Genomics history, Types of genomes. Chromosomal models, Chromosome structure and organization of genome. Genome sequencing methods, Tools of genomics.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
II	Comparative Genomics: Orthologous and Paralogous genes, Speciation: Types and advantages, Genomic and c-DNA libraries, Selection and screening of gene library	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
III	Microarrays tools and analysis: Process and Application of Microarrays, DNA and RNA microarray and its differences, PCR and its variants, Real Time PCR: Probes and application, Genome annotation	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	10
IV	Genomics techniques and applications: Genetic and physical mapping: Introduction to molecular markers- Single nucleotide polymorphisms, RFLP, RAPD, AFLP, FISH for genome analysis, Human Genome Project, Pharmacogenomics: An introduction. DNA barcoding for rapid assessment of genetic diversity	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
V	Fundamentals of Proteomics: Proteomics Basics and 2D Gel Electrophoresis, Protein Identification and Analysis: Protein preparation and Separation, HRT, HART, MALDI-TOF: Instrumentation and applications	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	To understand the genome organization	Internships	BL2-Understand	2
XI	Molecualr characterization of a plant using RAPD Markers	Experiments	BL4-Analyze	1 month
VI	To isolate plasmid DNA using alkaline lysis method and Quick method and its visualization by agarose gel electrophoresis	Experiments	BL5-Evaluate	5
VII	To perform restriction digestion using kit and its visualization using agarose gel electrophoresis	Experiments	BL3-Apply	5
VIII	To perform Native -PAGE.	Experiments	BL3-Apply	6
IX	To perform SDS-PAGE	PBL	BL3-Apply	6
X	Comparitive analysis of genomes of various plants and preparation of phylogentic tree	PBL	BL4-Analyze	2 months

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Gupta.P.K. :Biotechnology and Genomics ;3rd Edition Mir.R.A. Shafi.S.M and Zargar.S.M.Principles of Genomics and Proteomics;.Elsevier;2023
Articles	https://www.frontiersin.org/articles/10.3389/fmed.2021.747333/full https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2952408/ https://www.tandfonline.com/doi/full/10.1080/13102818.2017.1400401
References Books	Twyman.R.M.;Principles of Proteomics;2nd Edition Ahmed;N;Microbial Genomics And Proteomics; 2016
MOOC Courses	https://nptel.ac.in/courses/102101072
Videos	https://nptel.ac.in/courses/102101072

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	1	2	2	2	-	-	-	-	-	-	2	-	1
CO2	3	1	1	2	2	2	-	-	-	-	-	-	1	1	2
CO3	2	1	1	2	1	-	2	-	-	-	-	-	3	2	1
CO4	3	1	2	1	1	-	1	-	-	-	-	-	1	3	2
CO5	1	-	-	-	1	-	1	-	-	-	-	-	2	2	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Animal Tissue Culture
Course Code	BSBT 601 (T)

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Student must be aware of cell,tissues, culture media for the in vitro regeneration of cell organs.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To understand the Animal tissue culture: and how does it interact with living and non-living molecules**(BL2-Understand)** **CO2-** To Understand media constituents and media formulation strategies for mamalian cell culture.**(BL2-Understand)** **CO3-** Develop basic aseptic skills for mammalian cell culture and their applications.**(BL3-Apply)** **CO4-** To Develop proficiency in mammalian cell culture and the maintenance of cell lines.**(BL3-Apply)** **CO5-** To Apply cell and molecular techniques to in vitro situations.**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
I	Introducción: History Cell culture enchiques, Equipment, and sterilization methodology. Introduction to animal cell cultures: Nutritional and physiological: Growth factors and growth parameters	Lecture methods, demonstrations, experiments, field visit, Activity based learning	8
II	Primary cell cultures, Establishment and maintenance of primary cell cultures of adherent and non-adherent cell lines, fibroblasts, endothelial cells, embryonic cell lines and stem cells. Organ culture: Methods, behavior of organ explants and utility of organ culture, whole embryo culture.	Lecture methods, demonstrations, experiments, field visit, Activity based learning, Project based learning	9
III	Secondary cell cultures, □Establishment and maintenance of secondary mammalian and insect cell lines, Characterization of cell lines, □Karyotyping, biochemical and genetic characterization of cell lines	Lecture methods, demonstrations, experiments, field visit, Activity based learning, Project based learning	8
IV	Production of the vaccine in animal cells: □use of Hybridoma for production of monoclonal antibodies.Cell cloning and selection. Transfection & transformation of cell. Commercial scale production of animal cells, stem and their application. Application of animal cell culture for in vitro testing of drugs; Testing of toxicity of environmental pollutants in cell.	Lecture methods, demonstrations, experiments, field visit, Activity based learning, Project based learning	9
V	Scale-up: Scale-up in suspension: Rotating chambers; Perfused suspension cultures; Fluidized bed reactors for suspension culture.Scale-up in monolayers: Multisurface propagators; Multiarray disks, spirals, and tubes; Roller culture; Microcarriers; Perfused monolayer cultures; Membrane perfusion; Hollow fiber perfusion; Matrix perfusion; Microencapsulation; Growth monitoring	Lecture methods, demonstrations, experiments, field visit, Activity based learning, Project based learning	9

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Introdcution to animal tissue culture lab.	Experiments	BL2-Understand	2
II	Prerparation of Hank's Balanace salt solution	Experiments	BL3-Apply	2
III	To culture the animal tissue in the prpeared media	Experiments	BL3-Apply	3
IV	To check the viability of the cell and count the cell number	Experiments	BL4-Analyze	3
V	Observation of polymorpho nuclear monocytes	Experiments	BL4-Analyze	2
VI	To perform skin grafting	Internships	BL6-Create	1 month
VII	To observed the various cell lines and tissues under culture media for its growth and development	PBL	BL4-Analyze	1 week

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Freshney, Wiley-Liss,Culture of Animal Cells,5th Edition-2005
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7325846/
References Books	Culture of Animal Cells: A Manual of Basic Technique (6th Edition) R. Ian Freshney. REQUIRED. It is in your best interest to bring this book or the required chapters to class.
MOOC Courses	https://nptel.ac.in/courses/102106081
Videos	https://nptel.ac.in/courses/102106081

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	3	-	2	2	3	-	-	-	-	-	1	2	2
CO2	2	2	1	1	3	2	-	-	-	-	-	-	-	3	2
CO3	3	2	-	1	3	2	1	-	-	-	-	2	1	1	1
CO4	1	1	1	1	1	1	3	-	-	-	-	-	2	3	2
CO5	1	1	2	1	1	1	3	-	-	-	-	-	2	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Nanobiotechnology
Course Code	BSBT 602 (T)

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Disciplinary Minor							
Pre-Requisite/s	student should have the knowledge of biochemical molecules and there extraction , DNA RNA attachment and structures			**Co-Requisite/s**	nanomaterials and there synthesis and nanoparticle synthesis			
Course Outcomes & Bloom's Level	**CO1-** To Remember the Basis and History of Nanobiotechnology**(BL1-Remember)** **CO2-** To understand and apply the working principles of nanostructures.**(BL2-Understand)** **CO3-** To apply the uses of nanostructures in Biological cells and its product**(BL3-Apply)** **CO4-** To identify the application of nanosystem**(BL4-Analyze)** **CO5-** To develop an biotechnological application in health, medicine & environment**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Development of nanobiotechnology - timelines and progress, overview. Fundamentals of Nanoscience & Nanotechnology Introduction, classifications and definition	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Types of nanomaterials and their classifications (1D, 2D and 3D) Nanocrystal, Nanoparticle, Nano tubes,Quantum dot, Quantum Wire and Quantum Well	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Properties & characterization of nanomaterials -Optical (UV-Vis/Fluorescence) X-ray diffraction Imaging and size (Electron microscopy, light scattering) Biosensors: different classes - molecular recognition elements, transducing elements.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	Applications of Nano-Materials in Biosystems Nanomaterials and Diagnostics/Drug Delivery. Biological nanoparticles production - plants and microbial. Nano materials and Toxicity Evaluation Cyto-toxicity, Geno-toxicity In vivo tests/assays etc.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Nanobiotechnological applications in health and disease - infectious and chronic. Nanobiotechnological applications in Environment and food - detection and mitigation.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Synthesis Methods of Nanomaterials	PBL	BL6-Create	1 week
II	Metal Nanoparticles : Synthesis of plasmonic silver nanoparticles	PBL	BL6-Create	1 week
III	Characterization of nanoparticles	Internships	BL4-Analyze	15 DAYS

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Tuan Vo-Dinh Nanotechnology in Biology and Medicine: Methods, Devices, and Applications. 4rd Edition
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9865684/
References Books	Christof M.Niemeyer, Chad A. Mirkin,Wiley VCH. 1 Nanobiotechnology: Concepts,Applications and Perspectives (2004) 3rd Edition 2. Chad A Mirkin and Christof M. Niemeyer (Eds), Wiley VCH. Nanobiotechnology - II more concepts and applications. (2007) 4rd Edition
MOOC Courses	https://nptel.ac.in/courses/118107015
Videos	https://nptel.ac.in/courses/118107015

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	1	-	-	-	-	-	-	-	2	-	3
CO2	1	2	3	2	2	2	1	-	-	-	-	-	1	2	3
CO3	1	2	3	2	-	2	1	-	-	-	-	-	2	3	3
CO4	1	2	3	3	2	1	-	-	-	-	-	-	1	3	3
CO5	1	2	-	3-	2	1	-	-	-	-	-	-	1	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Drug designing
Course Code	BSBT 701 (T)

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					2	0	1	3
Course Type	Embedded theory and lab							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	The students will be highly motivated to this branch of biotechnology and will be acquainted with the different drug design processes, strategies to design and develop some important industrial lead molecules.			**Co-Requisite/s**	The students should be familiar with the basics of drug design, its databases, softwares, strategies adopted for drug design as well as the different methods used for drug design			
Course Outcomes & Bloom's Level	**CO1-** The course prepares the student to understand the basic concepts of Drug Discovery**(BL1-Remember)** **CO2-** They understand the different CADD techniques and their applications**(BL2-Understand)** **CO3-** The course provides various strategies to design and develop new drug like molecules **(BL3-Apply)** **CO4-** They becom e aware about the working with molecular modeling softwares to design new drug molecules **(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
Unit-I	Introduction to Drug Discovery and Development: Stages of drug discovery and development Lead discovery and Analog Based Drug Design Rational approaches to lead discovery based on traditional medicine, Random screening, Non-random screening, serendipitous drug discovery, lead discovery based on drug metabolism, lead discovery based on clinical observation	lecture method, collaborative learning, Field visits, ABL	8
Unit-II	Quantitative Structure Activity Relationship (QSAR) SAR versus QSAR, History and development of QSAR, Types of physicochemical parameters, experimental and theoretical approaches for the determibation of physicochemical parameters such as partition coefficient. Hammet's substitution constant and Tafts steric constant , 3D QSAR approaches like COMFA and COMSIA	lecture method, collaborative learning, Field visits, ABL, softwares, PBL	8
Unit-III	Molecular Modeling and virtual screening techniques Virtual Screening techniques: Drug likeness screening, Concept of pharmacophore mapping and pharmacophore based Screening, Molecular docking: Rigid docking, flexible docking, manual docking, Docking based screening. De novo drug design.	lecture method, collaborative learning, Field visits, ABL, softwares, PBL	8
Unit-IV	Informatics & Methods in drug design Introduction to Bioinformatics, Chemoinformatics, ADME databases, chemical, biochemical and pharmaceutical databases	lecture method, collaborative learning, Field visits, ABL, softwares, PBL	8
Unit-V	Molecular Modeling: Introduction to molecular mechanics and quantum mechanics.Energy Minimization methods and Conformational Analysis, global conformational minima determination.	lecture method, collaborative learning, Field visits, ABL, softwares, PBL	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Stages of drug discovery	Case Study	BL2-Understand	2
2	Analog based drug design and its applications	Case Study	BL2-Understand	2
3	Quantitative structure activity relationship (QSAR)	Case Study	BL3-Apply	2
4	Methods of drug design	Case Study	BL3-Apply	2
5	Molecular modeling approaches	Case Study	BL3-Apply	2
6	Molecular Docking	Case Study	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	30
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	30

Part E

Books	1. Computational and structural approaches to drug discovery, Robert M Stroud and Janet.F Moore, RCS Publishers. 2. Introduction to Quantitative Drug Design by Y.C. Martin, CRC Press, Taylor & Francis group.
Articles	https://onlinecourses.niptel.ac.in
References Books	1. Drug Design by Ariens Volume 1 to 10, Academic Press, 1975, Elsevier Publishers. 2. Principles of Drug Design by Smith and Williams, CRC Press, Taylor & Francis. 3. The Organic Chemistry of the Drug Design and Drug action by Richard B. Silverman, Elsevier Publishers.
MOOC Courses	https://onlinecourses.niptel.ac.in https://nptel.ac.in/courses/102106070
Videos	https://nptel.ac.in/courses/102106070 https://onlinecourses.niptel.ac.in

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	-	-	-	-	-	-	-	-	-	-	1	2
CO2	1	2	2	1	-	-	-	-	-	-	-	-	-	1	1
CO3	1	1	2	2	-	-	-	-	-	-	-	-	-	3	1
CO4	1	2	1	2	-	-	-	-	-	-	-	-	-	2	2
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Research Methodology
Course Code	BSBT 702 (T)

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	Student should have some basic knowledge of statistics			**Co-Requisite/s**	Should have understanding of the basic concepts of different types of research and their purposes			
Course Outcomes & Bloom's Level	**CO1-** The course prepares the student to understand the basic concepts of Research Methodology, its applications in experimental design and future prospects.**(BL1-Remember)** **CO2-** The subject Research Methodology is designed for post graduate students of Biotechnology for describing the basic concepts of each and every division of the subject along with its applications in other fields.**(BL2-Understand)** **CO3-** The course aims to provide experimental basis, and to enable students to acquire a specialized knowledge and understanding of data and its applications in experimental verification**(BL2-Understand)** **CO4-** The course aims to provide basis of analyzing the applications of Research Methodology in various fields of research and industries.**(BL3-Apply)** **CO5-** The course aims to provide basis of experimental design, computer applications and use of statistical tools in research and industries.**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction: Definition of Research, Qualities of Researcher, Components of Research Problem, Various Steps in Scientific Research, Types of Research; Hypotheses Research Purposes - Research Design - Survey Research, Research Reports.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Data Collection: Sources of Data: Primary Data, Secondary Data; Procedure Questionnaire - Sampling Merits and Demerits - Experiments - Kinds - Procedure; Control Observation.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Introduction to Statistics - Probability Theories - Conditional Probability, Point and Interval Estimates of Means and Proportions; Hypothesis Tests, One Sample Test - Two Sample Tests / Chi-Square Test, t-test - Standard deviation.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	Statistical Applications: Analysis of Variance, Completely Randomized Design, Randomized Complete Block Design, Latin Square Design	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Report Writing, Computer application: Use of computers for preparing and presenting Documents. Appropriate Statistical and other relevant packages, internet .Use of MS-Office	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Steps in scientific research methodology	Case Study	BL2-Understand	2
2	Sampling process	Case Study	BL2-Understand	2
3	Developing Hypothesis	Case Study	BL2-Understand	2
4	Data collection	Case Study	BL3-Apply	2
5	Analysis of Variance	Case Study	BL3-Apply	2
6	Randomized Block Design	Case Study	BL4-Analyze	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	30
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	Research methodology, C. R. Kothari, 6th Edition
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5037945/
References Books	Research methodology, Panneerselvam, R., Prentice Hall of India, New Delhi
MOOC Courses	https://nptel.ac.in/courses/121106007
Videos	https://nptel.ac.in/courses/121106007

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	-	-	-	1	2	-	-	-	-	-
CO2	1	2	-	-	-	-	-	-	1	1	-	-	-	-	-
CO3	1	2	-	-	-	-	-	-	1	2	-	-	-	-	-
CO4	1	2	-	-	-	-	-	-	1	1	-	-	-	-	-
CO5	1	2	-	-	-	-	-	-	1	1	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	English II
Course Code	BSBT AEC III

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Ability Enhancement Courses							
Pre-Requisite/s	1.Basic Language Proficiency 2.Educational Background 3.Motivation and Willingness to Learn Time Commitment 4.Technology Proficiency			**Co-Requisite/s**	1.Communication Skills Workshop 2.Emotional Intelligence Training 3.Conflict Resolution Seminar 4.Leadership Development Program 5.Cross-Cultural Competency Training 6.CareerDevelopment Workshops			
Course Outcomes & Bloom's Level	**CO1-** Determine interpersonal skills and be an effective goal-oriented team player.**(BL1-Remember)** **CO2-** They will be able to analyze and improve their speaking ability in English both in terms of fluency and comprehensibility.**(BL2-Understand)** **CO3-** They will be able to evaluate themselves by giving oral presentations and will receive feedback on their performances.**(BL3-Apply)** **CO4-** They will be able to develop their reading speed and comprehension of academic articles.**(BL4-Analyze)** **CO5-** They will be able to compare their reading fluency skills.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**					

Part B

Modules	Contents	Pedagogy	Hours
Module 1	Unit I: Introduction: Theory of communication, types and modes of communication, effective communication, barriers of communication, strategies to overcome the barriers.	lecture methods, collaborative learning, videos,group discussions, debates	10
Module 2	Unit II: Professional Skills: Social skills - Small talks and leading the conversation, conducting debate and discussions, public speaking, public speech, presentation skills and meeting etiquettes, business communication, group discussion and interview skills, critical conversations.	lecture methods, collaborative learning, videos,group discussions, debates	6
Module 3	Unit III: Cross Cultural Communication: Contextual conversation, do's and don'ts of cross cultural communication, verbal and non verbal communication, bias and prejudice body language.	lecture methods, collaborative learning, videos,group discussions, debates	6
Module 4	Unit IV: Internet Etiquettes: Email writing, social media articles/ blogs, notes, memos, reports & proposal writing, writing letters, formal and informal. Self profiling: Making job resume/ CV, elevator pitch (3 minutes self- introduction during interviews), Twitter/ Face book bio.	lecture methods, collaborative learning, videos,group discussions, debates	6
Module 5	Unit V: Critical Thinking: • Where the Mind is without Fear - Rabindranath Tagore. • The Portrait of a Lady - Khushwant Singh. • On the Rule of the Road - AG Gardiner. • Cherry Tree - Ruskin Bond. • Close Reading, Comprehension, analysis and interpretation, paraphrasing and summary.	lecture methods, collaborative learning, videos,group discussions, debates	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Fluency in English - Part II, 2006, Oxford University Press. • Business English, 2008, Pearson Publication.
Articles	https://www.frontiersin.org/articles/10.3389/feduc.2019.00087/full https://www.cii.co.uk/media/6158020/a-useful-guide-to-swot-analysis.pdf http://www.mmmut.ac.in/News_content/35141tpnews_10142020.pdf
References Books	• Language, Literature and Creativity, 2013, Orient Blackswan. • John E Warriner, Harcourt, Brace, Jovanovich, Warriner's English Grammar and Composition: Complete Course, 1973.
MOOC Courses	https://www.edx.org/learn/leadership/catalyst-leading-with-effective-communication-inclusive-leadership-training?hs_analytics_source=referrals&utm_source=mooc.org&utm_medium=referral&utm_campaign=mooc.org-course-list https://www.edx.org/learn/writing/university-of-california-berkeley-academic-and-business-writing?hs_analytics_source=referrals&utm_source=mooc.org&utm_medium=referral&utm_campaign=mooc.org-course-list
Videos	https://www.youtube.com/watch?v=fq98P9N9Hbg https://www.youtube.com/watch?v=uA5YeqgsjmYhttps://www.youtube.com/watch?v=eBSeCp__xhI

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	1	2	3	-	-	3	2	-	2	3	2	2	-
CO2	-	2	2	3	-	2	-	2	3	-	-	-	-	-	-
CO3	2	-	3	-	2	2	2	3	2	-	-	-	-	2	1
CO4	2	-	3	-	2	-	3	-	2	-	3	2	-	2	3
CO5	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Hindi II
Course Code	BSBT AEC IV

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Ability Enhancement Courses							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** हिंदी भाषा एवं नैतिक मूल्यों को समझना**(BL1-Remember)** **CO2-** सांस्कृतिक ,एवं राष्ट्रिय एकता बनाये रखना भाषा के माध्यम से संम्भव है।**(BL2-Understand)** **CO3-** छात्र जीविकोपार्जन के लक्ष्यों का सहज संधान कर सके ।**(BL3-Apply)** **CO4-** पाठ्यक्रम में व्याकरण ,सामान्य तथा पारम्परिक साहित्य ,लोक कलाएं ,स्थापत्य एवं लेखन परम्परा का बोध करना एवं समग्र व्यक्तित्व का विकास करना है।**(BL2-Understand)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG3(Good health and well-being) SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	मध्य प्रदेश की लोक -कलाएं (संकलित) इंद्रधनुष का रहस्य लोकोक्तियां एवं मुहावरे (संकलित संधि (संकलित)	lecture method, group discussion, story telling,	5
2	जनसंचार माध्यम -प्रिंट ,इलेक्ट्रॉनिक ,सोशल सपनों की उड़ान प्रमुख वैज्ञानिक आविष्कार संक्षिप्तियां (संकलित)	lecture method, collaborative learning, Field visits, ABL, PBL	4
3	पत्रकारिता के विविध आयाम (संकलित) मध्य प्रदेश का लोक साहित्य (संकलित) पत्र -लेखन ---आवेदन ,प्रारूपण ,आदेश ,परिपत्र ,ज्ञापन ,अनुस्मारक (संकलित) समास (संकलित)	lecture method, group discussion, story telling, role play	5
4	हिंदी की शब्द सम्पदा (संकलित) राज भाषा हिंदी (संकलित)- हिंदी की संवैधानिक स्थिति एवं व्यवहारिक स्थिति दूरभाष और मोबाइल (संकलित) अनुवाद -अर्थ ,प्रकार एवं अभ्यास	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	4
5	विश्व के प्रमुख धर्म एवं नैतिक विशेषताएं -हिन्दू ,जैन ,बौद्ध ,सिक्ख ,ईसाई ,इस्लाम धर्म सत्य के साथ मेरे प्रयोग -(महात्मा गाँधी की आत्मकथा का	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	भाषा एवं नैतिक मूल्यों;Madhy Pradesh hindi granth acadmi, bhopal
Articles	https://leverageedu.com/blog/hi/%E0%A4%A8%E0%A5%88%E0%A4%A4%E0%A4%BF%E0%A4%95-%E0%A4%B6%E0%A4%BF%E0%A4%95%E0%A5%8D%E0%A4%B7%E0%A4%BE-%E0%A4%AE%E0%A4%B9%E0%A4%A4%E0%A5%8D%E0%A4%B5-%E0%A4%AA%E0%A4%B0-nibandh/
References Books	
MOOC Courses	https://fliphtml5.com/jhnr/hnsm/basic
Videos	https://fliphtml5.com/jhnr/hnsm/basic

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	3	2	2	-	-	-	-	-	-	3	2	3
CO2	2	1	2	2	-	3	-	-	-	-	-	-	2	2	2
CO3	2	2	2	3	3	2	-	-	-	-	-	-	-	2	3
CO4	1	2	3	2	2	-	-	-	-	-	-	-	3	2	1
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Plant Ecology
Course Code	BSBT GE II (T)

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Generic Elective							
Pre-Requisite/s	Understand plant communities and ecological adaptations in plants			**Co-Requisite/s**	The interactions among plants and between plants and other organisms.			
Course Outcomes & Bloom's Level	**CO1-** Understand plant communities and ecological adaptations in plants **(BL1-Remember)** **CO2-** Learn about biodiversity and its conservation **(BL2-Understand)** **CO3-** Study botanical regions of India and different vegetation types.**(BL3-Apply)** **CO4-** Understand bioremediation, global warming and climate change**(BL4-Analyze)** **CO5-** The interactions among plants and between plants and other organisms.**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG4(Quality education) SDG5(Gender equality)				

Part B

Modules	Contents	Pedagogy	Hours
1	Concept of ecology. Approaches to ecology: its main divisions & development facets. Relation to other sciences. Ecology in India. Man-Environment relationship.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Environment factors, Climatic factors: Composition and stratification of atmosphere, global climate, precipitation temperature, light, wind. Topographic factors, Edaphic factors (soil): Biotic factors: Interaction between plants and animals, positive and negative interactions, alleopathy.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	7
3	Levels of Organisation, Population and Communities: concepts of autecology, synecology; concept of biological diversity; habitat and ecological niche. Distribution and characteristics of populations; population dynamics; Ecological Speciation. Ecotone and edge effect; methods of studying vegetation; dynamics of communities; plant succession, processes, type; primary and secondary succession; climax concepts.	Tutorials, Collaborative, Demonstrations, Project methods Experiments, field work	8
4	Ecosystems: Structure, biotic and the abiotic components, trophic organization, source of energy, autotrophy, heterotrophy, parasitism; food chains and webs; ecological pyramids. Energy flow; principles, grazing and detritus food chains, models of energy flow; ecosystem productivity, Measurement of productivity & ecological efficiencies. Biogeochemical cycles; dynamics: hydrologic cycle & gaseous cycles.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Diversity of Ecosystems: Aquatic: fresh water (lotic and lentic), marine (Pelagic and benthic) estuarine: major terrestrial biomes: tundra, temperate and tropical. Principles of phytogeography; phytogeogarphical divisions of India.Endemism; hotspots, Vegetation of Gwalior. Conservation of natural resources. Wild Life Management.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

M

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Analysis of soil: 1. pH 2. organicmatter 3. Water holdingcapacity, 4. Texture ofsoil.	Experiments	BL2-Understand	2
3	Study of vegetation by quadrat: 8. Frequency, 9. density 10. Abundance. 11. Minimum size of quadrat	Experiments	BL2-Understand	2
2	Analysis of water: 5. Turbidity, 6. conductivity, 7. Dissolved Oxygen.	Experiments	BL2-Understand	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Sharma, P.D. (2010) Ecology and Environment, (8th Ed.) Rastogi Publications, Meerut
Articles	https://academic.oup.com/jpe
References Books	Singh, J.S. singh, S.P. and Gupta, S. (2006) Ecology Environment and Resource Conservation. Anamaya Publications, NewDelhi
MOOC Courses	https://nptel.ac.in/courses/109105203
Videos	Wilkinson, D.M. (2007). Fundamental Processes in Ecology. An Earth System Approach.Oxford.

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	1	-	-	-	-	-	-	2	2	3
CO2	2	1	2	1	2	3	-	-	-	-	-	-	2	1	1
CO3	1	2	1	1	2	1	3	-	-	-	-	-	3	2	1
CO4	1	1	1	1	1	3	-	-	-	-	-	-	3	1	1
CO5	2	2	2	2	1	3	3	-	-	-	-	-	2	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Inorganic Chemistry
Course Code	BSBT GE III (T)

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Interdisciplinary Minor							
Pre-Requisite/s	Knowledge of coordination bonding in complexes, Transition elements their properties			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember Knowledge of Transition elements, Acids and Bases, Oxidation and reduction, Complexes , Lanthanides, Actinides**(BL1-Remember)** **CO2-** To understand Properties and uses of Transition elements, Coordination compounds, Acids and Bases , Non aqueous solvents Lanthanides, Actinides**(BL2-Understand)** **CO3-** To Apply the Transition elements, Complexes, Lanthanides, Actinides in the different application**(BL3-Apply)** **CO4-** To Analyze the Structure , Bonding ,Magnetic Properties of Transition elements, Complexes**(BL4-Analyze)** **CO5-** To Evaluate the results analyzed**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
Module 1	Chemistry of Elements of First Transition Series: Characteristic properties of d-block elements Properties of the elements of the first transition series, their binary compounds such as Carbides, Oxides and Sulphides Complexes illustrating relative stability of their oxidation states, co-ordination number and geometry	Stoy telling activity Mnemonics Experienced examples, Quizzes Summarizing, PPT's	8
Module 2	UNIT – II: Chemistry of Elements of second and Third Transition Series: General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behavior, spectral properties and stereochemistry	Mnemonics , Experienced examples, , Videos , PPT's	8
Module 3	UNIT – III: A. Co-ordination Compounds Werner's co-ordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of co-ordination compounds, isomerism in co-ordination compounds, valance bond theory of transition metal complexes theory of transition metal complexes B. Oxidation and Reduction Use of redox potential data: analysis of redox cycle, redox stability in water: Frost, latimer and Pourbaix diagrams, Principles involved in the extraction of elements	Demonstrations, Videos, PPT's Virtual labs Group discussions	8
Module 4	Chemistry of Lanthanide Elements Electronic structure, oxidation states, ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds. B. Chemistry of Actinides General features and chemistry of actinides, chemistry of separation of Np. Pu and Am from U, similarities between the later actinides and the later lanthanide	Interactive videos PPT's Experienced examples	8
Module 5	UNIT – V A. Acids and Bases Arrhenius, Bronsted- Lowry, the Lux-Flood, solvent system and lewis concepts of acids and bases B. Non-aqueous Solvents Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH3 and liquid SO2.	Interactive videos , PPT's Experienced examples, Seminar	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
Module 3	Synthesis of Complex and Double salt	PBL	BL3-Apply	6
Experiment	To determine Acid Radical Nitrate Sulphate	Experiments	BL3-Apply	2
Experiment	To determine Acid radical Sulphide Nitrite	Experiments	BL3-Apply	2
Experiment	To determine th Basic Radical Group Zero	Experiments	BL3-Apply	2
Experiment	To determine the Basic Radical Group One	Experiments	BL3-Apply	2
Experiment	To determine Basic Radical Group 2	Experiments	BL3-Apply	2
Experiment	To determine the Basic Radical Group 3	Experiments	BL3-Apply	2
Experiment	o determine the Basic Radical Group 4	PBL	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	M.N.N Tandon Unified Chemistry 2010
Articles	
References Books	J.D.Lee Concise Inorganic Chemistry Fifth edition
MOOC Courses	https://nptel.ac.in/courses/104101093
Videos	https://nptel.ac.in/courses/104101093

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	3	3	2	-
CO2	3	2	1	-	-	-	-	-	-	-	-	3	3	2	-
CO3	2	2	1	-	-	-	-	-	-	-	-	2	2	1	-
CO4	2	3	1	-	-	-	-	-	-	-	-	1	1	2	-
CO5	2	2	2	-	-	-	-	-	-	-	-	1	1	2	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Organic Chemistry
Course Code	BSBT GE III (T)

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Interdisciplinary Minor							
Pre-Requisite/s	Students should know the basic principles of chemistry			**Co-Requisite/s**	Students must know the basic chemical reactions of organic compounds			
Course Outcomes & Bloom's Level	**CO1-** To remember the Stereochemistry and reaction mechanism of organic compounds**(BL1-Remember)** **CO2-** To understand the basic principles of Chemistry**(BL2-Understand)** **CO3-** To apply the basic chemical test on natural organic compounds**(BL3-Apply)** **CO4-** To analyze the presence of functional groups in an organic compounds**(BL4-Analyze)** **CO5-** To evaluate the applications of organic reactions mechanisms in preparation of various industrial products like pharmaceutical agents, Paints , Synthetic dyes etc**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
Unit -I	Effects and Stereochemistry: Electronic effects (resonance, inductive, hyperconjugation) and steric effects and its applications (acid/base property); optical isomerism in compounds with and without any stereocenters (allenes, biphenyls); conformation of acyclic systems (substituted ethane/n-propane/n-butane) and cyclic systems (mono- and di-substituted cyclohexanes).	lecture method, collaborative learning, Field visits, ABL	8
Unit -II	Chemistry of Intermediate and Synthetic Applications-I: Chemistry of reactive intermediates (carbocations, carbanions, free radicals, carbenes, nitrenes, benzynes etc ...); Hofmann-Curtius-Lossen rearrangement, Wolff rearrangement, Simmons-Smith reaction, Reimer-Tiemann reaction, Michael reaction, Darzens reaction, Wittig reaction and McMurry reaction	lecture method, collaborative learning, Field visits, ABL	8
Unit -III	Chemistry of Intermediate and Synthetic Applications-II: Pinacol-pinacolone, Favorskii, benzilic acid rearrangement, dienone-phenol rearrangement, Baeyer-Villiger reaction; oxidation and reduction reactions in organic chemistry; organometallic reagents in organic synthesis (Grignard, organolithium and organocopper); Diels-Alder, electrocyclic and Sigmatropic reactions; functional group inter-conversions and structural problems using chemical reactions	lecture method, collaborative learning, Field visits, ABL	8
Unit -IV	Natural Products Chemistry: Chemistry of alkaloids, steroids, terpenes, carbohydrates, amino acids, peptides and nucleic acids.	lecture method, collaborative learning, Field visits, ABL	8
Unit -V	a)Aromatic and Heterocyclic Chemistry: Monocyclic, bicyclic and tricyclic aromatic hydrocarbons, and monocyclic compounds with one hetero atom: synthesis, reactivity and properties. b) Applications of Artificial Intelligence in Organic Chemistry Introduction of AI, AI in Organic Industry, Knowledge-based Expert System in an organic chemistry Industry, Fuzzy Logic Technique in Industry, ANN Technique in the FoIndustry, Machine Learning Techniques	lecture method, collaborative learning, Field visits, ABL	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
Unit - I	To check the presence of Carbohydrates in various organic products	Experiments	BL3-Apply	2
Unit -II	To check the presence of Proteins in various food products	PBL	BL3-Apply	2
Unit -III	To check the presence of Lipids/Fats in various food products	Experiments	BL3-Apply	2
Unit -IV	To separate Casein protein from milk sample	PBL	BL4-Analyze	4
Unit -V	To separate Nicotine from dry tea leaves	PBL	BL4-Analyze	4

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	0

Part E

Books	Reaction mechanism in organic Chemistry;O.P. Agarwal
Articles	Laboratory Techniques in Organic Chemistry ;A.I.Vogel
References Books	Advanced Organic Chemistry; Jerry March
MOOC Courses	https://nptel.ac.in/courses/104103111
Videos	https://nptel.ac.in/courses/104101115

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	3	3	-	-	-	-	-	-	-	1	2	2
CO2	2	2	1	3	2	-	-	-	-	-	-	-	1	1	1
CO3	1	2	3	2	2	-	-	-	-	-	-	-	1	2	2
CO4	2	2	2	3	3	-	-	-	-	-	-	-	1	2	3
CO5	2	1	3	3	2	-	-	-	-	-	-	-	1	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Animal Physiology
Course Code	BSBT GE IV (T)

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Generic Elective							
Pre-Requisite/s	basic concepts of physiology and the organ systems physiology of animals determine and understand working and functioning of different systems with their anatomical and biochemical aspects describe the system physiology of mammals			**Co-Requisite/s**	Relate with organic mechanisms in biology			
Course Outcomes & Bloom's Level	**CO1-** To describe fundamental knowledge of animal physiology**(BL1-Remember)** **CO2-** To understand the detailed concepts of digestion respiration excretion the functioning of nerves and muscles Hormones and reproduction**(BL2-Understand)** **CO3-** To understand the importance of Physiology and its applications**(BL3-Apply)** **CO4-** To provide experimental basis, and to enable students to basic concept of physiology**(BL4-Analyze)** **CO5-** To evaluate the applications of Physiology in various fields such as research and development as well as in various industries**(BL5-Evaluate)** **CO6-** To apply the understanding of Physiology in their future perspective fields i.e. Medical and clinical, Pathological, drug industries etc. **(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG2(Zero hunger) SDG4(Quality education) SDG14(Life below water) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours
1	Animal Nutrition- Nutrients and their Functions Physiology of Digestion Hormonal control of digestion absorption of Food and disorders.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Physiology of Respiration in Mammals Respiratory Pigments Regulation of Respiration Osmo-regulation in animals. Circulatory System: Heart Cardiac Cycle Blood pressure Blood Vessels ECG – its principle and significance	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Immune System In Mammals : An overview. Excretory System & Physiology of Excretion in Mammals Counter current theory Thermoregulation in Animals Hibernation Aestivation.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	Nervous tissue- Structure, Properties Function and Physiology of nerve Impulse Conduction EEG: its principle and significance Muscular Tissue -Types structure Muscular Physiology Chemical Changes during muscular physiology	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Endocrine gland- Pituitary gland Thyroid and Parathyroid gland Adrenal gland Thymus gland Pancreas and other glands Mechanism of Hormonal action Physiology of Reproduction in mammals	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Spotting vis permanent slides of digestivesystem and experiments based onmetabolism	Experiments	BL2-Understand	8
VI	Detection of Carbohydrates, Protein and fats in given samples	PBL	BL4-Analyze	6
III	determination of Blood group Bloodpressure and study of Immune organs	Experiments	BL4-Analyze	4
IV	Spotting Muscular and nervouse tissue	Experiments	BL2-Understand	4
V	Study of harmonal action and study ofgonads	Experiments	BL4-Analyze	4

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Prasad.N.K ;Enzyme Technology: Pacemaker of Biotechnology;2nd Edition Palmer;Enzymes; Horwood Publishing Series. 2001
Articles	https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/enzyme-activity https://www.jbc.org/article/S0021-9258(20)34049-7/fulltext https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8169242/ https://pubs.acs.org/doi/10.1021/acsomega.2c07560
References Books	Biocatalysts and enzyme technology, Buchholz.K;Kasche.V, Bornscheuer.U.V, Published by Wiley-VCH, 2005. Wiseman, A: Handbook of Enzyme Biotechnology, 3rd Edition, Ellis Horwood Publication,2010 Buchholz.K;Kasche.V;Bornscheuer.U.T.;Biocatalysts and enzyme technology, Published by Wiley-VCH, 2005. Palmer.T; Enzymes: Biochemistry, Biotechnology, Clinical Chemistry ;Horwood Publishing House, Chichester, England, 2001. Bisswanger.H;Practical enzymology.. Wiley Publication. 2nd Edition, 2011
MOOC Courses	https://nptel.ac.in/courses/102103097
Videos	https://nptel.ac.in/courses/102103097

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	1	2	2	2	-	-	-	-	-	-	2	-	1
CO2	3	1	1	2	2	2	-	-	-	-	-	-	1	2	2
CO3	2	1	1	2	1	1	-	-	-	-	-	-	2	3	1
CO4	3	-	-	1	1	1	1	-	-	-	-	-	1	2	2
CO5	-	-	-	-	1	-	1	-	-	-	-	-	2	-	1
CO6	-	2	-	-	1	-	-	-	-	-	-	-	1	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Plant Physiology
Course Code	BSBT GE IV (T)

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Generic Elective							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember the basic concepts and view of physiology of plants**(BL1-Remember)** **CO2-** To understand the mechanisms of photosynthesis, photophosphorylation and Light and dark reactions.**(BL1-Remember)** **CO3-** To describe the mechanism of active and passive adsorption**(BL3-Apply)** **CO4-** To provide experimental basis, and to enable students to analyze the mechanism of plant respiration and different pathways**(BL4-Analyze)** **CO5-** To evaluate the growth and development of different plants across geological periods.**(BL5-Evaluate)** **CO6-** To apply the understanding of growth and development and nutrition system in plants**(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
I	Water Relations: Importance of water to plants, Permeability – related theories, diffusion, osmosis, imbibition, plasmolysis, and mechanism of absorption – (active and passive). Ascent of sap. Transpiration, kinds of transpiration, mechanisms of transpiration. Mechanisms of Stomatal movement, plant Anti Transpirants, guttation.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
II	Photosynthesis: Photosynthetic pigments, mechanisms of photosynthesis, photophosphorylation, Light and dark reactions, C3 (Calvin cycle), C4 (Hatch and Slack cycle), Factors affecting the rate of photosynthesis	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
III	Respiration: Significance of respiration, types of respiration, respiration quotient, Aerobic and Anaerobic respiration, Glycolysis, Kreb"s cycle, Electron transport system. Oxidative phosphorylation, pentose phosphate pathway. Factors affecting the rate of respiration.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
IV	Mineral nutrition – Essential micro and macro nutrients, role of essential elements, their deficiency and toxicity symptoms. Assimilation of mineral nutrients. Stress physiology: Plant responses to water stress, temperature stress, and salt stress.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
V	Growth and Development: Phases of growth and kinetics of growth Plant movement. Photoperiodism. Senescence, vernalization. Seed dormancy, phytochrome and plant nutrients. Organic translocation: phloem sap, P-protein, phloem loading and unloading, mass flow hypothesis and its critical evaluation.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	To demonstrate the process of osmosis (Potato and Egg. Membrane)	Experiments	BL2-Understand	2
II	To demonstrate the process of Plasmolysis	Experiments	BL4-Analyze	2
III	To prove that chlorophyll, light and CO2 are necessary for photosynthesis	PBL	BL4-Analyze	5
IV	Experiment to show anaerobic respiration.	PBL	BL4-Analyze	8
V	To determine the value of R. Q.	Experiments	BL4-Analyze	2
VI	To demonstrate the process of transpiration among green plants.	Case Study	BL4-Analyze	5
VII	Enzymes specificity: effect of temperature, heavy metals.	PBL	BL5-Evaluate	5 days

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	20	40	

Part E

Books	1. Hopkins, W.G. and Huner, P.A. 2008 Introduction to Plant Physiology. John Wiley and Sons.
Articles	https://www.nature.com/subjects/plant-physiology
References Books	2. Nelson, D.L., Cox, M.M. 2004 Lehniger Principles of Biochemistry, 4th edition, W.H. Freeman and Company, New York, USA. 3. Saliisbury, F.B. and Ross, C.W.1991 Plant Physiology, Wadsworth Publishing Co. Ltd. 4. Taiz,L. and Zeiger, E. 2010 Plant Physiology, 5th edition, Sinauer Associates Inc. MA,USA.
MOOC Courses	https://nptel.ac.in/courses/102107075
Videos	https://nptel.ac.in/courses/102107075

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3	3	-	-	-	-	-	-	-	-	2	3	3
CO2	1	1	2	2	1	2	1	-	-	-	-	-	2	3	2
CO3	1	3	2	2	2	3	1	-	-	-	-	-	3	2	2
CO4	1	3	2	2	2	2	2	-	-	-	-	-	3	1	1
CO5	3	3	1	1	1	1	2	-	-	-	-	-	3	2	1
CO6	1	-	-	1	-	-	-	-	-	-	-	-	-	-	2

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Biostatistics & Computer applications
Course Code	BSBT SEC III (T)

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	Understanding of basic concepts of Computers, operating systems, their designing, and applications of Biostatistics in research and development.			**Co-Requisite/s**	Basic concepts of Biostatistics and Computer Applications, its applications and future prospects in research and analysis using statistical tools.			
Course Outcomes & Bloom's Level	**CO1-** The course prepares the student to understand the basic concepts of Fundamentals of Biostatistics and Computer Applications, its applications and future prospects**(BL1-Remember)** **CO2-** The subject Fundamentals of Biostatistics and Computer Applications is designed for under graduate students of biotechnology for understanding of basic concepts of each and every division of the subject along with its applications in other fields. **(BL2-Understand)** **CO3-** The course aims to provide experimental basis, and to enable students to acquire a specialized knowledge and understanding**(BL2-Understand)** **CO4-** The course aims to provide basis of analyzing the applications of Fundamentals of Biostatistics and Computer Applications in various fields of research and industries.**(BL3-Apply)** **CO5-** The course aims to provide basis of experimental design, computer applications and use of statistical tools in research and industries.**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to Computer Systems – Basics of Computer Systems, various Hardware Components – Data Storage and various Memory Units – Central Processing Unit, Introduction to Software and its life cycle.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	DOS, MS-Offices and its application, Operating System: types of operating system, application, process and its characteristics. WWW, web browser, E-mail.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	DOS, MS-Offices and its application, Operating System: types of operating, Topologies & Technologies – LAN, WAN, MAN,PAN, Wireless LAN.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	Introduction to Biostatistics ,common terms ,notions and Applications, Statistical population and Sampling Methods,Classification and tabulation of Data, Diagrammatic and graphical presentation,Frequency Distribution, Measures of central value,Measures of variability; Standard deviation, standard Error, Range, Mean Deviation, Coefficient Variation, Analysis of variance.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Basic tests, tests of significance, t-test, chi-square test, Regression , Basis of regression, regression analysis, Estimation, testing, Prediction, Checking residual analysis. Multivariate Analysis. Design of Experiments, randomization, replication, local control, complementary randomized, randomized block design	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Methods of Sampling	Case Study	BL2-Understand	2
2	Diagrammatic and graphical presentation of data	Case Study	BL3-Apply	2
3	Calculation of Standard deviation	Case Study	BL5-Evaluate	2
4	Analysis of variance	Field work	BL3-Apply	2
5	Tests of significance: t-test	Case Study	BL3-Apply	2
6	Tests of significance: Chi Square test	Case Study	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	20
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0		0		0

Part E

Books	Computer fundamentals, P.K. Sinha
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3469943/
References Books	Working in MS- Office, Ron Mansfield, TMH
MOOC Courses	https://nptel.ac.in/courses/102101056
Videos	https://nptel.ac.in/courses/102101056

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	-	-	-	1	2	-	-	1	2	-
CO2	1	2	-	-	-	-	-	-	1	1	-	-	2	1	-
CO3	1	2	-	-	-	-	-	-	1	1	-	-	1	2	-
CO4	1	2	-	-	-	-	-	-	1	2	-	-	2	1	-
CO5	1	2	-	-	-	-	-	-	1	2	-	-	1	2	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Bioethics and Biosafety
Course Code	BSBT SEC IV

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	scientific communication approaches for Bioethics and Biosafety			**Co-Requisite/s**	concept of containment level and Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).			
Course Outcomes & Bloom's Level	**CO1-** To remember the basic concepts and view of professional and scientific communication approaches for Bioethics and Biosafety **(BL1-Remember)** **CO2-** To understand the Introduction to science, technology and society, issues of access-Case studies/experiences from developing and developed countries. Ownership, monopoly and an environmental sustainability, public vs. private funding, biotechnology in international relations, globalization and development and their analysis.**(BL2-Understand)** **CO3-** To describe comprehensive understanding of Challenges for the Indian Biotechnological research and industries Bioethics – Necessity of Bioethics, different paradigms of Bioethics – National & International.**(BL3-Apply)** **CO4-** To provide Theoretical basis,and to enable students to analyze the basic concepts of the concept of containment level and Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP). Cartagena Protocol for biosafety **(BL4-Analyze)** **CO5-** To apply Appraise the current regulatory, quality control, and legal frameworksthat impact biotechnology and ethical behaviors that foster positive and productive interactions in diverse bioterrorism and convention on biological weapons. Social and ethical implications of biological weapons settings **(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Biotechnology And Society: Introduction to science, technology and society, issues of access-Case studies/experiences from developing and developed countries. Ownership, monopoly, traditional knowledge, biodiversity, benefit sharing, environmental sustainability, public vs. private funding, biotechnology in international relations, globalization, and development divide.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	6
2	Public acceptance issues for biotechnology: Biotechnology and hunger: Challenges for the Indian Biotechnological research and industries Bioethics – Necessity of Bioethics, different paradigms of Bioethics – National & International. Ethical issues against the molecular technologies	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Biosafety– Introduction to biosafety and health hazards concerning biotechnology. Introduction to the concept of containment level and Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP). Cartagena Protocol for biosafety	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	6
4	Biosafety assessment procedures in India and abroad. International dimensions in biosafety, bioterrorism, and convention on biological weapons. Social and ethical implications of biological weapons.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	6
5	Principles of bioethics: Legality, morality and ethics, autonomy, human rights, beneficence, privacy, justice, equity etc. The expanding scope of ethics from biomedical practice to biotechnology, bioethics vs. business ethics	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	Thomas J.A.-Biotechnology and Safety Assessment Thomas J.A., Fuch R.L Academic Press 3rd Edition 2002-ASM Press 3rd. ed. 2000
Articles	https://www.ndcebios.in/v1n1/2021010110.pdf https://www.researchgate.net/publication/353346609_ON_BIOETHICS_AND_BUSINESS_ETHICS
References Books	Fleming D.A., Hunt D.-Biological safety Principles and practices-ASM Press 3rd. ed. 2000
MOOC Courses	https://nptel.ac.in/courses/109106092
Videos	https://nptel.ac.in/courses/109106092

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	1	3	3	3	1	2	3	1	3	2	3
CO2	1	1	2	3	1	3	3	3	2	1	3	2	1	1	2
CO3	3	3	2	1	3	3	3	2	1	1	3	2	2	3	2
CO4	3	3	3	3	2	2	3	3	1	1	3	2	3	3	2
CO5	3	3	2	2	1	3	3	3	1	1	3	2	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Disaster Management
Course Code	BSBT VAC III

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Community Enganement and Service							
Pre-Requisite/s	To be familiar with the basics of natural disasters as well as anthropogenic factors and various approaches for disaster managements.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To learn types of disasters and its profile in India**(BL1-Remember)** **CO2-** To understand the causes and impacts of disasters on environment and related case studies of Global and National disasters.**(BL2-Understand)** **CO3-** To learn about risk reduction approaches of disasters with safety issues in mitigating industrial disasters.**(BL3-Apply)** **CO4-** To understand the concept of Disaster Management Cycle and its Risk Reduction Measures**(BL4-Analyze)** **CO5-** To apply the National Acts and policies for mitigating disasters, Role of Army, Police, Community, Corporate, Media etc. for post Disaster Management.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG1(No poverty) SDG3(Good health and well-being) SDG4(Quality education) SDG6(Clean water and sanitation) SDG8(Decent work and economic growth) SDG10(Reduced inequalities) SDG11(Sustainable cities and economies) SDG12(Responsible consuption and production) SDG13(Climate action) SDG15(Life on land) SDG17(Partnerships for the goals)				

Part B

Modules	Contents	Pedagogy	Hours
1	Concepts and definitions (Disaster, Hazard, Vulnerability, Resilience, Risks, Capacity buildings) Factors of disasters, Global trends in disaster: urban disasters, pandemics, complex emergencies, Climate change	lecture method, collaborative learning, group dicussions, field visit,	8
2	Classification of disaster: geophysical, hydrological, climatological, meteorological, biological and technological or man-made hazards. Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc. Differential impacts- in terms of caste, class, gender, age, location, disability.	lecture method, collaborative learning, group dicussions, field visit,case studies	8
3	Disaster management cycle – Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA).	lecture method, collaborative learning, group dicussions, field visit,case studies	8
4	Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc. Climate Change Adaptation. Relevance of indigenous knowledge, appropriate technology and local resources	lecture method, collaborative learning, group dicussions, field visit,case studies	8
5	Disaster Management Indian scenario, India's vulnerability profile, Disaster Management Act 2005 and Policy guidelines, Environmental Legislation for Disaster Risk Management in India. Role of information technology in protecting environment and health. Role of NGOs Cases Studies: Bhopal Gas Disaster, Gujarat Earth Quake, Orissa Super-cyclone, South India Tsunami, Bihar floods, Plague Surat, COVID-19 pandemic	lecture method, collaborative learning, group dicussions, field visit,case studies	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Contemporary Disaster Issues in India & World	Case Study	BL4-Analyze	4
2	Disaster Mitigation Methods & Involvement of Technologies	Seminar	BL3-Apply	4

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	• Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423 • Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361] • Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011 • Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010. • Kapur, Anu & others, 2005: Disasters in India Studies of grim reality, Rawat Publishers, Jaipur
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3105552/
References Books	• Coppola P Damon, 2007. Introduction to International Disaster Management, Carter, Nick 1991. Disaster Management: A Disaster Manager's Handbook. • Cuny, F. 1983. Development and Disasters, Oxford University Press. Document on World Summit on Sustainable Development 2002. • Govt. of India: Disaster Management Act 2005, Government of India, New Delhi. Government of India, 2009. National Disaster Management Policy. • Disaster Management Guidelines. GOI-UNDP Disaster Risk Reduction Programme (2009-2012. • Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003 • National Institute of Disaster Management • National Disaster Management Authority • http://nidm.gov.in, http://cwc.gov.in , http://ekdrm.net , http://www.emdat.be , http://www.nws.noaa.gov , http://pubs.usgs.gov , http://nidm.gov.ini http://www.imd.gov.ini
MOOC Courses	https://nptel.ac.in/courses/124107010
Videos	https://nptel.ac.in/courses/124107010

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	1	3	3	3	1	2	3	1	3	2	3
CO2	1	1	2	3	1	3	3	3	2	1	3	2	1	1	2
CO3	3	3	2	1	3	3	2	1	1	3	2	2	3	2	2
CO4	3	3	3	3	2	2	3	3	1	1	3	2	3	3	2
CO5	3	3	2	2	1	3	3	3	1	1	3	2	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Environemental Issues and Sustainable Development
Course Code	BSBT VAC IV

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Community Enganement and Service							
Pre-Requisite/s	Basic Knowledge of Environmental Issues and Sustainable Development			**Co-Requisite/s**	Goals and Targets of Sustainable Development Goals. Strategies for the implementation of Sustainable Development goals			
Course Outcomes & Bloom's Level	**CO1-** CO1. To develop sentiments and sensitize them towards environmental challenges and concept of sustainable development.**(BL2-Understand)** **CO2-** CO2. To acquire analytical skills/methods in assessing environmental impacts through a multidisciplinary approach;**(BL4-Analyze)** **CO3-** CO3. Ability to design sustainability performance metric to assess the impact on community's sustainable development**(BL5-Evaluate)** **CO4-** CO4. Acquire expertise and skills to evaluate feedback systems that can readjust the pathways of processes and procedures to ensure success in implementing sustainable development initiatives.**(BL1-Remember)** **CO5-** CO5. Students acquire skills to communicate, prepare, plan and implement the sustainable development project to achieve milestone of SDGs.**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG4(Quality education) SDG5(Gender equality) SDG12(Responsible consuption and production) SDG13(Climate action)				

Part B

Modules	Contents	Pedagogy	Hours
1	History and emergence of the concept of Sustainable Development, Environmental issues and crisis, Resource degradation, greenhouse gases and Effects, desertification, social insecurity, Industrialization, Globalization and Environment. Dimensions of Sustainable Development, Principles of Sustainable Development.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, discussion (questions & answers section)	8
2	Sustainable Development Goals: Capacity Building for Sustainable Environment, Sustainable Land Management. Global and regional progress on SD, Individual and collective actions for SD, Sustainable Mountain development, Clean air for Climate Mitigation and Human Health, Sustainable Corporate Practices, Sendai Framework for Disaster Risk Reduction, Conservation and Management of Global Forest Ecosystem	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	8
3	Society, environment, culture and economy; current challenges - natural, political, socio-economic imbalance; sustainable development initiatives and policies of various countries: global, regional, national, local; needs of present and future generation - political, economic, and environmental.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	8
4	GSD-2019, GSD 2023. Implementation Progress: SDG Progress report, Sustainability and development indicators and SDGs, UN's outlook of sustainable development and efforts	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures,Audio/Video clips, Group discussion.	8
5	Case Studies & Projects on Rural Sustainable Development (Indian village perspectives) - Village resources (broad perspectives); current challenges and thematic areas; village social hierarchy; village economy; needs of present and future generation; conflicts - sustainability and rural culture & tradition; road to achieving sustainable development goals - bridging conflicts and way forward.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion. Field visits. Industrial Visit (MSW/BMW/STP/ETP)	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Sustainable development aims to use natural resources and the environment to raise the standard of living while preserving future generations' capacity to meet their own needs	PBL	BL3-Apply	2 MONTHS
II	Analyze the current situation to identify specific challenges and opportunities in the targeted area or community in order to Assess environmental, economic, and social factors.	Internships	BL4-Analyze	1 MONTHS
III	Monitor energy production and savings, and assess environmental impact.	Field work	BL4-Analyze	1 MONTHS
IV	Plan a community solar farm where residents can buy or lease solar panels	Field work	BL3-Apply	2 MONTHS

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	1. Chiras, D. D and Reganold, J. P. (2010). Natural Resource Conservation: Management for a Sustainable Future.10th edition, Upper Saddle River, N. J. Benjamin/Cummins/Pearson. 2. John W. Twidell and Anthony D. (2015). Renewable Energy Sources, 3rd Edition, Weir Publisher (ELBS) 3. William P.Cunningham and Mary A. (2015) Cunningham Environmental Science: A Global Concern, Publisher (Mc-Graw Hill, USA)
Articles	1. Nhamo, Godwell, and Vuyo Mjimba. Sustainable Development Goals and institutions of higher education. Springer, 2020. 2. Bell, Simon, and Stephen Morse. Sustainability indicators: measuring the immeasurable?. Routledge, 2012. 3. Sørensen, Bent. Energy, Resources and Welfare: Exploration of Social Frameworks for Sustainable Development. Academic Press, 2016. 4. Dent, David, Olivier Dubois, and Barry Dalal-Clayton. Rural planning in developing countries: supporting natural resource management and sustainable livelihoods. Routledge, 2013. 4. Sala, Serenella, Biagio Ciuffo, and Peter Nijkamp. "A systemic framework for sustainability assessment." Ecological Economics 119 (2015): 314-325.
References Books	1. Elliott, Jennifer. 2012. An Introduction to Sustainable Development. 4th Ed. Routledge, London. 2. Rogers, Peter P., Kazi F. Jalal, and John A. Boyd. "An introduction to sustainable development." (2012).
MOOC Courses	https://nptel.ac.in/courses/109106200
Videos	https://nptel.ac.in/courses/109106200

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-1	3	2	-	-	-	1	-	1	-	-	-	2	2	3
CO2	1	3	2	-	-	-	2	-	1	-	-	-	1	2	3
CO3	3	2	1	-	-	-	3	-	2	-	-	-	1	2	-
CO4	2	3	1	-	-	-	3	-	2	-	-	-	-	3	1
CO5	2	3	1	-	-	-	3	-	3	-	-	-	1	-	-
CO6	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Fundamentals of Biochemistry
Course Code	BSBT101[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Knowledge about basic chemistry and science			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember the structure of various biomolecules like carbohydrates, fats, amino acids, etc**(BL1-Remember)** **CO2-** To comprehend the biological material; and its relation to living matter and elaborate the structure and functions of different biomolecules**(BL2-Understand)** **CO3-** To understand the importance of biophysical chemistry and its applications.**(BL3-Apply)** **CO4-** To provide experimental basis, and to enable students to analyze the various biomolecules in food samples.**(BL4-Analyze)** **CO5-** To evaluate the applications of biomolecules in various fields such as research and industries**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Bonds in biological system: Principles of biophysical chemistry (ph2Henderson Hasselback equation) Buffers and its role in biological systems. Solution and its types. Osmosis, diffusion and its significance in biological systems	Tutorials, Collaborative, Demonstrations, Project methods Experiments	8
2	Carbohydrates: Monosaccharide: Classification, Common Disaccharides, Structure and occurrence of storage and structural polysaccharides	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments	9
3	Lipids: Classification, structure-function, role in biological membrane, Lipoprotein, structure and functions. Prostaglandins and its role in biological systems	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	9
4	Amino Acids: structure, nomenclature and general properties, Peptide bond, Classification of amino acids Proteins; Levels of organization Primary, Secondary structure, domains, motif and folds)., tertiary and Quaternary Conformation of proteins (Ramachandran plot, Stability of Proteins	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lectures	9
5	Composition, structure and function of nucleic acids. Conformation of nucleic acids (helix (A, B, Z), t-RNA, micro-RNA). Vitamins: Classification: source and biochemical function, RDA. Nucleic acids: DNA, RNA-basic structure (nucleosides and nucleotides): double helical structure of DNA (Watson - Crick Model), types of DNA, B-, A- and Z-DNA.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lectures	9

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Quantitative analysis of sugar in the given plant sample	PBL	BL4-Analyze	4
2	Qualitative analysis of sugars.by Molisch's Test	Experiments	BL4-Analyze	2
3	Qualitative analysis of reducing sugars by Fehling's Test	Experiments	BL4-Analyze	2
4	Qualitative analysis of sugars.by Barfoed's Test	Experiments	BL4-Analyze	2
5	Qualitative analysis of ketose sugars by Seliwanoff Test.	PBL	BL4-Analyze	2
6	Qualitative analysis of amino acids by ninhydrin Test.	Experiments		2
7	Qualitative analysis of peptide bond by Biuret Test	Experiments	BL5-Evaluate	2
8	Qualitative analysis of protein by Xanthoproteic Test.	Experiments	BL5-Evaluate	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	U Satyanarayan,U Chakrapani Biochemistry 3rd Edition
Articles	https://www.mdpi.com/1422-0067/22/22/12219
References Books	G.Zubay Biochemistry 3rd Edition
MOOC Courses	https://nptel.ac.in/courses/104105076
Videos	https://nptel.ac.in/courses/104105076

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	2	-	-	-	2	-	-	1	-	1
CO2	2	3	2	2	2	2	-	-	-	2	-	-	1	-	3
CO3	3	1	1	-	1	-	-	-	-	-	-	-	3	2	3
CO4	3	2	-	2	1	-	-	-	-	-	-	-	2	3	3
CO5	3	1	-	2	1	-	-	-	-	-	-	-	2	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	General Microbiology
Course Code	BSBT102[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	the basic concepts and view of professional and scientific communication approaches for microbiology settings			**Co-Requisite/s**	comprehensive understanding of sterilization processes and media preparation pipelines			
Course Outcomes & Bloom's Level	**CO1-** To identify the basic concepts and view of professional and scientific communication approaches for microbiology settings **(BL1-Remember)** **CO2-** To understand the gene transfer mechanisms and a detailed insight into mutations and their analysis **(BL2-Understand)** **CO3-** To describe comprehensive understanding of sterilization processes and media preparation pipelines **(BL3-Apply)** **CO4-** To provide experimental basis, and to enable students to analyse the basic concepts of microbial evolution, phylogeny, nutritional aspects, and elements of microbial genetics**(BL4-Analyze)** **CO5-** To apply Appraise the current regulatory, quality control, and legal frameworksthat impact biotechnology and ethical behaviours that foster positive and productive interactions in diverse microbiology and biotechnology settings. **(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕			**SDG (Goals)**	SDG4(Quality education)			

Part B

Modules	Contents	Pedagogy	Hours
1	History and scope of microbiology, modern development of microbiology, Classification of microorganism: Haeckel's; three kingdom concepts, Whittaker; five kingdom concepts. Introduction and general characteristic of bacteria, fungi. Algae and virus and their physiological characteristics	Tutorials, Collaborative, Demonstrations, Project methods Experiments	8
2	Concept of Sterilization - Definition of sterilization, methods of sterilization; dry and moist heat, pasteurization, tantalization; radiation, filtration, disinfection, sanitization. Stains and staining techniques -Mechanism of gram staining, acid fast staining, negative staining, capsule staining, flagella staining.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Culture media: Type of media and their uses, pure culture techniques. Microbial growth: growth curve, measurement of growth and factor affecting the growth, Microbial nutrition: Nutritional classification of microorganism. Cultivation of microorganism: aerobic and anaerobic culture and preservation of microbial culture. Oxygen toxicity: Study of catalase, peroxidase, superoxidase, dismutase, mechanism of oxygen toxicity	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	9
4	Gene transfer mechanisms: transformation, transduction, conjugation and transfection, Mechanism and applications, genetic analysis of microbes- bacteria and yeast. Plasmids: characteristics and their uses.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Genetic analysis of bacteria: Importance and uses of Mutation analysis. Inheritance in bacteria, types of mutations, spontaneous and induced mutagenesis.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Preparation of broth and liquid culture media to grow the test bacterial culture.	Experiments	BL2-Understand	2
X	To isolate bacteria flora from the different location of the university campus.	PBL	BL5-Evaluate	7 days
III	Perform the simple staining of the given test organisms to observe their shape.	Experiments	BL2-Understand	2
IV	Perform the negative staining of the given test organisms to observe their shape.	Experiments	BL2-Understand	2
V	Perform the Gram's staining of the given test organism	Experiments	BL2-Understand	2
VI	Perform the Endospore staining of the given test organisms.	Experiments	BL3-Apply	2
VII	Check the effect of UV radiation on the growth of microorganisms.	Experiments	BL3-Apply	2
VIII	Demonstrate the acid and gas production by the organisms.	Experiments	BL4-Analyze	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	Nancy Trun and Janine Trempy-Fundamental Bacterial Genetics-1st Edition
Articles	https://bmcmicrobiol.biomedcentral.com/articles
References Books	U.N. Streips and R.E. Yasbin-Modern Microbial Genetics-2nd Edition
MOOC Courses	https://nptel.ac.in/courses/102105087 https:el.ac.in/courses/102103015//n
Videos	https://nptel.ac.in/courses/102105087 https:el.ac.in/courses/102103015//npt

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	3	1	3	-	-	-	-	-	-	1	2	3
CO2	2	3	3	2	1	3	1	-	-	-	-	-	2	3	3
CO3	3	3	1	1	3	3	-	-	-	-	-	-	3	3	3
CO4	1	3	1	3	1	3	-	-	-	-	-	-	1	3	3
CO5	2	1	3	3	3	2	2	-	-	-	-	-	2	1	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	NCC
Course Code	BSBT104[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					2	0	2	4
Course Type	Theory only							
Course Category	Generic Elective							
Pre-Requisite/s	Should be acquainted with the basics knowledge of General Awareness about Leadership Quality, Personality Development, Defense system etc.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To Remember about the history of NCC, its organization, and incentives of NCC for their career prospects and the concept of national integration and its importance.**(BL1-Remember)** **CO2-** To Understand the concept of critical & creative thinking and the concept of self-awareness and emotional intelligence.**(BL2-Understand)** **CO3-** To Acquire knowledge of duties and conduct of NCC cadets.**(BL3-Apply)** **CO4-** To analyze the concept of team and its functioning.**(BL4-Analyze)** **CO5-** To Evaluate the process of decision making & problem solving.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG1(No poverty) SDG6(Clean water and sanitation) SDG13(Climate action) SDG14(Life below water) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours
Unit 1- NCC General (N)	History of NCC, Aims and Objectives of NCC. Organization &Training. NCC Song, Motto of NCC - Motivation of Cadets.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, discussion (questions & answers section)	6
Unit 2- NCC Organization	NCC as Organization, Incentives of NCC, Duties of NCC Cadet. NCC Camps: Types & Conduct. Preparation and participation. Rank of officers and cadets.	Whiteboard, PPT, Video Case Study, Project Based Activity, Application Based Activity	6
Unit 3- National Integration (NI) & Awareness	National Integration: Importance & Necessity, Factors Affecting National Integration, Unity in Diversity & Role of NCC in Nation Building, Threats to National Security	Audio/Video clips, group discussion, lecture with ppt, classroom presentations	6
Unit 4- Personality Development	Intra & Interpersonal skills - Self-Awareness-&Analysis, Empathy, Critical & creative thinking, Decision making and problem solving.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	6
Unit 5- Social Service and Community Development	Basics of social service and its need, Types of social service activities, Objectives of rural development programs and its importance, NGO's and their contribution in social welfare, contribution of youth and NCC in Social welfare.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	6

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	Cadets training handbook common subjects (2017), D.G NCC Delhi-110030
Articles	https://indiancc.mygov.in/activity/snehahoro/article-on-ncc-camp-and-training/
References Books	DG, NCC Training directive
MOOC Courses	
Videos	https://www.youtube.com/watch?v=Am1Cs0DHMZ4

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Immunology
Course Code	BSBT202(T)

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	This course will introduce to the applied aspects of immunology in disease detection and diagnosis			**Co-Requisite/s**	The students should be well versed with different types of immune responses which show different types of changes.			
Course Outcomes & Bloom's Level	**CO1-** To remember the structure of various Immunological Barriers of the body**(BL1-Remember)** **CO2-** To understand the Different cells & proteins involved in Immune system**(BL2-Understand)** **CO3-** To understand the connection of immune system failure & disorders.**(BL2-Understand)** **CO4-** To apply the use of Proteins & receptors in antibody formation**(BL3-Apply)** **CO5-** To evaluate the applications of Antigens & Antibodies in Diagnostic & Medical Research**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to the immune system, Cells and organs of the immune system, Hematopoietic development and mediators of the process. Sign and symptoms and mechanism involved in inflammatory response.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Innate and Adaptive immune responses: Anatomical and Physiological barriers of the innate immunity. Receptors of Innate Immune system. Connection between innate and adaptive immune response and its mechanism.Antigens& Immunogens and its properties, Epitopes and CDRS	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Structure, classification and functions of Antibody, Antigen-antibody reactions :Precipitation and agglutination reactions, Organization and expression of Immunoglobulin genes, Monoclonal antibodies: production and application	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	Major histocompatibility complex (MHC), Types of MHC and Display of antigenic peptide, Role of MHC in antigen processing and presentation. Complement system: component, activation pathway , Complement deficiency diseases	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Hypersensitivity: Allergens and its types, types of hypersensitivity and There mechanism, Introduction to Autoimmune disorders(Central and peripheral Tolerance). Immunization: active and passive immunization, types of vaccines and their production strategy.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Anatomical view of mammalian thymus and various immune organs	Experiments	BL3-Apply	2
2	Study about Covaxin vaccine administration in local area and effect visualized	Internships	BL4-Analyze	15 DAYS
3		PBL		
4	To perform Radial immune diffusion	Experiments	BL3-Apply	2
5	To perform Double immuno diffusion	Experiments	BL3-Apply	2
6	Haemoglobin detection by given Blood Sample	Experiments	BL3-Apply	2
VII	Detection of Hb% of human population in locality and relate to their nutrition diet.	PBL	BL4-Analyze	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Immunology by Kindt, Goldsby, Osborne, 4th Edition
Articles	https://njms.rutgers.edu/sgs/olc/mci/prot/2009/Hypersensitivities09.pdf
References Books	Essentials Immunology, Ivam M Roitt, 12th Edition
MOOC Courses	https://nptel.ac.in/courses/104108055
Videos	https://nptel.ac.in/courses/104108055

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	2	2	-	1	-	-	-	-	-	1	2	2
CO2	1	2	2	3	1	3	1	-	-	-	-	-	1	2	2
CO3	1	2	1	2	1	2	2	-	-	-	-	-	1	2	2
CO4	1	2	1	2	1	2	2	-	-	-	-	-	3	3	3
CO5	1	2	2	1	2	-	2	-	-	-	-	-	3	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Genetics
Course Code	BSBT303(T)

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Generic Elective							
Pre-Requisite/s	Knowladge about Fundamentals and principles about genetics also provide knowladge about Genetic techniques.			**Co-Requisite/s**	Relate all Biotech and microbiology engeneering techniques like RDT PTC ATC etc.			
Course Outcomes & Bloom's Level	**CO1-** To describe basic principles and concepts of genetics**(BL1-Remember)** **CO2-** To understand the Mendalian and non Mendalian inheritance**(BL2-Understand)** **CO3-** To understand the importance of heredity and its applications**(BL3-Apply)** **CO4-** To provide experimental basis, and to enable students to acquire a specialized knowledge and understanding in advanced the field of genetics**(BL4-Analyze)** **CO5-** To evaluate the applications of genetics in various fields such as research **(BL5-Evaluate)** **CO6-** To apply the understanding of heredity and variation and genetic disorders and mutations and others in various fields or industries**(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG4(Quality education) SDG11(Sustainable cities and economies) SDG14(Life below water) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours
1	Chromosomes: Transmitters of heredity structure, types and special type of chromosomes Mendalism: Law of Inheritance Concept of gene : Allele, Multiple alleles: ABO System and Rh factor Importance of Blood Groups in Blood transfusion Extensions of Mendalism: Co-dominance, incomplete dominance gene interaction: Epistasis	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Sex determination and sex linkage: Sex chromosomes mechanism of sex determination Sex linked inheritance (Color blindness and Hemophilia) Linkage and crossing over gene expression Chromosome mapping: Gene mapping methods Linkage maps Twins: physical and mental traits	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Gamete formation: Spermatogenesis and Oogenesis Mitosis & Meiosis: Stages and significance differences. Nucleic Acids, DNA Replication Introduction to Genetic Engineering in brief Fine structure of gene genetic Code Split gene overlapping and pseudo gene.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	Extra chromosomal inheritance in Mitochondrial and Chloroplast effect Maternal inheritance Nucleo-cytoplasmic interaction Genetic disorders: Human Syndromes	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Mutation : Types causes and detection Types of mutants – lethal, conditional, biochemical, loss of function gain of function, germinal verses somatic mutants Gene mutation: Causes, insertion mutagenesis Chromosomal aberrations: variation in chromosome number Change in chromosome structure	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Identification of chromosomes and spotting as per theory syllabus	Experiments	BL2-Understand	4
2	Study of Linkage and sex linked inheritance	Experiments	BL3-Apply	4
3	Study of Mitosis and meiosis	Experiments	BL3-Apply	4
4	Study of Nucleic acids	Experiments	BL2-Understand	4
5	study of syndroms and other mutation	Field work	BL4-Analyze	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Principles of genetics By P K Gupta
Articles	https://www.nature.com/scitable/topicpage/gregor-mendel-and-the-principles-of-inheritance-593/
References Books	Genetics BY B D singh Genetics By: A G Gardner
MOOC Courses	https://nptel.ac.in/courses/102104052
Videos	https://www.google.com/search?sca_esv=e2da69de12d3bb4c&sca_upv=1&rlz=1C1NMEO_enIN999IN999&q=Principles+of+Genetics&tbm=vid&source=lnms&prmd=ivsnbmtz&sa=X&ved=2ahUKEwiHpqq9ioqGAxVG4zgGHcRzAgkQ0pQJegQIDBAB&biw=1366&bih=625&dpr=1#fpstate=ive&vld=cid:d538888b,vid:-PtxId_Ga7k,st:0

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	1	2	-	-	-	-	-	-	-	-	1	2	3
CO2	2	3	1	2	-	-	-	-	-	-	-	-	2	2	3
CO3	2	2	2	1	-	-	-	-	-	-	-	-	2	1	3
CO4	1	2	2	1	-	-	-	-	-	-	-	-	1	1	2
CO5	1	2	1	1	-	-	-	-	-	-	-	-	1	1	2
CO6	-	1	-	2	-	-	-	-	-	-	-	-	-	1	1

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Environemntal Microbiology
Course Code	DSE I (T)

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					2	0	1	3
Course Type	Embedded theory and lab							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	define microbes and environmental microbiology.			**Co-Requisite/s**	explain the distribution of microbes in several different environments, including water, sediments, soil and air.			
Course Outcomes & Bloom's Level	**CO1-** To define microbes and environmental microbiology.**(BL1-Remember)** **CO2-** explain the distribution of microbes in several different environments, including water, sediments, soil and air.**(BL2-Understand)** **CO3-** To describe the diversity of microbes in the different environments**(BL2-Understand)** **CO4-** To demonstrate how diversity is assessed and identify methodological issues associated with each technique.**(BL3-Apply)** **CO5-** To illustrate the ecological importance of microbes and their function in natural ecosystems**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG4(Quality education) SDG6(Clean water and sanitation)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to Environmental Microbiology, Significance, History and Challenges of Environmental Microbiology, cultured and uncultured microorganisms.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	7
2	Microbiology of soil:- Soil, Edaphon, Edaphic factors, Distribution, of Microorganisms in, Soil Activity of microorganisms, Symbiosis, forms, Soil bioremediation	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	8
3	Microbial ecology- Concept, development of microbial community in biosphere, biofilm and its ecological implication. Microbial diversity, extremophiles ecological adjustment and molecular adaptations in extreme conditions. Community ecology: community structure, benevolent - interactions, antagonistic interactions, (competition, antibiosis predation etc.)	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	7
4	Microbiology of air:- The air as an environment of microorganisms , Adaptation of microorganisms to the air environment, Important Airborne Pathogens Biological aerosols, Mechanisms protecting lungs against bioaerosol penetration, Survival and spread of bioaerosols Biological aerosols as a hazardous source for humans, Basic sources, of bioaerosol emission, Investigation of microbiological air pollutions Bioaerosol Control.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	8
5	Introduction to Waste water treatment, activated sludge process, bulking a foaming in activated sludge plants, process based on attached microbial growth, waste stabilization ponds. Sludge microbiology anaerobic digestion of wastewater and biosolids, biological aerosols and bioodors from wastewater treatment plants, Microbiological aspects of drinking w distribution of bioterrorsm and drinking ater safety.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Isolation of organisms from air.	Experiments	BL2-Understand	2
6	microbial test of milk with methylene blue reductase enzyme	Experiments	BL4-Analyze	3
3	Isolation of organisms from food sources	Experiments	BL2-Understand	2
4	Isolation of Yeast.	Experiments	BL3-Apply	2
5	Isolation of phosphorous solubilizing bacteria/fungus from soil sample.	PBL	BL2-Understand	6

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Nuzhat Ahmed, Fouad M. Qureshi and Obaid Y. Khan, Industrial and environmental biotechnology Vol. I
Articles	https://www.epa.gov/sites/default/files/2015-12/documents/9131.pdf https://cdn.who.int/media/docs/default-source/wash-documents/water-safety-and-quality/dwq-guidelines-4/gdwq4-with-add1-chap7.pdf?sfvrsn=3bdd70a5_3
References Books	Michael T Madigan Brock Biology of Microorganisms 11th Edition
MOOC Courses	https://nptel.ac.in/courses/105107173 https://nptel.ac.in/courses/109105203 https://nptel.ac.in/courses/102105087
Videos	https://nptel.ac.in/courses/105107173 https://nptel.ac.in/courses/109105203 https://nptel.ac.in/courses/102105087

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	2	2	3	-	-	-	-	-	-	1	3	-
CO2	1	1	1	2	-	3	3	-	-	-	-	-	1	3	3
CO3	2	1	-	1	2	3	3	-	-	-	-	-	2	-	2
CO4	3	3	3	3	3	2	3	-	-	-	-	-	3	1	3
CO5	1	2	1	1	2	3	-	-	-	-	-	-	1	2	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Agriculture Biotechnology and Intellectual property rights
Course Code	DSE II (T)

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	Student should have basic knowledge of botany and genetic engineering			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To define and contrast the terms agriculture and agricultural biotechnology**(BL1-Remember)** **CO2-** To understand the techniques, skills, and modern engineering tools necessary for engineering practice in agriculture biotechnology**(BL2-Understand)** **CO3-** To define the concept of utilizing plants for production of vaccines and production of biofertilizers**(BL2-Understand)** **CO4-** To apply the knowledge of engineering principles of agriculture biotechnology to living entities for societal welfare**(BL3-Apply)** **CO5-** The students will be able to develop the relationship between science and society and will be able to give justification for biotechnological manipulation of plants for human use**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
I	Introduction To Agricultural Biotechnology: Origin of cultivated plants and plant indication, Introduction to Indian Agriculture heritage; Soil management and its relevance in Pre-modern India. Review of plant cell structure and function; Review of water uptake Introduction to plant nutrition; Mineral availability- uptake of minerals	Lecture method, demonstrations, field visit, ABL, Case studies, ABL.	8
II	Methods of breeding self-pollinated and vegetatively propagated plants; Seed Germination and Seedling Growth; Photoperiodism and its significance; Vernalization and hormonal control. Heterosis-Genetic and Molecular basis, Apomixis -Mechanism and significance in crop improvement	Lecture method, demonstrations, field visit, ABL, Case studies, ABL.	9
III	Post Harvest Biotechnology: Importance of post harvest physiology; Stages of growth; Maturity indices; Fruit ripening- changes during ripening; Post harvest losses-types; Technologies to control post harvest losses; Respiration and transpiration loss, methods to measure respiration and transpiration losses; Spoilage of fruit and vegetable, Microbial contaminants and post-harvest pathology	Lecture method, demonstrations, field visit, ABL, Case studies, ABL.	8
IV	Biotechnology In Organic Farming: Organic farming, principles and its scope in India; Role of Biotechnology in organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming; Molecular Farming And Nitrogen Fixation: Molecular farming for the production of industrial enzymes, biodegradable plastics, polyhydroxybutyrate, antibodies, edible vaccines; Metabolic engineering of plants for the production of fatty acids, industrial oils, flavonoids etc.,.	Lecture method, demonstrations, field visit, ABL, Case studies, ABL.	9
V	Introduction to Intellectual Property Rights Concept and Theories Kinds of Intellectual Property Rights Economic analysis of Intellectual Property Rights Need for Private Rights versus Public Interests Advantages and Disadvantages of IPR, International Regime Relating to IPR TRIPS and other Treaties (WIPO,WTO, GATTS)		8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	To analyze the soil samples of various locations to check it sfertility.	PBL	BL4-Analyze	1 week
II	To study the mechanism and significance in crop improvement.	Industrial Visit	BL4-Analyze	8 hrs
III	To apply for the patent for a specific product, product developement process or any idea	PBL	BL6-Create	15 days

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	MS Swamynathan,Biotechnology in Agriculture, a Dialogue,1981 Arun K. Sharma,Hand book of organic farming Agrobios,2002
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8751662/
References Books	Arie Altman Paul Hasegawa,Plant Biotechnology and Agriculture,2011 K. Lindsey and M.G.K. Jones,Plant biotechnology in Agriculture, 1989
MOOC Courses	https://nptel.ac.in/courses/126105014 https://nptel.ac.in/courses/126105337 https://nptel.ac.in/courses/109106128
Videos	https://nptel.ac.in/courses/126105014 https://nptel.ac.in/courses/126105337 https://nptel.ac.in/courses/109106128

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	1	2	-	-	-	-	-	1	2	3	2
CO2	1	-	2	3	-	3	2	-	-	-	-	-	1	2	2
CO3	1	3	1	3	1	1	1	1	-	-	-	-	-	1	2
CO4	2	1	2	2	1	-	2	-	-	-	-	-	2	2	1
CO5	2	3	1	2	2	2	1	-	-	-	-	-	3	2	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Agricutlure Microbiology
Course Code	DSE II (T)

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Embedded theory and lab							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	Basic knowledge of microscope and other microbiological techniques			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** TO Understand and accurately apply terminology used in the field of microbiology, and understand the fundamental differences between different types of microorganisms including bacteria, viruses, fungi, prions and protozoa**(BL1-Remember)** **CO2-** Describe the structure and biology of bacterial cells, including the arrangement and replication of genetic material, and understand the concept of virulence and virulence factors**(BL2-Understand)** **CO3-** To analyse how microorganisms may be detected within various environments, including how they may be cultivated within the laboratory setting, and molecular methods of detection**(BL3-Apply)** **CO4-** To identify specific microorganisms important to animals, plants and soil ecosystems, and explain why these microorganisms are significant**(BL4-Analyze)** **CO5-** Review and evaluate readings relating to microbiology and agricultural production**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction – Soil as an environment for microorganisms. Classification of soil, physical and chemical properties of soil, structure of soil. Microbial interactions - mutualism, commensalism, amensalism, synergism, parasitism, predation and competition. Microbial interactions between plants–phyllosphere, mycorrhizae, rhizosphere and symbiotic association in root nodules. Biofertilizer – VAM, Rhizobium, Frankia, Azospirillum, Azotobacter, cyanobacteria and Azolla.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	8
2	Soil microbes and fertility of soil. Roles of microbes in biogeochemical cycles, Microorganisms in soil processes, carbon cycle, organic matter decomposition, humus formation, nitrogen cycle, nitrogen fixation, symbiotic, non-symbiotic, associative organisms, ammonification, nitrification, denitrification, reactions, organisms involved.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	8
3	Plant protection – phenolics – phytoalexins and related compounds. Bio insecticides – viral, bacterial and fungal, Chemical Pesticide and their adverse effect on agriculture (soil and crop).	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	8
4	Plant pathogenic Microorganisms :- Historical Background, Disease symptoms, Mode of Entry of pathogens, Plant Disease Resistance, Physiology of Parasitism, Factors effecting disease Incidence, Algal, Fungal, Viral, Bacterial disease. Bacterial diseases of agricultural crops -pathogens, symptoms and control measures with reference to paddy, cotton, maize, tomato, citrus, mango and potato. Mycoplasma Disease, Nematode Disease.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	8
5	Microorganisms Harmful to Man and Animal: - Resentence of animal to pathogens, Group of organisms causing disease, Foot mouth disease, Johne's disease, Control of Johne's disease (JD) in cattle, poisoning of livestock by blue-green algae	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Enumeration of microbial population in soil; qualitative and quantitative distribution;	PBL	BL3-Apply	1 month
2	isolation of symbiotic nitrogen fixing bacteria –non symbiotic and associative symbiotic bacteria;	Experiments	BL3-Apply	2
3	soil algae ; nitrification	Experiments	BL4-Analyze	4
4	isolation of sulphur and iron bacteria;	Experiments	BL5-Evaluate	2
5	Isolation and study of phosphobacteria and phosphorus solubility	Experiments	BL5-Evaluate	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Martin Alexander 1976. Introduction to soil microbiology Willy Eastern Ltd. New Delhi. Robert LTate III. 1995. Soil Microbiology. John Wiley & Sons, New York, pp 398.
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8313292/
References Books	Subbarao, N.S. 1977. Soil microorganisms and plant growth, Oxford & IBH Publishing Co., New Delhi. Walker, N. 1975. Soil Microbiology. Butterworths, London AGRICULTURAL MICROBIOLOGY By D. J. BAGYARAJ, G. RANGASWAMI Alexander M. 1997. Introduction to soil microbiology, John Wiley & Sons, Inc, New York. EcEldowney S., Hardman, D.J. and Waite, S. 1993. Pollution Ecology and Biotreatment-Longman Scientific Technical.
MOOC Courses	https://nptel.ac.in/courses/105107173
Videos	https://nptel.ac.in/courses/105107173

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	-	-	2	-	-	-	2	2	-	2	2	3
CO2	2	1	2	-	-	3	-	-	-	2	1	-	1	2	2
CO3	2	2	2	-	-	1	-	-	-	1	1	-	1	1	2
CO4	1	2	1	-	-	2	-	-	-	1	2	-	3	1	1
CO5	2	2	1	-	-	1	-	-	-	1	-	-	3	2	1
CO6	2	2	3	-	-	3	-	-	-	-	2	-	2	1	1

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Organic Mechanisms in Biology
Course Code	DSE III (T)

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Specialization Elective Courses							
Pre-Requisite/s	Provide knowladge about Metabolic Mechanisms in Living Beings			**Co-Requisite/s**	relate with other clinical and research as well as toxicological feilds.			
Course Outcomes & Bloom's Level	**CO1-** To describe the concept of organic mechanisms (metabolism) in animals**(BL1-Remember)** **CO2-** Understandabout the metabolism of biomolecules and toxicology**(BL2-Understand)** **CO3-** To understandthe importanceofmetabolism in lifeanditsapplications in other sciences**(BL3-Apply)** **CO4-** To provideexperimentalbasis andtoenablestudentstobasic concept of metabolism and toxicology**(BL4-Analyze)** **CO5-** Toevaluatetheapplicationsofbiological mechanism and toxicology invariousfieldssuchasresearch anddevelopment.**(BL5-Evaluate)** **CO6-** Toapply theunderstanding of metabolism and toxicologyinvarious levels.**(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Integration of metabolism. Carbohydrate metabolism: Glycolysis Krebs Cycle glycogenolysis glycogenesis PPP cycle ETS Gluconeogenesis, regulation of Carbohydrate metabolism	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Degradation of fatty acids: Beta oxidation Oxidation of odd carbon chain and unsaturated fatty acids. Biosynthesis of lipids in prokaryotes Regulation of lipid metabolism	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Biosynthesis of amino acids Degradation of amino acids regulation of amino acid metabolism; Urea Cycle.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	Biosynthesis and degradation of purine nucleotides, and regulation; Biosynthesis and Degradation of Pyrimidine nucleotide and regulation. Inborn errors in metabolism	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Basic concept of Toxicology toxicity testing LC 50 and LD 50 & chronic toxicity LD50 acute & chronic toxicity Occupational health hazards Heavy metal toxicity- Pb Cd & Hg Pesticides and their toxicological effects	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	IDetermination of Cabohydrate oin serum	Experiments	BL4-Analyze	8
2	Determination of Protein in blood serum and BMI	Experiments	BL4-Analyze	8
3	Determination of Cholestrol in blood	Experiments	BL4-Analyze	4
4	determination of urea and uric acid	Experiments	BL4-Analyze	4
5	Toxicity testing	Experiments	BL5-Evaluate	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	0

Part E

Books	Biochemistry by: Satyanarayana U Ch akrapani U
Articles	https://pubs.acs.org/doi/10.1021/acs.jchemed.5b00901
References Books	Principles of Biochemistry by: Nelson Cox & Lehninger A.L.
MOOC Courses	https://www.khanacademy.org/science/ap-biology/cellular-energetics/cellular-
Videos	https://www.khanacademy.org/science/ap-biology/cellular-energetics/cellular-energy/v/introduction-to-metabolism-anabolism-and-catabolism

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	1	2	2	-	-	-	-	-	-	-	1	2	3
CO2	2	3	1	2	2	-	-	-	-	-	-	-	2	2	3
CO3	2	2	2	1	1	-	-	-	-	-	-	-	2	1	3
CO4	1	2	2	1	1	-	-	-	-	-	-	-	1	1	2
CO5	1	2	1	1	2	-	-	-	-	-	-	-	1	1	2
CO6	2	1	-	1	1	-	-	-	-	-	-	-	-	1	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Waste Management
Course Code	DSE III (T)

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	Knowledge of basic science and environment			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Learn basic concepts of waste management, beginning from source generation to waste disposal.**(BL1-Remember)** **CO2-** Develop understanding on various technological applications for processing of waste and their disposals in various ways.**(BL2-Understand)** **CO3-** Acquire knowledge on waste to energy productions in the perspectives of sustainable development.**(BL2-Understand)** **CO4-** Apply basic concepts in hazardous waste management and integrated waste management for urban areas..**(BL3-Apply)** **CO5-** Creating knowledge on waste characterization and its management practiced in various cities of India**(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to Waste, Definitions, sources, types and composition of various types of wastes. Characterization of Municipal Solid Waste (MSW), Industrial waste, Biomedical Waste (BMW) and Chemical waste. Classification and Quantification of waste. Waste generation rates. Impact of waste on environmental health.	lecture method, collaborative learning, ABL	8
2	Municipal Soild Waste Disposal Methods – composting, incineration, pyrolysis, medical waste disposal strategies. Disposal in landfills: site selection and operation of sanitary landfills; leachate and landfill gas management.	lecture method, collaborative learning, ABL, field visit, demonstrations	8
3	Hazardous wastes Disposal Method and treatment technologies. Hazardous waste landfills: site selection, design and operation. Different type of incineration; land fill classification, types, methods and sitting consideration.	lecture method, collaborative learning, ABL, field visit, demonstrations	8
4	Handling and segregation of wastes at source. Collection, transportation and storage of municipal solid wastes; labeling and handling of hazardous wastes. Public participation and the role of NGOs. Concepts of waste reduction, recycling and reuse. Concepts of waste reduction, recycling and reuse.	lecture method, collaborative learning, ABL, field visit, demonstrations	8
5	Sources of energy generation, incineration, pyrolysis, gasification of waste using gasifiers, direct combustion of MSW- production, land fill gas generation and utilization, present status of technologies for conversion of waste into energy. Environmental and health impacts of waste to energy conversion. Rules related to the handling, treatment and disposal of MSW, BMW and Hazardous waste in India	lecture method, collaborative learning, ABL, field visit, demonstrations	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Impact of waste on human health & environment	Seminar	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	Sustainable solid waste management: issues, policies, and structures. Academic Foundation, New Delhi. Dhamija, U., (2009).
Articles	https://www.sciencedirect.com/science/article/pii/S2666049020300244
References Books	Handbook of solid waste management, McGraw-Hill Publication, USA Kreith F, Tchobanoglous G (2002)
MOOC Courses	https://nptel.ac.in/courses/105103205
Videos	https://nptel.ac.in/courses/105103205

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	2	-	-	-	2	-	-	1	-	1
CO2	2	3	2	2	2	2	-	-	-	2	-	-	1	-	3
CO3	3	1	1	-	1	-	-	-	-	-	-	-	3	2	3
CO4	3	2	-	2	1	-	-	-	-	-	-	-	2	3	3
CO5	-	-	1	-	2	-	-	-	-	-	-	-	-	1	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Frontiers in Biotechnology & Microbiology
Course Code	DSE IV (T)

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	To be familiar with the basics of biomolecules, physiology and genetic composition of prokaryotic and eukaryotic cell.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To understand the strategies and applications of genetically modifies crops. **(BL2-Understand)** **CO2-** To understand and apply the working principles of biofertilizers and bioinsecticides for crop improvement.**(BL3-Apply)** **CO3-** To analyze the gene behavior and genetic modifications in the field of health and medicine.**(BL4-Analyze)** **CO4-** To identify the genetic and infectious diseases using various biotechnological tools.**(BL1-Remember)** **CO5-** To develop an improved & efficient drug using homology modelling & structure-based drug designing for the treatment of various diseases**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
I	Artificial Seed – Definition, Techniques, factors affecting, applications limitations, Germplasm preservation-Introduction, principle, Long term, storage, factors affecting, short/medium storage techniques, applications , limitations, GM Crops - Herbicide resistance, bacterial, fungal, virus, insect , Molecular farming.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
II	Biofertilizers and Biopesticide: Biofertilizers – Definition, Principle advantages. Mass production and field application – Rhizobium Azotobacter, Azospirillum, Acetobacter, Azolla, Cyanobacteria, PSB, VAM, Green manure and compost, Principle and applications of bacterial, fungal, viral and plant origin pesticides	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
III	Stem cells : unipotent, pleurepotent and totipotent stem cells, fertilization: Process, types and application, Gene therapy: Types –, Somatic, Germ line, Augmentation. Gene therapy strategies for cancer Gene therapy: Types – Somatic, Germ line, Augmentation. Gene therapy, strategies for cancer.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
IV	Forensic medicine: Preparation of DNA sample, Approaches of DNA analysis, Public Health: Epidemiology, Diagnosis of infectious diseases, Diagnosis of genetic diseases. Diagnosis of cancer.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
V	Structure -based drug designing: Introduction , Structure based- drug designing approaches, , Target identification and validation , Homology modelling and protein folding, pharmacophore mapping.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Application of molecular markers in sex determination of various plants	Internships	BL5-Evaluate	30 days
II	Production of Artificial seeds and its preservation	PBL	BL5-Evaluate	6 days

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Gupta.P.K ;Biotechnology and Genomics
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8488131/
References Books	Kumar.J;Pharmaceutical Biotechnology
MOOC Courses	https://nptel.ac.in/courses/102103041 https://nptel.ac.in/courses/102106070 https://nptel.ac.in/courses/102103013 https://nptel.ac.in/courses/102103016 https://nptel.ac.in/courses/102103074
Videos	https://nptel.ac.in/courses/102103041 https://nptel.ac.in/courses/102106070 https://nptel.ac.in/courses/102103013 https://nptel.ac.in/courses/102103016 https://nptel.ac.in/courses/102103074

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	2	-	-	-	-	-	-	1	2	2
CO2	3	2	2	2	2	-	2	-	-	-	-	-	2	2	2
CO3	2	1	3	2	2	1	1	-	-	-	-	-	3	2	3
CO4	1	1	2	2	1	2	2	-	-	-	-	-	3	1	3
CO5	2	-	1	-	2	2	2	-	-	-	-	-	2	3	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Molecular Diagnostics
Course Code	DSE IV (T)

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Embedded theory and lab							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	Student must be aware of basic immulogy and immunological assays.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** understanding of the basic principles and clinical significance of laboratory testing in the field of molecular diagnostics.**(BL1-Remember)** **CO2-** Demonstrate an understanding of basic molecular diagnostic techniques**(BL2-Understand)** **CO3-** Demonstrate an understanding of electrophoresis in the separation of DNA fragments**()** **CO4-** Apply molecular diagnostic techniques to the identification and diagnosis of diseases**(BL3-Apply)** **CO5-** Understand the basics in quality control and quality assurance**(BL2-Understand)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG8(Decent work and economic growth)				

Part B

Modules	Contents	Pedagogy	Hours
I	Enzyme Immunoassays: Comparison of enzymes available for enzyme immunoassays, conjugation of enzymes. Solid phases used in enzyme immunoassays. Homogeneous and heterogeneous enzyme immunoassays.Enzyme immunoassays after immuno blotting.	lecture method,Demonstrations, experiments, ABL, PBL , case studies	6
II	Enzyme immuno histochemical techniques: Use of polyclonal or monoclonal antibodies in enzymes immuno assays. Applications of enzyme immunoassays in diagnostic microbiology; Molecular methods in clinical microbiology: Applications of PCR, RFLP, Nuclear hybridization methods, Single nucleotide polymorphism and plasmid finger printing in clinical microbiology	lecture method,Demonstrations, experiments, ABL, PBL , case studies	7
III	Laboratory tests in chemotherapy: Susceptibility tests: Micro-dilution and macro-dilution broth procedures. Susceptibility tests: Diffusion test procedures. Susceptibility tests: Tests for bactericidal activity. Automated procedures for antimicrobial susceptibility tests.	lecture method,Demonstrations, experiments, ABL, PBL , case studies	8
IV	Automation and rapid diagnostic approach: Automation in microbial diagnosis, rapid diagnostic approach including technical purification and standardization of antigen and specific antibodies.	lecture method,Demonstrations, experiments, ABL, PBL , case studies	8
V	Idiotypes and immunodiagnostic: Concepts and methods in idiotypes.Immunodiagnostic tests- Immuno florescence. Radioimmunoassay. Diagnostic tools: HPLC, Electron microscopy, flow cytometry and cell sorting.	lecture method,Demonstrations, experiments, ABL, PBL , case studies	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	To isolate genomic DNA from the animal sample	Experiments	BL3-Apply	6
II	To anlayse immunological activity using various assays	PBL	BL3-Apply	7
III	To perform ELISA test	PBL	BL5-Evaluate	6
IV	To preform radial immunodiffsion	Experiments	BL3-Apply	5
V	To analyse the AIDS patients through immunological assays and moelcular markers	Case Study	BL5-Evaluate	1 week
VI	Detection and identification of microorganisms using molecular techniques	PBL	BL3-Apply	1 week

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Williams, Bethany Jill, Chloe Knowles, and Darren Treanor. "Maintaining quality diagnosis with digital pathology: a practical guide to ISO 15189 accreditation." Journal of clinical pathology 72.10 (2019): 663-668. Modern Approaches to Quality Control. Croatia, IntechOpen, 2011.
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1214554/
References Books	Moumtzoglou, Anastasius, ed. Laboratory Management Information Systems: Current Requirements and Future Perspectives: Current Requirements and Future Perspectives. IGI Global, 2014. Burnett, David. A Practical Guide to ISO 15189 in Laboratory Medicine. United Kingdom, ACB Venture Publications, 2013.
MOOC Courses	https://nptel.ac.in/courses/127105391
Videos	https://nptel.ac.in/courses/127105391

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	1	-	1	-	-	-	-	-	-	3	3	1
CO2	1	3	2	2	1	3	-	-	-	-	-	-	2	2	1
CO3	1	1	2	-	1	3	-	-	-	-	-	-	2	2	1
CO4	2	1	2	1	3	1	-	-	-	-	-	-	2	1	3
CO5	1	1	-	1	1	1	-	-	-	-	-	-	1	1	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Medical Biotechnology
Course Code	DSE V (T)

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Embedded theory and lab							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	Students acquainted with the fundamental concepts of nanotechnology and develop an understanding to employ its principles in modern biotechnology applications.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** The students are introduced to the biological revolutions in this field.**(BL1-Remember)** **CO2-** To understand the role of biotechnology in the world wide market**(BL2-Understand)** **CO3-** To learn about biosensors, vaccine production, monoclonal antibodies, nanotechnology and its applications.**(BL2-Understand)** **CO4-** The students will be able to demonstrate the use of biotechnology in solving various medical problems**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
I	Introduction – Origin, significance & worldwide market of Medical Biotechnology. Revolution in clinical diagnosis, Antibody and Nucleic Acid Hybridization techniques, Imaging techniques (Nanodiagnosis).	Lectue methods, demonstrations, experiments, ABL, PBL, Field visits	8
II	Genetic & Metabolic Disorders – Introduction, Classification, Impact of genetic diseases on human health - Chromosome errors - Down syndrome, Klinefelter's and Turner's syndrome. Metabolic disorders – Phenylketonuria, Homocystinuris, Mucopolysaccharidosis, Gangliosidosis, Gaucher's disease, Diabetes, Hemophilia and sickle cell anemia. Treatment of Genetic diseases - prenatal diagnosis, Genetic Counseling - Ethical, Legal and Social Issues	Lectue methods, demonstrations, experiments, ABL, PBL, Field visits	8
III	Revolution in treatment – Recombinant DNA technology for human insulin, Hepatitis B vaccine. Tissue plasminogen activator, clotting factor VIII. Antibody Engineering and Therapeutic Antibodies. Phage therapy.	Lectue methods, demonstrations, experiments, ABL, PBL, Field visits	8
IV	Cancer - Molecular, cellular and genetic basis of cancer, tumor virus and oncogenes, tumor suppressor genes and mechanism of action of p53 proteins. Stem Cells - Sources and types of stem cells, Stem cell transplant and its types, Potential targets for stem cell treatment, Therapeutic applications of stem cells, Regenerative medicine and Stem cell ethics. Skin Grafting	Lectue methods, demonstrations, experiments, ABL, PBL, Field visits	8
V	Gene therapy- basic approaches and types of gene therapy, vectors used in gene therapy, application of gene therapy in medicine. Nanobiotechnology - Introduction, types and structures of nanoparticles, biosynthesis of nanoparticles, application of nanoparticles in treatment.	Lectue methods, demonstrations, experiments, ABL, PBL, Field visits	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Biochemical test for identification of bacteria	Experiments	BL4-Analyze	3
II	Extraction and separation of Antigen proteins from Bacteria & protozoa	Experiments	BL4-Analyze	3
III	Estimation of blood glucose.	Experiments	BL4-Analyze	2
IV	Estimation of cholesterol in blood.	Experiments	BL4-Analyze	2
V	Estimation of iron in blood.	Experiments	BL5-Evaluate	3
VI	Biological synthesis of nanoparticles	Experiments	BL6-Create	2
VII	Widal test	PBL	BL4-Analyze	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Glick B.R. and Pasurank..Molecular biotechnology – Principle and Applications of Recombinant DNA- J.I.(4th edition), ASM Press. 2010. Anthony D. Ho, Hoffman. R, and Esmail D. Zanjani, Stem Cell Transplantation (4th edition), Wiley – liss publishers, 2006. Hornyak. G.L , Moore. J.J. Tibbals H.F., Dutta. J. Fundamentals of Nanotechnology (1st edition), CRC press, 2008.
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6153617/
References Books	Jogdand. S. N. Medical Biotechnology –, (4th edition), Himalayan publishing house, 2004. Freshney.I, Stacey. G. N, Auerbach.J.M, Culture of Human Stem Cells (1st edition) , Wiley – Liss publishers, 2007.
MOOC Courses	NA
Videos	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6153617/

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	1	1	-	-	-	-	-	-	-	1	2	1
CO2	2	2	2	2	3	1	2	-	-	-	-	-	2	1	2
CO3	3	1	1	2	2	-	2	-	-	-	-	-	2	1	2
CO4	2	1	1	2	1	3	1	-	-	-	-	-	1	1	1
CO5	1	2	2	1	1	-	1	-	-	-	-	-	1	3	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Medical Microbiology
Course Code	DSE V (T)

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	This course provides learning opportunities in the basic principles of medical microbiology and infectious disease.			**Co-Requisite/s**	It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora.			
Course Outcomes & Bloom's Level	**CO1-** This course provides learning opportunities in the basic principles of medical microbiology and infectious disease.**(BL1-Remember)** **CO2-** It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora. **(BL1-Remember)** **CO3-** It also provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases. **(BL2-Understand)** **CO4-** To understand the importance of pathogenic bacteria in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract, skin and soft tissue.**(BL3-Apply)** **CO5-** Helps to understand the use of lab animals in medical field. Explain the methods of microorganisms control, e.g., chemotherapy & vaccines. Solve problems in the context of this understanding. Recall the relationship of this infection to symptoms, relapse and the accompanying pathology.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Fundamental Concepts: History of microbiology, Discovery of microorganisms, Contributions of Louis Pasteur and Robert Koch in Medical Microbiology. Requirements for microbial growth, growth factors, culture media- synthetic and complex, types of media. Obtaining Pure Cultures, Preserving Bacterial Cultures, Growth Curves and generation time, Control of microbial growth, general concept of effect of environmental factors on growth of microbes.	Tutorials, Collaborative, Demonstrations, videos, case studies , tutorials	8
2	Bacterial Cells - fine structure and function: Size, shape and arrangement of bacterial cells. Cell membrane, cytoplasmic matrix, inclusion bodies (e.g. magnetosomes), nucleoid, Ultrastructure of Gram +ve and Gram –ve bacterial cell wall, Pili, Capsule, Flagella and motility.	Tutorials, Collaborative, Demonstrations, videos, case studies , tutorials	8
3	Principles of Diseases and Epidemiology: Relationship between Normal microbiota and host, Opportunistic microorganisms, nosocomial infections, Development and spread of infectious disease: invasion, pathogen, parasite, pathogenicity, virulence, carriers and their types.	Tutorials, Collaborative, Demonstrations, videos, case studies , tutorials	7
4	Bacterial Diseases (with reference to etiology, clinical symptoms, virulence factors involved, detection and prevention) Respiratory tract infections: Diphtheria and Tuberculosis, Gastrointestinal tract infections, staphylococcal food poisoning and E. coli gastroenteritis, Urinary tract infections: gonorrhea and syphilis.	Tutorials, Collaborative, Demonstrations, videos, case studies , tutorials	8
5	Antimicrobial chemotherapy and emerging antimicrobial resistance: Spectrum of antimicrobial activity, action of antimicrobial drugs, inhibitors of cell wall synthesis, anti-mycobacterial antibiotics, inhibitors of protein synthesis and nucleic acid synthesis, competitive inhibitors of essential metabolites, antifungal, antiviral, anti-protozoan drugs; effectiveness of chemotherapeutic agents, concepts of antimicrobial resistance, novel methods to combat increasing antimicrobial resistance.	Tutorials, Collaborative, Demonstrations, videos, case studies , tutorials	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
5	Antibiotic sensitivity test against microorganism	PBL	BL3-Apply	1 week

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	Gerard J. Tortora, Berdell R. Funke, Christine L. Case-Microbiology: An Introduction-9th edition
Articles	http://microbiology.free.fr/Presentations/antimicrobialchemotheray.pdf
References Books	Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, Prescott, Harley, and Klein's Microbiology 8th edition
MOOC Courses	https://nptel.ac.in/courses/102105087 https://nptel.ac.in/courses/102103015
Videos	https://nptel.ac.in/courses/102105087 https://nptel.ac.in/courses/102103015

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	2	1	3	-	-	-	-	-	-	1	3	2
CO2	1	2	1	-	1	3	-	-	-	-	-	-	2	2	1
CO3	3	3	3	3	3	-	3	-	-	-	-	-	3	1	3
CO4	1	2	1	1	1	3	3	-	-	-	-	-	3	2	1
CO5	3	2	2	2	3	3	-	-	-	-	-	-	1	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Industrial Microbiology
Course Code	DSE VI (T)

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Explain the various fermentation strategies and the growth kinetics of industrial microorganisms			**Co-Requisite/s**	the environmental and nutritional factors affecting the production of various metabolites. the best conditions and optimization protocol needed for various microbial products			
Course Outcomes & Bloom's Level	**CO1-** To identify the different types of fermenters**(BL1-Remember)** **CO2-** Explain the various fermentation strategies and the growth kinetics of industrial microorganisms **(BL2-Understand)** **CO3-** Discuss the methods for the production of certain products (metabolites) using different microorganisms **(BL2-Understand)** **CO4-** Describe the environmental and nutritional factors affecting the production of various metabolites**(BL3-Apply)** **CO5-** Select the best conditions and optimization protocol needed for various microbial products**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG4(Quality education) SDG8(Decent work and economic growth)				

Part B

Modules	Contents	Pedagogy	Hours
1	Bioreactor / Fermenter – types & operation of Bioreactors, physico-chemical standards used in bioreactors, limitations of bioreactors, stages of fermentation processes, Media design for fermentation processes, Solid substrate fermentation, Fermenters (Stirred tank, bubble columns, airlift. Bioreactors, Static, Submerged and agitated fermentation), advantages & disadvantages of solid substrate & liquid fermentation	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
2	Technology of Microbial cell maintenance – steps to maintain microbial culture in an aseptic & sterile environment (how to inoculate, preserve & maintain), Strain preservation, maintenance and strain improvement by mutation of gene transfer processes.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visits	8
3	Downstream processing – extraction, separation, concentration, recovery & purification, operations (Insulin, Vitamins, Metabolites), Industrial production of Ethyl alcohol, Acetic Acid (Vinegar), Citric acid, lactic acid, α-amylase, protease penicillin, tetracycline and vitamin B12, with reference to easily available raw materials, Production of herbal drugs.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visits	8
4	Enzyme technology – nature of enzymes, application of enzymes, limitations of microbial cells used as catalysts in fermentation, multi-enzyme reactors, genetic engineering & protein engineering of enzymes, cloning strategy for enzymes, technology of enzyme production, use of immobilized cells and enzymes (Ca-alginate beads, polyacrylamide), industrial applications of immobilized enzymes.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
5	Biotechnology in specific medical & industrial applications - Retting of jute, microbial process for immunization (Production of monoclonal antibodies), Deterioration of paper, textiles, painted surfaces and their prevention, Biofilms, microbial biopolymers, bio-surfactants, Microbial culture selection with high yield potential.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visits	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Study different parts of fermenter	Experiments	BL2-Understand	2
1	To check the antimicrobial properties of Asoca sarca	PBL	BL4-Analyze	2 months
4	Solid state fermentation – Mushroom production	Experiments	BL3-Apply	2
5	Production of Wine from Grapes	Experiments	BL3-Apply	2
6	Cell separation of yeast and LAB by Centrifugal and Filtration	Experiments	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	L. E. Casida Industrial Microbiology (1st Edition)
Articles	strainimprovement-130430125756-phpapp02.pdf
References Books	Nduka Okafor Modern Industrial Microbiology and Biotechnology-1st Edition
MOOC Courses	https://nptel.ac.in/courses/102106053 https://nptel.ac.in/courses/102106022
Videos	https://nptel.ac.in/courses/102106053 https://nptel.ac.in/courses/102106022

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	1	1	3	1	-	-	-	-	-	1	2	1
CO2	1	1	1	3	3	2	-	-	-	-	-	-	2	3	-
CO3	3	2	3	-	3	-	1	-	-	-	-	-	3	1	3
CO4	3	2	3	2	2	3	2	-	-	-	-	-	1	2	3
CO5	3	3	3	2	3	2	2	-	-	-	-	-	2	3	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Industrial Biotechnology
Course Code	DSE VI (T)

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	This course provides learning opportunities in the basic principles of medical microbiology and infectious disease.			**Co-Requisite/s**	It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora.			
Course Outcomes & Bloom's Level	**CO1-** This course provides learning opportunities in the basic principles of medical microbiology and infectious disease.**(BL1-Remember)** **CO2-** It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora. **(BL1-Remember)** **CO3-** It also provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases. **(BL2-Understand)** **CO4-** To understand the importance of pathogenic bacteria in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract, skin and soft tissue.**(BL3-Apply)** **CO5-** Helps to understand the use of lab animals in medical field. Explain the methods of microorganisms control, e.g., chemotherapy & vaccines. Solve problems in the context of this understanding. Recall the relationship of this infection to symptoms, relapse and the accompanying pathology.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Fundamental Concepts: History of microbiology, Discovery of microorganisms, Contributions of Louis Pasteur and Robert Koch in Medical Microbiology. Requirements for microbial growth, growth factors, culture media- synthetic and complex, types of media. Obtaining Pure Cultures, Preserving Bacterial Cultures, Growth Curves and generation time, Control of microbial growth, general concept of effect of environmental factors on growth of microbes.	Tutorials, Collaborative, Demonstrations, videos, case studies , tutorials	8
2	Bacterial Cells - fine structure and function: Size, shape and arrangement of bacterial cells. Cell membrane, cytoplasmic matrix, inclusion bodies (e.g. magnetosomes), nucleoid, Ultrastructure of Gram +ve and Gram –ve bacterial cell wall, Pili, Capsule, Flagella and motility.	Tutorials, Collaborative, Demonstrations, videos, case studies , tutorials	8
3	Principles of Diseases and Epidemiology: Relationship between Normal microbiota and host, Opportunistic microorganisms, nosocomial infections, Development and spread of infectious disease: invasion, pathogen, parasite, pathogenicity, virulence, carriers and their types.	Tutorials, Collaborative, Demonstrations, videos, case studies , tutorials	7
4	Bacterial Diseases (with reference to etiology, clinical symptoms, virulence factors involved, detection and prevention) Respiratory tract infections: Diphtheria and Tuberculosis, Gastrointestinal tract infections, staphylococcal food poisoning and E. coli gastroenteritis, Urinary tract infections: gonorrhea and syphilis.	Tutorials, Collaborative, Demonstrations, videos, case studies , tutorials	8
5	Antimicrobial chemotherapy and emerging antimicrobial resistance: Spectrum of antimicrobial activity, action of antimicrobial drugs, inhibitors of cell wall synthesis, anti-mycobacterial antibiotics, inhibitors of protein synthesis and nucleic acid synthesis, competitive inhibitors of essential metabolites, antifungal, antiviral, anti-protozoan drugs; effectiveness of chemotherapeutic agents, concepts of antimicrobial resistance, novel methods to combat increasing antimicrobial resistance.	Tutorials, Collaborative, Demonstrations, videos, case studies , tutorials	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
5	Antibiotic sensitivity test against microorganism	PBL	BL3-Apply	1 week

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	Gerard J. Tortora, Berdell R. Funke, Christine L. Case-Microbiology: An Introduction-9th edition
Articles	http://microbiology.free.fr/Presentations/antimicrobialchemotheray.pdf
References Books	Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, Prescott, Harley, and Klein's Microbiology 8th edition
MOOC Courses	https://nptel.ac.in/courses/102105087 https://nptel.ac.in/courses/102103015
Videos	https://nptel.ac.in/courses/102105087 https://nptel.ac.in/courses/102103015

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	2	1	3	-	-	-	-	-	-	1	3	2
CO2	1	2	1	-	1	3	-	-	-	-	-	-	2	2	1
CO3	3	3	3	3	3	-	3	-	-	-	-	-	3	1	3
CO4	1	2	1	1	1	3	3	-	-	-	-	-	3	2	1
CO5	3	2	2	2	3	3	-	-	-	-	-	-	1	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Pharmaceutical Biotechnology
Course Code	DSE VII (T)

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Student must know Genetic engineering applications in relation to production of pharmaceuticals and the use of microorganisms in fermentation technology			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember the basic concpet of enzymes, drug , gene and genome interaction **(BL1-Remember)** **CO2-** Understanding the importance of Immobilized enzymes in Pharmaceutical Industries**(BL2-Understand)** **CO3-** To apply Genetic engineering applications in relation to production of pharmaceuticals**(BL3-Apply)** **CO4-** To understand the Importance of Monoclonal antibodies in Industries**(BL2-Understand)** **CO5-** To apply and anlayze the Appreciate the use of microorganisms in fermentation technology**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG8(Decent work and economic growth)				

Part B

Modules	Contents	Pedagogy	Hours
I	Brief introduction to Biotechnology with reference to Pharmaceutical Sciences,Enzyme Biotechnology- Methods of enzyme immobilization and applications,Biosensors- Working and applications of biosensors in Pharmaceutical Industries, Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase	Lecture method, demonstrations, experiments, field visit, ABL, PBL	7
II	Basic principles of genetic engineering,cloning vectors, restriction endonucleases and DNA ligase,Recombinant DNA technology. Application of genetic engineering in medicine,production of: i) Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin	Lecture method, demonstrations, experiments, field visit, ABL, PBL	8
III	Types of immunity- humoral immunity, cellular immunity,General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity,Storage conditions and stability of official vaccines	Lecture method, demonstrations, experiments, field visit, ABL, PBL	8
IV	,Hybridoma technology- Production, Purification and Applications, Immuno blotting techniques- ELISA, Western blotting, Southern blotting,Introduction to Microbial biotransformation and applications.	Lecture method, demonstrations, experiments, field visit, ABL, PBL	8
V	Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring.,Large scale production fermenter design and its various controls,Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid,Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substituties	Lecture method, demonstrations, experiments, field visit, ABL, PBL	7

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Isolation of enzymes from natural isolates	PBL	BL3-Apply	1 week
II	production of immobilized enzymes using isolated enzymes	PBL	BL6-Create	7
III	Isolation of genomic DNA	Experiments	BL3-Apply	6
IV	To perform restriction digestion using kit and its visualization using agarose gel electrophoresis	Experiments	BL4-Analyze	7
V	Preparation of culture media and necessary arrangements for production of amino acids	Field work	BL6-Create	30 days
VI	To demonstarte the working of PCR	Industrial Visit	BL2-Understand	5
VII	Preparation of different methods of medicinal plant extracts	Experiments	BL3-Apply	3
VIII	Antibacterial activity.	Experiments	BL4-Analyze	3
IX	Antifungal activity.	Experiments	BL4-Analyze	3
X	Total antioxidant activity.	PBL	BL4-Analyze	5
XI	Phytochemical screening of Primary metabolites.	PBL	BL4-Analyze	6
XII	Phytochemical screening of Secondary metabolites	PBL	BL5-Evaluate	7
XIII	Separation of medicinal plant extracts by chromatography.	PBL	BL4-Analyze	10
XIV	Estimation of ascorbic acid in multivitamin formulations	PBL	BL5-Evaluate	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	J.W. Goding: Monoclonal Antibodies
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3525971/
References Books	B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of RecombinantDNA: ASM Press Washington D.C. RA Goldshy et. al., : Kuby Immunology J.M. Walker and E.B. Gingold: Molecular Biology and Biotechnology by Royal
MOOC Courses	https://nptel.ac.in/courses/102105342
Videos	https://nptel.ac.in/courses/102105342

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	2	1	1	-	-	-	-	-	-	1	1	2
CO2	2	2	1	1	2	-	1	-	-	-	-	-	2	2	3
CO3	2	1	2	3	2	1	2	-	-	-	-	-	2	3	1
CO4	3	1	3	3	1	1	1	-	-	-	-	-	3	3	1
CO5	1	1	3	1	3	2	-	-	-	-	-	-	2	3	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Food and Dairy Microbiology
Course Code	DSE VII (T)

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Explain the interactions between microorganisms and the food environment, and factors influencing their growth and survival.			**Co-Requisite/s**	Describe the characteristics of foodborne, waterborne, and spoilage microorganisms, and methods for their isolation, detection, and identification.			
Course Outcomes & Bloom's Level	**CO1-** Explain the interactions between microorganisms and the food environment, and factors influencing their growth and survival.**(BL1-Remember)** **CO2-** Explain the significance and activities of microorganisms in food.**(BL2-Understand)** **CO3-** Describe the characteristics of foodborne, waterborne and spoilage microorganisms, and methods for their isolation, detection and identification.**(BL3-Apply)** **CO4-** Explain why microbiological quality control programmes are necessary in food production.**(BL3-Apply)** **CO5-** Explain the effects of fermentation in food production and how it influences the microbiological quality and status of the food product.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to microbiology: Microbiology in daily life, Characteristics and morphology of bacteria, fungi, virus, protozoa and algae. Control of micro-organisms- Growth curve; Influence of environmental factors on growth- PH, Water activity, O2 availability, Temperature, Pressure, and Radiation.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
2	Principles, physical methods of food preservation: temperature (low, high, canning, drying), irradiation, hydrostatic pressure, high voltage pulse, microwave processing, and aseptic packaging, chemical methods of food preservation: salt, sugar, organic acids, SO2, nitrite and nitrates, ethylene oxide, antibiotics, and bacteriocins.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
3	Contamination and spoilage of different foods: Cereals, sugar and their products, Milk and milk products, Fruits and vegetables, canned foods, Meat, fish, egg, and poultry.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visit	8
4	Foodborne illness: Food intoxication- Staphylococcal intoxication, botulism. Food infection- Salmonellosis, Clostridium perfringens, Bacillus cereus gastroenteritis, E. coli infection, Yersinia enterocolitica, Listeria monocytogenes, Campylobacter jejuni, and others. Pre-biotic and pro-biotic	utorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visit	8
5	SCP- Microorganisms used, raw materials used as substrate, condition for growth and production, nutritive value and use of SCP; Fat from microorganisms- Microorganisms used raw materials, production of fat; Production of amino acids; Production or other substances added to foods. Production of enzymes- amylases, invertase, pectolytic enzymes, proteolytic enzymes, and other enzymes	utorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visit	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Staining of microorganisms	Experiments	BL3-Apply	2
2	Composition, preparation and sterilization of media	Experiments	BL3-Apply	2
3	Demonstration of techniques for pure culture of microorganisms	Experiments	BL4-Analyze	2
4	Streak plate method	Experiments	BL3-Apply	2
5	Pour plate method.	Experiments	BL3-Apply	2
6	Serial dilution agar plate method	Experiments	BL4-Analyze	2
7	Microbiology testing of milk	PBL	BL4-Analyze	2
8	Serial dilution agar plate method	Experiments	BL4-Analyze	2
9	To visit the various food industries in order to learn the basic methodologies	Industrial Visit	BL2-Understand	5
10	To visualize the effect of antibiotics on the expression and growth of fungi and Bacterial cell.	PBL	BL3-Apply	4
11	To determine the production of primary and secondary metabolites by Endophytic Microorganism.	PBL	BL3-Apply	4

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	Virendra Kumar Pande Textbook of Food Microbiology 1st Edition
Articles	https://academic.oup.com/jimb
References Books	John C. Ayres Microbiology of Foods 2nd Edition Frazier, W.C. Food Microbiology 4th edition Pelzar, H.J. and Rober, D. Microbiology 5th edition
MOOC Courses	https://onlinecourses.nptel.ac.in/noc24_ag03/preview https://onlinecourses.nptel.ac.in/noc23_ag02/preview https://nptel.ac.in/courses/126105015 https://onlinecourses.nptel.ac.in/noc24_ag07/preview
Videos	https://nptel.ac.in/courses/102105058

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	2	2	1	-	-	-	-	-	2	3	1	2
CO2	2	2	1	3	1	3	2	-	-	-	-	2	1	2	1
CO3	1	1	2	2	2	1	2	3	-	-	-	1	3	3	2
CO4	3	2	3	3	1	1	3	2	-	-	-	1	2	3	1
CO5	2	3	3	2	3	2	1	2	-	-	-	3	1	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Field Project/Internship
Course Code	FP/In I

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					0	0	6	6
Course Type	Project							
Course Category	Projects and Internship							
Pre-Requisite/s	Deep knowledge of all disciple core subject of biotechnology program			**Co-Requisite/s**	Presentation of research project/ internship			
Course Outcomes & Bloom's Level	**CO1-** Understand themselves in relation to their community and develop among themselves since of social and civic and responsibility**(BL1-Remember)** **CO2-** Identify the needs and problem of the community and involve them in problem solving.**(BL2-Understand)** **CO3-** Utilize their knowledge in finding practical solution to individual and community problem**(BL3-Apply)** **CO4-** Develop the confidence require for group living and sharing of responsibilities of acquire leader ship qualities and democratic attitudes. **(BL4-Analyze)** **CO5-** Develop the capacity to meet emergencies and natural disasters and practice national integration and social harmony**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**					

Part B

Modules	Contents	Pedagogy	Hours

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
300					

Part E

Books	
Articles	
References Books	
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	-	-	1	-	-	-	-	3	2	2
CO2	1	2	1	1	-	1	-	-	-1	-	-	-	3	2	3
CO3	1	2	1	1	1	-	-	-	-	-	-	-	3	3	3
CO4	2	2	1	1	-	-	1	-	-	-	-	-	3	3	3
CO5	2	2	1	1	1	-	-	1	1	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Field Project/Internship
Course Code	FP/In II

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					0	0	8	8
Course Type	Project							
Course Category	Internships							
Pre-Requisite/s	Deep knowledge of all disciple core subject of Biotechnolgy program			**Co-Requisite/s**	Presentation of research project/ internship			
Course Outcomes & Bloom's Level	**CO1-** Understand themselves in relation to their community and develop among themselves since of social and civic and responsibility**(BL1-Remember)** **CO2-** Identify the needs and problem of the community and involve them in problem solving.**(BL2-Understand)** **CO3-** Utilize their knowledge in finding practical solution to individual and community problem**(BL3-Apply)** **CO4-** Develop the confidence require for group living and sharing of responsibilities of acquire leader ship qualities and democratic attitudes. **(BL4-Analyze)** **CO5-** Develop the capacity to meet emergencies and natural disasters and practice national integration and social harmony**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
400					

Part E

Books	
Articles	
References Books	
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	-	-	1	-	-	-	-	3	2	2
CO2	1	2	1	1	-	1	-	-	-1	-	-	-	3	2	3
CO3	1	2	1	1	1	-	-	-	-	-	-	-	3	3	3
CO4	2	2	1	1	-	-	1	-	-	-	-	-	3	3	3
CO5	2	2	1	1	1	-	-	1	1	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Bioinstrumentation
Course Code	SEC I [T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	The course prepares the student to understand the Bio-Instrumentation; and how doesnit interacts with living and non-living molecules. and how it predicts their structure and function.			**Co-Requisite/s**	The subject Fundamental of Bio-Instrumentation is designed for graduate biotechnology students to understand the basic concepts of every part of Bio-Instrumentation and their types. the course aims to provide the basis for analyzing the applications of Bio-Instrumentation in various fields such as research and industries			
Course Outcomes & Bloom's Level	**CO1-** The course prepares the student to understand the Bio-Instrumentation; and how does it interacts with living and non-living molecules. and how it predicts their structure and function.**(BL2-Understand)** **CO2-** The subject Fundamental of Bio-Instrumentation is designed to under graduate students of biotechnology for understanding of basic concepts of each and every part of Bio-Instrumentation and their types. **(BL2-Understand)** **CO3-** The course aims to provide experimental basis, and to enable students to acquire a specialized knowledge and understanding.**(BL4-Analyze)** **CO4-** The course aims to provide basis of analyzing the applications of Bio-Instrumentation in various fields such as research and industries.**(BL4-Analyze)** **CO5-** To apply the understanding of Bio-Instrumentation in evaluation in various Biological Samples and to evaluate the applications of Bio-Instrumentation in various fields such as research and industries **(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕			**SDG (Goals)**	SDG4(Quality education)			

Part B

Modules	Contents	Pedagogy	Hours
1	Microscopy: History, principle, types, and applications (Bright field, dark field, and fluorescent microscopy). Electron microscopy: principle and applications of scanning electron, transmission electron microscope.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
2	Centrifugation: Basic principle, types (analytical and ultracentrifugation) and applications.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
3	Chromatography: Principle, working, and applications of Paper chromatography, thin layer chromatography, gel filtration chromatography, ion exchange chromatography, and affinity chromatography.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
4	Electrophoresis: principles, types, and applications of paper, agarose gel & PAGE electrophoresis. Radioactivity: the principle of radioactive decay, half-life. Radioisotopes: applications in biological sciences, Scintillation counters: basic principle and application.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
5	Spectrum and their Types, the wavelength range of electromagnetic radiation. Spectroscopy: basic principle and applications of colorimetry and U.V, Visible and Infrared spectroscopy. Microtomy: Basic principle and applications	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Preparation of broth and liquid culture media to grow the test bacterial culture.	Experiments	BL2-Understand	2
2	To the determine of unknown Protein Concentration & Nucleic Acid (NA) Quantification: Estimate protein and NA concentration using absorbance at 280 & 260 nm.	Experiments	BL3-Apply	3
3	To determine of the food additives, preservatives, and contaminants.	Experiments	BL4-Analyze	4
4	Essential for observing biological samples at various magnifications. Includes light microscopes.	PBL	BL3-Apply	4
5	• quantifying nucleic acids, proteins, and small molecules by UV Visible Microscopy.	PBL	BL3-Apply	4

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	Nelson, Cox and Leininger Biochemistry 8th Edition
Articles	https://pubs.acs.org/doi/full/10.1021/acs.jchemed.0c00404
References Books	Stryer Biochemistry 9th Edition
MOOC Courses	https://nptel.ac.in/courses/102108082
Videos	https://nptel.ac.in/courses/102108082

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	2	2	3	1	2	3	1	1	3	1	2	2
CO2	1	2	1	2	2	3	2	1	2	1	2	2	3	2	1
CO3	1	3	2	1	3	3	2	1	2	2	1	3	2	1	2
CO4	2	3	3	3	1	2	2	3	1	2	2	2	3	3	2
CO5	1	2	2	1	3	2	1	3	1	3	2	1	2	1	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Basics of Forensic Science
Course Code	SEC II (T)

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	Knowledge about basic science and tools used in Biotechnology			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember the structure of various branches, tools and techniques and causes of crime in forensic science.**(BL1-Remember)** **CO2-** To comprehend the human genetics, mutation and DNA typing techniques.**(BL2-Understand)** **CO3-** To understand the importance of various chromatographic methods and their role in forensic science.**(BL2-Understand)** **CO4-** To provide experimental basis, of detection and identification of blood and other seminal fluids.**(BL4-Analyze)** **CO5-** To apply the understanding of various identification methods in evaluation in various samples in forensic science.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction and principles of forensic science, forensic science laboratory and its organization and service, tools and techniques in forensic science, branches of forensic science, causes of crime, role of modus operandi in criminal investigation.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	5
2	Introduction, History of DNA Typing, Human Genetics- Heredity, Alleles, Mutations and Population Genetics, Molecular Biology of DNA, Variations, Polymorphism, DNA Typing Systems- RFLP Analysis, PCR Amplifications, Sequence Polymorphism, Forensic Significance of DNA Profiling	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	4
3	History, Introduction, Definition, Principles of Chromatographic Techniques, Classification of Chromatographic Methods, Adsorption and Partition Chromatography, Application of different Chromatographic Methods in Forensic Science	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	5
4	Detection and identification of blood stains. Determination of blood group systems and species of origin. Techniques for the determination of blood group and stains. Detection of seminal and other body fluids, Red cells enzymes, Serum proteins of forensic significance	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	4
5	Introduction, Basic Principles, Instrumentation & Forensic Applications of various Electrophoresis, Paper Electrophoresis, Cellulose Acetate Membrane Electrophoresis, Gel Electrophoresis, Agarose Gel Electrophoresis, Polyacrylamide Gel Electrophoresis, Sodium dodecyl sulphate (SDS),Two Dimensional Electrophoresis, Capillary Electrophoresis	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	5

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Detection and Identification of Blood Stains	Seminar	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	S.H. James and J.J. Nord by, Forensic Science: An Introduction to Scientific and Investigative Techniques, Forensic Science: An Introduction to Scientific and Investigative Techniques 2nd Edition, CRC Press, Boca Raton (2005)
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7838326/
References Books	Molecular Biotechnology Principles and Applications of recombinant DNA. ASM Press, Washington. Molecular Biotechnology□Principles and Applications of recombinant DNA. 2 Edition ASM Press, Washington B.B. Nanda and R.K. Tiwari, Forensic Science in India: A Vision for the Twenty First Century, Forensic Science in India: A Vision for the Twenty First Century, Publishers, New Delhi (2001) W.G. Eckert and R.K. Wright Introduction to Forensic Sciences, W.G. Eckert (ED.), CRC Press, Boca Raton (1997). 2nd Edition, W.J. Tilstone, M.L. Hastrup and C. Hald Fisher's Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013)
MOOC Courses	https://nptel.ac.in/courses/109106408
Videos	https://nptel.ac.in/courses/109106408

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	2	-	-	-	2	-	-	1	-	1
CO2	2	3	2	2	2	2	-	-	-	2	-	-	1	-	3
CO3	3	1	1	-	-	-	-	-	-	-	-	-	3	2	3
CO4	3	2	1	1	-	-	-	-	-	2	-	-	2	3	2
CO5	2	2	1	1	-	-	-	-	-	2	-	-	2	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Marine Microbiology
Course Code	SEC V (T)

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					2	0	1	3
Course Type	Theory only							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	Understand the marine ecosystem and familiarize the structure and various habitat of marine environment.			**Co-Requisite/s**	To realize marine pollution and control measure, bio-corrosion and bioremediation.			
Course Outcomes & Bloom's Level	**CO1-** To Understand the marine ecosystem and familiarize the structure and various habitat of marine environment.**(BL1-Remember)** **CO2-** To comprehend water borne diseases and water borne pathogen **(BL2-Understand)** **CO3-** To understand various biotechnology applications of marine microbiology such as biosensor, transgenic, biosurfactant etc.**(BL3-Apply)** **CO4-** To realize marine pollution and control measure, bio-corrosion and bioremediation.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG2(Zero hunger) SDG3(Good health and well-being) SDG4(Quality education) SDG6(Clean water and sanitation) SDG7(Affordable and clean energy) SDG8(Decent work and economic growth) SDG11(Sustainable cities and economies) SDG13(Climate action) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to oceanography: the world's oceans and seas, properties of seawater, physico-chemical factors in the marine environment such as temperature, density, nutrients, salinity, dissolved gases, waves, tides, oceanic currents	Tutorials, Collaborative, Demonstrations, videos, case studies ,	8
2	Marine microbial habitats: estuaries, mangroves, salt marshes, beach and coastal ecosystems, reef and coral reefs, water column, sediments.	Tutorials, Collaborative, Demonstrations, videos, case studies ,	7
3	Marine microbes – bacteria, fungi, phytoplankton, zooplankton, viruses: their growth, physiology and contribution to ocean processes,Physiology of marine microbes: metabolic diversity and energy-yielding processes: microbial loop; marine snow; phototrophy and primary productivity, fermentation, aerobic respiration, anaerobic respiration (denitrification	Tutorials, Collaborative, Demonstrations, videos, case studies ,	7
4	Marine ecosystem: Environment of marine bacteria, bacterial growth in sea and its regulation by environmental conditions, modeling of growth and distribution of marine micro plankton, mechanism of dissolved, organic matter production (DOM), strategies of organic matter utilization and microbial utilization of organic matter in sea.	Tutorials, Collaborative, Demonstrations, videos, case studies ,	8
5	Methods in marine microbiology:- Sampling equipment: water samplers such as Niskin sampler, Hydro-Bios, sampler, Rosette samplers; sediment samplers such as van Veen grabs and corers. Tools to study marine microbial diversity: flow cytometry (bacteria, picoplankton, picoeukaryotes, viruses); molecular approaches such as metagenomics, community fingerprinting and Fluorescence in situ hybridization (FISH)	Tutorials, Collaborative, Demonstrations, videos, case studies ,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Composition, preparation, and sterilization of media:	Experiments	BL2-Understand	3
2	Demonstration of techniques for pure culture of microorganisms:	Experiments	BL2-Understand	3
3	Microbiology testing of milk	Experiments	BL3-Apply	4
4	Serial dilution agar plate method	Experiments	BL3-Apply	3
5	isolating and culturing marine microbes from their collected samples.	PBL	BL4-Analyze	4
6	To determine the production of primary and secondary metabolites by marine microbes.	PBL	BL3-Apply	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	0

Part E

Books	Meller, C. B., Wheeler, P. A Biological Oceanography, Wiley-Blackwell Publishers. Volume3
Articles	https://www.ncbi.nlm.nih.gov/books/NBK559439/
References Books	Belkin, S. and Colwell, R. R.-Ocean & Health: Pathogens in the Marine Environment, Springer-3rd Edition
MOOC Courses	https://www.microbiologyresearch.org/content/marine-microbiology
Videos	https://www.microbiologyresearch.org/content/marine-microbiology

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	3	1	3	3	1	1	1	3	1	2	1	3
CO2	3	1	2	2	1	3	3	1	2	1	3	3	3	2	1
CO3	1	3	1	1	3	3	3	2	1	2	3	2	3	1	2
CO4	2	1	2	1	3	1	3	1	1	2	1	1	1	3	2
CO5	3	3	2	1	3	1	2	3	2	2	1	3	3	2	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Organic Farming
Course Code	SEC V (T)

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					2	0	1	3
Course Type	Embedded theory and lab							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	Student must be aware of basic plant physiology and soil classification			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** This course provides learning opportunities in the basic principles of medical microbiology and infectious disease.**(BL1-Remember)** **CO2-** It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora. **(BL1-Remember)** **CO3-** It also provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases. **(BL2-Understand)** **CO4-** To understand the importance of pathogenic bacteria in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract, skin and soft tissue.**(BL3-Apply)** **CO5-** Helps to understand the use of lab animals in medical field. Explain the methods of microorganisms control, e.g., chemotherapy & vaccines. Solve problems in the context of this understanding. Recall the relationship of this infection to symptoms, relapse and the accompanying pathology.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓	**SDG (Goals)**	SDG2(Zero hunger) SDG3(Good health and well-being) SDG4(Quality education) SDG6(Clean water and sanitation) SDG7(Affordable and clean energy) SDG8(Decent work and economic growth) SDG11(Sustainable cities and economies) SDG13(Climate action) SDG15(Life on land)					

Part B

Modules	**Contents**	**Pedagogy**	**Hours**

Part C

Modules	**Title**	**Indicative-ABCA/PBL/ Experiments/Field work/ Internships**	**Bloom's Level**	**Hours**
I	Visit to Organic farm to study the various components, identification and utilization of Organic products.	Field work		6
II	Preparation of Organic Compost-Over ground compost, Pit compost, Liquid compost, Vermi compost.	PBL	BL3-Apply	1 MONTH
III	Preparation of Neem products and other botanicals for Pest and disease control	Internships	BL6-Create	1 MONTH
IV	Weed control through organic way	Experiments	BL3-Apply	30 days
V	Soil analysis: pH determination.	Experiments	BL4-Analyze	2
VI	Seed bed preparation, seed selection and seedling preparation	Experiments	BL3-Apply	1 WEEK
VII	Method of application of different types of fertilizer and Green manure.	PBL	BL3-Apply	1 MONTH
VIII	Preparation of Panchagavya/ Amrit Jol	PBL	BL6-Create	1 MONTH

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Sharma, Arun K. 2002. A Handbook of Organic farming. Agrobios, India. Sathe, T.V. 2004, Vermiculture and Organic Farming. Daya Publishers Gupta, M., 2004. Organic Agriculture Development in India. ABD publishers, Jaipur, India. Dr. Pratiksha Raghuvanoki. Handbook of Organic Farming
Articles	https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/organic-farming
References Books	Dongarjal R. P. and Zade S.B. 2019. Insect Ecology and Integrated Pest Management, Akinik Publications, New Delhi. Dushyent Gehlot. 2005. Organic Farming- standards, accreditation, certification and inspection. Agribios, India.
MOOC Courses	https://nptel.ac.in/courses/126105014
Videos	https://nptel.ac.in/courses/126105014

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1	1	2	-	-	-	-	-	-	2	2	2
CO2	1	2	3	3	2	2	1	-	-	-	-	-	2	1	2
CO3	1	1	1	3	2	2	1	-	-	-	-	-	1	1	1
CO4	2	1	3	2	1	1	1	-	-	-	-	-	2	1	2
CO5	3	1	3	3	1	1	-	-	-	-	-	-	1	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Introduction to Good Laboratory practices
Course Code	SEC VI (T)

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	Knowledge of food laboratory euipments and testing protocols			**Co-Requisite/s**	To study guidelines on good laboratory practices and SOPs and calibration procedure of different instruments.			
Course Outcomes & Bloom's Level	**CO1-** This course provides learning opportunities in the basic principles of medical microbiology and infectious disease.**(BL1-Remember)** **CO2-** It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora. **(BL1-Remember)** **CO3-** It also provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases. **(BL2-Understand)** **CO4-** To understand the importance of pathogenic bacteria in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract, skin and soft tissue.**(BL3-Apply)** **CO5-** Helps to understand the use of lab animals in medical field. Explain the methods of microorganisms control, e.g., chemotherapy & vaccines. Solve problems in the context of this understanding. Recall the relationship of this infection to symptoms, relapse and the accompanying pathology.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG2(Zero hunger) SDG3(Good health and well-being) SDG6(Clean water and sanitation) SDG12(Responsible consuption and production)				

Part B

Modules	Contents	Pedagogy	Hours

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	World health organization (WHO); Handbook Good Laboratory Practices
Articles	
References Books	Indian council of medical research, New Delhi; Guidelines for good laboratory practices B.W.Wenclawiak, M.Koch E. Hadjicostas; Quality Assurance in Analytical Chemistry.
MOOC Courses	https://nptel.ac.in/courses/126105020
Videos	https://youtu.be/h5NpTku5BGc?si=U-GL_p3nLe4_7pZM

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	1	-	1	1	1	-	1	1	1
CO2	2	2	1	1	1	1	1	1	-	1	-	-	2	1	1
CO3	2	2	1	2	1	2	-	-	1	1	-	-	2	1	2
CO4	2	3	2	2	1	2	1	1	-	1	1	-	3	2	2
CO5	3	3	2	2	1	2	-	1	1	1	1	-	3	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Entrepreneurship development
Course Code	SEC VI (T)

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Generic Elective							
Pre-Requisite/s	Students must have studied food business managemnet in previous semester			**Co-Requisite/s**	Students should have prior knowledge of economics and basics of management			
Course Outcomes & Bloom's Level	**CO1-** This course provides learning opportunities in the basic principles of medical microbiology and infectious disease.**(BL1-Remember)** **CO2-** It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora. **(BL1-Remember)** **CO3-** It also provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases. **(BL2-Understand)** **CO4-** To understand the importance of pathogenic bacteria in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract, skin and soft tissue.**(BL3-Apply)** **CO5-** Helps to understand the use of lab animals in medical field. Explain the methods of microorganisms control, e.g., chemotherapy & vaccines. Solve problems in the context of this understanding. Recall the relationship of this infection to symptoms, relapse and the accompanying pathology.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG3(Good health and well-being)				

Part B

Modules	Contents	Pedagogy	Hours

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	
Articles	https://www.forbes.com/entrepreneurs/?sh=3e2b77403035
References Books	Effective Small Business Management by Scarborough & Zimmerer
MOOC Courses	https://nptel.ac.in/courses/110106141
Videos	https://www.youtube.com/watch?v=N3-FZn_iQFU&t=3s

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	-	1	1	-	3	1	3	3	1	1
CO2	3	3	2	1	1	-	-	-	-	2	-	2	3	1	1
CO3	1	1	3	3	2	2	1	-	-	-	1	1	3	1	1
CO4	3	1	-	-	-	2	2	1	-	-	2	-	3	3	3
CO5	1	2	-	-	-	-	1	1	-	3	1	3	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Hydroponics Cultivation
Course Code	SEC VII (T)

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Embedded theory and lab							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	Basic knowledge of plants, plant physiology, nutrient requirements			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** This course provides learning opportunities in the basic principles of medical microbiology and infectious disease.**(BL1-Remember)** **CO2-** It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora. **(BL1-Remember)** **CO3-** It also provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases. **(BL2-Understand)** **CO4-** To understand the importance of pathogenic bacteria in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract, skin and soft tissue.**(BL3-Apply)** **CO5-** Helps to understand the use of lab animals in medical field. Explain the methods of microorganisms control, e.g., chemotherapy & vaccines. Solve problems in the context of this understanding. Recall the relationship of this infection to symptoms, relapse and the accompanying pathology.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG8(Decent work and economic growth) SDG12(Responsible consuption and production)				

Part B

Modules	Contents	Pedagogy	Hours

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Handling of tools required for hydroponic set up	Experiments	BL2-Understand	2
II	Preparation of macronutrients and micronutrients solutions/stock cultures	Experiments	BL3-Apply	4
III	Preparation of different media for hydroponic system.	Experiments	BL3-Apply	4
IV	Evaluating the effect of bio fertilizers on hydroponic cultivation	PBL	BL4-Analyze	30 days
V	Weeding management techniques - demonstration	PBL	BL5-Evaluate	30 days
VI	Demonstration of pests and diseases control and prevention methods	Field work	BL2-Understand	5
VII	Cultivation of tomato by hydroponic system	Internships	BL6-Create	30 days
VIII	Cultivation of chilli through hydroponic cultivation	Internships	BL6-Create	30 days
IX	Demonstrating importance of nutrients/light/temperature for successful hydroponic cultivation.	Field work	BL2-Understand	5
X	Visit to local Hydroponics cultivation farm, observing the crop growths. Submission of field work report of 10 pages in the prescribed format.	Industrial Visit	BL2-Understand	6
XI	Attending special lectures, group discussions and seminars on related topics B. Sc Semester – V (Skill Enhancement Course-Elective) Credits:1 Course: 7A Hydroponics cultivation Lab	Industrial Visit	BL2-Understand	6

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Prasad S and Kumar U. Green House management for Horticultural crops. Agro-Bios India. Dahama A.K. Organic Farming for Sustainable Agriculture. Agrobios, India
Articles	https://psci.princeton.edu/tips/2020/11/9/the-future-of-farming-hydroponics
References Books	Keith Roberto, How to Hydroponics. The future Garden Press New York.4th Edition Howard M. Resh. Hobby Hydoponics. CRC Press, USA. Subba Rao N.S. (1995). Biofertilizers in Agriculture and Forestry. Oxford and IBH Publishing Company. Pvt. Ltd New Delhi.
MOOC Courses	NA
Videos	https://youtu.be/ZRVHQylThGA https://www.britannica.com/topic/hydroponics

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	2	2	2	-	2	-	-	-	-	-	2	2	2
CO2	2	2	2	2	1	1	3	-	-	-	-	-	1	2	1
CO3	3	2	1	1	1	2	3	-	-	-	-	-	2	1	-
CO4	1	2	2	2	-	3	-	-	-	-	-	-	2	1	2
CO5	3	1	-	1	1	1	1	-	-	-	-	-	2	2	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	India in 21st Century
Course Code	VAC II (T)

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Indian Knowledge System (IKC)							
Pre-Requisite/s	1. *Understanding of Sociological Concepts*: A foundational knowledge of sociological concepts is essential to grasp the composition of Indian society discussed in Unit I. This includes understanding social institutions, cultural environments, and threats to national integration. 2. *Historical Background*: Familiarity with the history of India, particularly the Indian Freedom Movement, is crucial for comprehending Unit II. Knowledge of events such as the Revolt of 1857, the emergence of nationalism, and the various phases of the freedom struggle provides context for understanding the birth of the Indian nation-state. 3. *Awareness of Political Movements*: A basic understanding of political movements in India, particularly those led by figures like Gandhi, is necessary for Unit III. Familiarity with concepts like non-cooperation, civil disobedience, and the Quit India movement aids in analyzing the dynamics of Indian freedom and partition. 4. *Knowledge of Post-Independence Era*: Understanding the phases of nation-building since independence is vital for Unit IV. This includes awareness of the planned progress era, populist policies, and the paradigm shift towards liberalization and globalization. Knowledge of responses from different societal groups and regions enriches the understanding of India's post-independence journey. 5. *Global Awareness*: Unit V delves into global concerns such as environmental issues, globalization, and movements for democracy and sustainability. A broad understanding of global trends and their impact on nations is necessary to engage with this content effectively.			**Co-Requisite/s**	1. *Foundational Understanding of Sociological Concepts*: - Understanding social institutions, cultural environments, and threats to national integration is fundamental. - Familiarity with sociological theories such as functionalism, conflict theory, and symbolic interactionism can provide a deeper comprehension of societal dynamics. 2. *Historical Context of India*: - Knowledge of Indian history, including the colonial period, the struggle for independence, and post-independence developments, offers context for understanding the evolution of Indian society. - Understanding the socio-economic impacts of colonial rule and the transition to independence enhances insight into contemporary social issues. 3. *Understanding of Political Movements in India*: - Knowledge of key figures, ideologies, and strategies of political movements in India, including those led by Gandhi, Nehru, and other prominent leaders, is essential. - Awareness of the socio-political context of colonial India and the role of various stakeholders in the struggle for independence enriches understanding. 4. *Familiarity with Post-Independence Developments*: - Understanding the socio-economic and political changes in post-independence India, including the Nehruvian era, economic reforms, and social movements, is crucial. - Awareness of key policies, such as the Green Revolution, reservation system, and economic liberalization, provides insights into contemporary Indian society. 5. *Global Perspective and Awareness*: - Knowledge of global trends in areas such as technology, economics, environment, and geopolitics enhances understanding of India's position in the global context. - Understanding global issues like climate change, international trade, and human rights movements enables students to analyze their impact on India and vice versa.	
Course Outcomes & Bloom's Level	**CO1-** This course provides learning opportunities in the basic principles of medical microbiology and infectious disease.**(BL1-Remember)** **CO2-** It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora. **(BL1-Remember)** **CO3-** It also provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases. **(BL2-Understand)** **CO4-** To understand the importance of pathogenic bacteria in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract, skin and soft tissue.**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG3(Good health and well-being) SDG4(Quality education) SDG5(Gender equality) SDG10(Reduced inequalities) SDG12(Responsible consuption and production) SDG13(Climate action)				

Part B

Modules	Contents	Pedagogy	Hours

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
0	0	Experiments		00

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Bipan Chandra and others: India's Struggle For Independence , Penguine Publishers. Bipan Chandra: History Of Modern India, Orient Blackswan publishers. Sunil Khilnani: The Idea of India, Penguine publishers.
Articles	.https://www.youtube.com/watch?v=i8N6YRTJsDk
References Books	Shekhar Bandopadhyay: From Plastic to Partition and After, A History of Modern India, Orient Blackswan publishers. Shekhar Bandopadhyay: From Plastic to Partition and After, A History of Modern India, Orient Blackswan publishers. A R Desai:Social Background of Indian Nationalism, Popular Prakashan . B R Nanda: Mahatma Gandhi ,A Biography,London
MOOC Courses	1.https://www.youtube.com/watch?v=i8N6YRTJsDk
Videos	1.https://www.youtube.com/watch?v=i8N6YRTJsDk 2. https://youtu.be/MWsT7x3qd3E 3.https://www.youtube.com/watch?v=pQghqJSUAK4&list= 4.https://youtu.be/9BEU8A_JZPU 5.https://youtu.be/pPsKQwaZ4dg

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	1	-	-	1	-	-	-	-	1
CO2	-	-	-	-	-	1	1	-	1	-	-	1	-	-	1
CO3	-	-	-	-	-	1	3	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	2	-	-	-	1	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_Biotechnology

Title of the Course	Environmental Science
Course Code	VACI[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Community Enganement and Service							
Pre-Requisite/s	Should be acquainted with the basics knowledge of environment and its management			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** This course provides learning opportunities in the basic principles of medical microbiology and infectious disease.**(BL1-Remember)** **CO2-** It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora. **(BL1-Remember)** **CO3-** It also provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases. **(BL2-Understand)** **CO4-** To understand the importance of pathogenic bacteria in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract, skin and soft tissue.**(BL3-Apply)** **CO5-** Helps to understand the use of lab animals in medical field. Explain the methods of microorganisms control, e.g., chemotherapy & vaccines. Solve problems in the context of this understanding. Recall the relationship of this infection to symptoms, relapse and the accompanying pathology.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG1(No poverty) SDG3(Good health and well-being) SDG4(Quality education) SDG5(Gender equality) SDG6(Clean water and sanitation) SDG7(Affordable and clean energy) SDG8(Decent work and economic growth) SDG10(Reduced inequalities) SDG11(Sustainable cities and economies) SDG12(Responsible consuption and production) SDG13(Climate action) SDG14(Life below water) SDG15(Life on land) SDG17(Partnerships for the goals)				

Part B

Modules	Contents	Pedagogy	Hours

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Poster Presentation	Case Study	BL2-Understand	4
2	Noise Survey with the help of Noise Level Meter	PBL	BL4-Analyze	4
3	STP of Jalalpur, Motijheel	Industrial Visit		4
4	Concurrent Issues related to the subject	Case Study	BL3-Apply	4

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	Anubha Kaushik & C.P. Kaushik Perspective in Environment and Ecology 2010 Robert Morrison & Brian Murphy Environmental Forensic 1st Edition 2005 J. Jeffrey Peice Environmental Pollution and Control 4th Edition, 1997 A. K. De Environmental Chemistry 7th Edition 2014 Anupam Mishra The Ponds are still relevant (Aaj Bhi Khare Hain Taalab) 1st Edition 2018 Anupam Mishra Rajasthan Ki Rajat Bunden Edition 2021
Articles	https://www.snexplores.org/topic/environment
References Books	K. Lee Lerner; Brenda Wilmoth Lerner Environmental Issues: Essential Primary Sources 2006-07-11 Elizabert Fisher Environmental Law: A very short Introduction 2018-01-01 Ashok Bajpai Paryavaran Ke Path with Anupam Mishra (Interview) 3rd Edition 2022
MOOC Courses	https://nptel.ac.in/courses/109103186
Videos	https://nptel.ac.in/courses/109103186

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	1	3	3	3	1	2	3	1	3	2	3
CO2	1	1	2	3	1	3	3	3	2	1	3	2	1	1	2
CO3	3	3	2	1	3	3	3	2	1	1	3	2	2	3	2
CO4	3	3	3	3	2	2	3	3	1	1	3	2	3	3	2
CO5	3	3	2	2	1	3	3	3	1	1	3	2	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	Hindi
Course Code	AEC0101[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Foundation core							
Pre-Requisite/s	varn gyan , shabd gyan			**Co-Requisite/s**	lipi , samajdari			
Course Outcomes & Bloom's Level	**CO1-** भारतीय ज्ञान परम्परा सेवि द्यार्थि यर्थि ों को अवगत कराना**(BL1-Remember)** **CO2-** सांस्कृतिक ,एवं राष्ट्रिय एकता।।**(BL3-Apply)** **CO3-** भाषा अध्ययन एवं अध्यापन का उद्देश्य विद्यार्थियों के सर्वांगीण विकास में सहायक है। छात्र जीविकोपार्जन के लक्ष्यों का सहज संधान कर सके । जीविकोपार्जन के लक्ष्यों का सहज संधान कर सके । **(BL2-Understand)** **CO4-** पाठ्यक्रम में व्याकरण ,सामान्य तथा पारम्परिक साहित्य , लेखन परम्परा का बोध करना एवं समग्र व्यक्तित्व का विकास करना है। **(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**					

Part B

Modules	Contents	Pedagogy	Hours
1	स्वतंत्रता पुकारती {कविता} वाक्य संरचना और अशुद्धियाँ {३ संकलित } जयशंकर प्रसाद वाक्य संरचना और अशुद्धियाँ {३ संकलित } जयशंकर प्रसाद वाक्य संरचना और अशुद्धियाँ {३ संकलित } जयशंकर प्रसाद पुष्प की अभिलाषा२ {कविता}	Audio/Video clips, group discussion, lecture with PPTs, quiz	5
2	१ नमक का दरोगा} { कहानी} ---प्रेमचंद २ एक थे राजा भोज { निबंध } --त्रिभुवननाथ शुक्ल ३ पर्यायवाची , विलोम , एकार्थी ,अनेकार्थी एवं शब्दयुग्म शब्द {संकलित }	Audio/Video clips, group discussion, lecture with ppt, quiz	4
3	} { निबंध } ---स्वा1मी विवेकानंद २ लोकतंत्र एक धर्म है{ निबंध --डॉ सर्वपल्ली राधा कृष्णन ३ नहीं रूकती है नदी --हीरालाल बाछोतिया ४ पल्लवन १ भगवान् बुद्ध	Audio/Video clips, group discussion, lecture with ppt, classroom presentations	5
4	अफसर{ निबंध -शरद जोशी २ हमारी सांस्कृतिक एकता संग्रह में -भारत एक है{ निबंध -रामधारी सिंह दिनकर ३ संक्षेपण {संकलित }	Audio/Video clips, group discussion, lecture with ppt, classroom presentations	4
5	नैतिक मूल्य परिचय एवं वर्गीकरण{ आलेख } --डॉ शशि राय २ आचरण की सभ्यता --सरदार पूर्ण सिंह ३ अंतर्ज्ञान और नैतिक जीवन{लेख --डॉ सर्वपल्ली राधाकृ ४ अप्प दीपोभव {लेख } -स्वामी श्रद्धानन्द	Audio/Video clips, group discussion, lecture with ppt	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	hindi bhasha aur naitik mulay
Articles	
References Books	hindi bhasha aur naitik mulay
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	2	-	-	-	-	2	-	-	-	-	-	-
CO2	-	2	-	-	-	2	-	1	-	-	-	-	-	-	-
CO3	2	-	-	1	-	-	-	-	-	2	-	-	-	-	-
CO4	2	-	-	-	-	2	-	-	1	-	-	-	-	-	-
CO5	1	-	-	-	1	-	-	2	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	English-I
Course Code	AEC0201[T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Ability Enhancement Courses							
Pre-Requisite/s	The students have a basic knowledge and understanding of the English language and communication.			**Co-Requisite/s**	Communication skills, Leadership development etc.			
Course Outcomes & Bloom's Level	**CO1-** Determine interpersonal skills and be an effective goal-oriented team player**(BL1-Remember)** **CO2-** Elaborate creativity and lateral thinking**(BL2-Understand)** **CO3-** Examine attitudes, emotional intelligence and understand its influence on behavior**(BL3-Apply)** **CO4-** Justify approaches to conflict resolution.**(BL4-Analyze)** **CO5-** Evaluate goal setting, management, decision-making skills.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
Module 1	Where the Mind is Without Fear, The Tryst with Destiny The Hero, Indian Weavers The Portrait of a Lady The Solitary Reaper	Classroom Lecture, PPts, Videoes	10
Module 2	Basic Language Skills Synonyms, Antonyms,Homonyms, Word Formation,Prefix, Suffix	Classroom Lecture, PPts,	6
Module 3	Uncountable Noun, Verb, Tense, Adverb	Classroom Lecture, PPts,	6
Module 4	Trading Comprehension, Unseen Passage	Classroom Lecture, PPts, Videos	4
Module 5	Introduction to Report Writing, Major Objectives of Writing Reports, Significance of Business/Technical, Types and Forms of Reports, Styles of Writing Reports – Printed format, Memo Format, Letter Format, Book/Letter Text Format, Layout and Structure of Reports, Components of Report Writing.	Classroom Lecture, PPts, Videos	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	C. Muralikrishna and S. Mishra (2011) Communication Skills for Engineers, Pearson education. ISBN: 9788131733844
Articles	Carnegie Dale, How to win Friends and Influence People, New York: Simon & Schuster, 1998.
References Books	Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2007, New Delhi.
MOOC Courses	https://nptel.ac.in/courses/109103020
Videos	https://nptel.ac.in/courses/109103020

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	2	-	-	-	2	-	-	1	-	1
CO2	2	2	1	2	2	2	-	-	-	2	-	-	1	-	3
CO3	2	1	1	-	1	-	-	-	-	2	-	-	3	2	3
CO4	3	2	-	2	1	-	-	-	-	2	-	-	2	3	3
CO5	3	2	-	2	1	-	-	-	-	2	-	-	2	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	AEC-IV
Course Code	AEC0401[T]

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Foundation core							
Pre-Requisite/s	Bhasha gyan			**Co-Requisite/s**	shabd gyan , varn gyan, samajik samaj			
Course Outcomes & Bloom's Level	**CO1-** हिंदी भाषा एवं नैतिक मूल्यों को समझना **(BL1-Remember)** **CO2-** सांस्कृतिक ,एवं राष्ट्रिय एकता।।**()** **CO3-** भाषा अध्ययन एवं अध्यापन का उद्देश्य विद्यार्थियों के सर्वांगीण विकास में सहायक है। छात्र जीविकोपार्जन के लक्ष्यों का सहज संधान कर सके । जीविकोपार्जन के लक्ष्यों का सहज संधान कर सके । **()** **CO4-** पाठ्यक्रम में व्याकरण ,सामान्य तथा पारम्परिक साहित्य , लेखन परम्परा का बोध करना एवं समग्र व्यक्तित्व का विकास करना है। **()**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being)				

Part B

Modules	Contents	Pedagogy	Hours
1	वर्ण-विन्यास - डॉ विश्वनाथ मिश्रसांकृत्यायन पत्थर (कविता) - सूर्यकांत त्रिपाठी निराला दिमागी गुलामी (निबंध) - राहुल ह तोड़ती व	Audio/Video clips, group discussion, lecture with ppt, quiz	5
2	नारीत्व का अभिशाप (निबंध) -महादेवी वर्मा चीफ की दावत (कहानी) - भीष्म साहनी विराम चिन्ह (संकलित)	Audio/Video clips, group discussion, lecture with ppt, quiz	4
3	चली फगुनहट बौरे आम (ललित निबंध) - विवेकी राय इंद्रधनुष का रहस्य (वैज्ञानिक लेख) - डॉ कपूरमल जैन संधि (संकलित)	Audio/Video clips, group discussion, lecture with ppt, classroom presentations	5
4	सपनो की उड़ान (प्रेरक निबंध) - ए पी जे अब्दुल कलाम हमारा सौर मंडल (संकलित) प्रमुख वैज्ञानिक अविष्कार और हमारा जीवन (संकलित) समास-संरचना और प्रकार (संकलित)	Audio/Video clips, group discussion, lecture with ppt, classroom presentations	4
5	शिकागो व्याख्यान (व्याख्यान) - स्वामी विवेकानंद धर्म और राष्ट्रवाद (लेख) - महर्षि ऑरबिंदो सादगी (आत्मकथा) -महात्मा गाँधी चित्त जहां भयविहीन (कविता) - रबिन्द्र टैगोर	Audio/Video clips, group discussion, lecture with ppt	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	evm sha Hindi bhasha naitik mulayha
Articles	
References Books	evm sha Hindi naitik mulayha
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	1	-	-	-	3	-	-	-	-	-	-
CO2	-	-	3	-	-	-	2	1	-	-	-	-	-	-	-
CO3	-	1	-	-	2	-	-	-	2	-	-	-	-	-	-
CO4	1	-	-	-	-	2	-	-	-	-	-	-	-	-	-
CO5	-	-	-	1	-	2	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	Programming in C
Course Code	BSCS0101[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Basic knowledge of computer fundamental, algorithm and flowchart			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To Remember the basics of Computer Knowledge.**(BL1-Remember)** **CO2-** To Understand debugging and testing, implementation and maintenance.**(BL2-Understand)** **CO3-** To apply the various techniques for C Programming.**(BL3-Apply)** **CO4-** To analysis modular programming**(BL4-Analyze)** **CO5-** To Evaluate Students will learn to write algorithm for solutions to various real-life problems.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Classification of programming language: procedural languages, problem oriented languages, non-procedural languages, Structured programming concepts: modular programming: top-down analysis, bottom-up analysis, structured programming. Problem solving using computers: problem definition and analysis, problem design, coding, compilation, debugging and testing, documentation, implementation and maintenance.	White Board, Group Discussion	8
2	Introduction to C language: constants, variables, keywords, data types, operators, expressions, operator precedence and associativity. Structure of C program: variable declaration of variable as constant.	White Board, Group Discussion	8
3	Managing input/output operators: formatted and unformatted. Control statements: branching, jumping & looping, scope rules, and storage classes.	White Board, Group Discussion	8
4	Arrays (one and two dimensional), Functions: user defined function, standard function, categories in functions, passing arguments to a function, recursion. Pointers: operators, declaration, pointer to arithmetic, array of pointers. Structures: declaring, accessing, initializing, array of structures.	White Board, Group Discussion	8
5	File handling in C: opening and closing a data file, inserting data to data file. Graphics programming- introduction, functions, stylish lines, drawing and filling images, palettes and colours, justifying text, bit of animation.	White Board, Group Discussion	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Write a program to print digits of entered number in reverse order.	Experiments	BL2-Understand	2
2	Write a program to print sum of two matrices.	Experiments	BL2-Understand	2
3	Write a program to print subtraction of two matrices.	Experiments	BL2-Understand	2
4	Write a program to print multiplication of two matrices	Experiments	BL2-Understand	2
5	Write a program to demonstrate concept of structure.	Experiments	BL2-Understand	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	20

Part E

Books	Let us C by Yashwant Kanetkar ANSI C by Balagurusamy
Articles	
References Books	Introduction to Algorithms by Cormen, PHI Programming in C: Denis Richie
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	Basics of Computer and information technology
Course Code	BSCS0102[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Preliminary knowledge of computer, their operations and applications.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To Remember the basics of Computer Knowledge.**(BL1-Remember)** **CO2-** Understand basic concepts and terminology of information technology.**(BL2-Understand)** **CO3-** To apply the various techniques for Basics Computer Knowledge.**(BL3-Apply)** **CO4-** To analysis of MS Ofiice in Windows and other OS.**(BL4-Analyze)** **CO5-** To evaluate the study problem of application programmings by using the different types of Software and solve base problems which arise in all applied sciences.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	INTRODUCTION TO COMPUTER Basic organization of computer system: block diagram & functions (Central Processing Unit, Input / Output Unit, and Storage Unit); Characteristics; Capabilities & Limitations. Types of Computing Devices: Desktop, Laptop & Notebook Smart-Phone, Tablet PC, Server, Workstation & their Types: RAM, ROM, PROM, EPROM, EEPROM; Cache Memory. PERIPHERAL DEVICES Input Devices: Keyboard, Mouse, Trackball, Joystick, Digitizer or Graphic Tablet, Scanners, Digital Camera, Web Camera, MICR, OCR, OMR, Bar-Code Reader, Voice Recognition device, Light Pen & Touch Screen. STORAGE DEVICES Magnetic Tape, cartridge, Data Drives, Hard Disk Drives (Internal & External), Floppy Disk, CD, VCD, CD-RW, Zip Drive, DVD,-RW, USB Flash Drive, Blue Ray Disk & Memory Cards.	White Board, Group Discussion	8
2	OPERATING SYSTEM DOS basics: FAT, File & Directory Structure and naming rules, Booting process, DOS system files, Internal & External DOS Commands. Window Basics (only elementary ides): Windows 7 & 8: Desktop, Control Panel; saving renaming, moving copying and searching files & folders, restoring from recycle Bin, Creating shortcut, Establishing Network Connections.	White Board, Group Discussion	8
3	MS Word Text Editing and formatting using Word 2007 & onwards versions: Creating documents using Template; Saving Word file formats; Previewing documents, Printing document to file/page; Protecting document; Editing of selected text, Inserting, Deleting and Moving text. Formatting documents: page layout, paragraph format, Aligning text and paragraph, Borders and Shading, Headers and Footers.	White Board, Group Discussion	8
4	MS Power point & MS Excel • Creating presentation using slide master and template in various themes & variants. • Working with slides: New slide, move, copy, delete, duplicate, slide layouts, presentation views. • Format menu: Font, paragraph, drawing & Editing. • Printing presentation: Print slides, notes, handouts and outlines. • Saving presentation in different file formats. • Workbook & Worksheet Fundamentals: Concept of Row, Column & Cell; creating a new workbook through blank & template. • Working with worksheet: Entering data into worksheet (General, number, Currency, Data, Time, Text, Accounting, etc.); Renaming, Copying, Inserting, deleting & protecting worksheet. • Working with Row & Column (Inserting, Deleting, Pasting, resizing & Hiding), Cell & Cell formatting, and Concept of range.	White Board, Group Discussion	8
5	Internet and Cyber Security • Internet: World Wide Web, Dial up connectivity, leased line, VSAT, Broad Band, Wi- Fi, URL, Domain name, Web Browser (Internet Explorer, Firefox, Google Chrome, Opera, UC Browser, etc.) Search Engine (Google, Ask, Etc.); Website: Static & Dynamic; Difference between Website & Portal. • E-mail: Account opening. Sending & Receiving Mails, Managing Contacts & Folders. • E-mail: Internet & Social Networking Ethics. • Types of Viruses & Antivirus. • Computer security issues & its protection through firewall & antivirus Making secured online transactions.	White Board, Group Discussion	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	MS Word Text Editing and formatting using Word 2007 & onwards versions and Formatting documents	Experiments	BL2-Understand	2
2	MS Power point Creating presentation using slide master and template in various themes & variants.	Experiments	BL2-Understand	2
3	MS Excel Working with slides: New slide, move, copy, delete, duplicate, slide layouts, presentation views.	Experiments	BL2-Understand	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	20

Part E

Books	PC Software for Windows by R. K. Taxali Fundamental of Computers by P. K. Sinha
Articles	
References Books	Internet Security by Kenneth EinarHimma, 207 Computer Today by Suresh K. Basandra
MOOC Courses	
Videos	https://www.youtube.com/watch?v=q3rplCwtvU0

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	2	-	-	-	-	-	-	-
CO3	-	-	-	-	3	-	-	3	-	-	-	-	-	-	-
CO4	-	-	4	4	-	-	-	-	-	-	-	-	-	-	-
CO5	5	-	-	-	5	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	Operating System
Course Code	BSCS0201[T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Disciplinary Major							
Pre-Requisite/s	Must have knowledge the computer architecture.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To Remember the basics of Computer Knowledge.**(BL1-Remember)** **CO2-** To Understand the concept of System Programmer's view**(BL2-Understand)** **CO3-** To apply the various techniques of Operating system in the field of Computer Science**(BL3-Apply)** **CO4-** To analysis of Inter-process Communication and Synchronization of Operating system.**(BL4-Analyze)** **CO5-** To evaluate the study problem from application point of view by using the results of the different algorithms and solve real life base problems which arise in all applied sciences**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction: Evolution of operating system, Types of operating systems, Multitasking, Timesharing, Multithreading, Multiprogramming and, Real time operating systems, Different views of the operating system, System Programmer's view, User's view, Operating system concepts and structure, Layered operating system, Monolithic systems.	White Board, Group Discussion	8
2	Processes: The Process concept, The process control block, System programmer's views of processes, Operating system services for process management, Scheduling algorithms, FCFS, Round robin, Shortest run time next, Highest response ratio next, Multilevel Feedback Queues, Performance evaluation of scheduling algorithms.	White Board, Group Discussion	8
3	Memory Management : Memory management without swapping or paging, Concepts of swapping and paging, page replacement algorithms namely, Least recently used, Optimal page replacement, Most recently used, Clock page replacement, FIFO, Modeling paging algorithms, Design issues for paging system, Segmentation, Segmented paging, Paged Segmentation.	White Board, Group Discussion	8
4	Inter-process Communication and Synchronization: The need for Inter-process Synchronization, Concept of Mutual exclusion, binary and counting semaphores, Classical problems in concurrent programming, Dining Philospher's problem, Bounded Buffer Problem, Readers and Writers problem, Critical section, Critical region and conditional Critical region, Monitors and Messages.	White Board, Group Discussion	8
5	Deadlocks: Concepts of deadlock detection, deadlock prevention, deadlock avoidance, Banker's Algorithm, Disk: Disk hardware, Disk scheduling algorithms, Error handling, Track at a time caching, RAM Disks.	White Board, Group Discussion	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Operating System Concepts An Introduction to Operating System
Articles	
References Books	Gavlin P, .L. Abraham Silberschatz. Deitel, H.M.
MOOC Courses	
Videos	https://www.youtube.com/watch?v=vBURTt97EkA

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	3	-	-	-	3	-	-	-	-	-	-
CO4	-	4	-	-	-	-	-	-	-	4	-	-	-	-	-
CO5	-	-	-	5	-	5	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	DBMS
Course Code	BSCS0202[T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Basic understanding of software and programming language. Basic data manipulation operations, file handling, file organization. Set Theory (Mathematics) Cartesian, cross product and discrete mathematics.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To Remember the basics of Computer Knowledge.**(BL1-Remember)** **CO2-** To Understand the basic theory of the relational model and both its strengths and weaknesses**(BL2-Understand)** **CO3-** To apply the various techniques of SQL programs in the field of Computer Science**(BL3-Apply)** **CO4-** To analysis of design entity-relationship diagrams to represent simple database application scenarios**(BL4-Analyze)** **CO5-** To evaluate the study problem from User point of view by using the results of the different SQL Programs and Familiar with various recent trends in the database area.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Purpose of date base system, views of data, data models: relation, network, hierarchical, instances and schemas, data dictionary, types of database languages:- DDL, DML, structure of DBMS, advantages and disadvantages of DBMS, 3-level architecture proposal:- external, conceptual & internal levels	White Board, Group Discussion	8
2	Entity relationship model as a tool of conceptual design: entities & entities set, relationship and relationship set, attributes and mapping constraints, keys, ER diagram:- strong and weak entities, generalization specialization & aggregation, reducing ER diagram to tables.	White Board, Group Discussion	8
3	Fundamentals of set theoretical notations: relations, domains, attributes, tuples, concept of keys: primary key, super key, alternate key, candidate key, foreign key, fundamentals of integrity rules: entity & referential integrity, extension and intention, relational algebra: select, project, Cartesian product, different types of joints: theta, equi, natural, outer joins, set operations.	White Board, Group Discussion	8
4	Functional Dependencies, Good & Bad Decomposition and Anomalies as a database: A consequences of bad design, Universal relation, Normalization: 1NF, 2NF, 3NF, & BCNF normal forms, multi valued dependency, join dependency, 4NF, 5NF.	White Board, Group Discussion	8
5	Basic concepts:- Indexing and Hashing, B-tree Index files, Hashing: Static & Dynamic hash function, Index definition in SQL: Multiple key accesses.	White Board, Group Discussion	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	WAQ to insert some new records in emp table.	Experiments	BL2-Understand	2
2	WAQ to list the number of employees whose name is not „ford", „jams" or „jones"	Experiments	BL2-Understand	2
3	WAQ to list the name and salary and sort them in descending order of their salary	Experiments	BL2-Understand	2
4	WAQ to list the details of employees whose name is starts from „a"	Experiments	BL2-Understand	2
5	WAQ to delete all records form emp table	Experiments	BL2-Understand	2
6	WAQ to list the student name having „d" as second character.	Experiments	BL2-Understand	2
7	WAQ to list the name and salary and sort them Id descending order of their salary	Experiments	BL2-Understand	2
8	WAQ in employee table find all the manager who earns between 1000 and 2000	Experiments	BL2-Understand	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	30

Part E

Books	Database System Concepts by Henry Korth and A. Silberschatz Simplification approach to DBMS, Prateek Bhatia, Gurvinder Singh Kalyani Publication
Articles	
References Books	An Introduction to Database System by Bipin Desai An Introduction to Database System by C.J. Date.
MOOC Courses	
Videos	https://www.youtube.com/playlist?list=PLxCzCOWd7aiFAN6I8CuViBuCdJgiOkT2Y

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-
CO3	3	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	4	-	-	-	-	-	-	-	-	-	4	-	-	-
CO5	-	-	5	-	5	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	Computer Networks
Course Code	BSCS0301[T]

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Study of computer networks provides basic knowledge of Computer system architecture and various techniques used in it, along with error detection techniques like parity bit etc			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Remembering the concepts of computer networks, their types.**(BL1-Remember)** **CO2-** Understand to the concept of Class full and Classless addressing Network address Translation, Mobile IP.**(BL2-Understand)** **CO3-** Apply to Unicast and Multicast Routing and Next Generation IP for networking.**(BL3-Apply)** **CO4-** Analyze the applications to address the issues of Networking Technologies.**(BL4-Analyze)** **CO5-** Evaluating to investigate routers, IP and Routing Algorithms in Network Layer**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Data Communication System: Purpose, Components: Source, transmitter, transmission System, receiver, and destination. Line Configurations, Signal Representation, Parallel and Serial Data Transmission, Asynchronous and Synchronous Modes of Data Transmission. Digital Signal Encoding, Channel Coding	Lectures with whiteboard/PPT	8
2	Analog and digital data transmission. Data and signal. Analog and digital Signaling of analog and digital data. Modem, Modulation techniques, CODEC, Digital Transmitter etc. Introduction to Network, OSI reference model, TCP/IP reference model. Transmission Media: Magnetic Media, Twisted-Pair cables, Baseband & Broadband Coaxial cables, Fiber Optics. Wireless Transmission: Radio Transmission, Microwave Transmission..	Lectures with whiteboard/PPT	8
3	ISDN; ATM; Data Link Layer: Services, Framing, Error Control, Error-detecting & Correcting Codes. Data Link Protocols: Stop-and-Wait Protocol, Sliding Window Protocol. HDLC; Static & Dynamic Channel allocation in LANs & MANs. Multiple Access Protocols: ALOHA, CSMA/CD	Lectures with whiteboard/PPT	8
4	IEEE standards 102.3 and Ethernet, 102.4: Token Bus; 102.5: Token Ring. Bridges, Routers, Gateways, Routing Algorithm, Congestion control Algorithm, Internetworking, The TCP/IP Protocol ,IP Addressing, Subnets.	Lectures with whiteboard/PPT	8
5	Wide Area Network: Introduction, Network routing, Routing Tables, Types of routing, Dijkstra's Algorithm, Bellman-Ford Algorithm, Link state routing, Open shortest path first, Flooding, Broadcasting, Multicasting,Internet Protocols, Overview of TCP/IP, Transport protocols, Elements Recorded of Transport Protocol, Transmission control protocol (TCP), User data-gram protocol (UDP).	Lectures with whiteboard/PPT	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Configure to DNS Server	Experiments	BL2-Understand	2
2	Configure to DHCP Server	Experiments	BL2-Understand	2
3	Configure IP routing with RIP using CISCO Packet Tracer	Experiments	BL2-Understand	2
4	Configure to router for one network	Experiments	BL2-Understand	2
5	Configure to two different router	Experiments	BL2-Understand	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	20

Part E

Books	Behrouz A. ; Data Communications and Networking. ForouzanMcGraw-Hill. Andrew S. Tanenbaum; Computer Networks; Pearson Prentice Hall
Articles	
References Books	William J. Beyda Data Communication Prentice Hall William Stallings Data and Computer Communications Pearson Prentice Hall
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	Data Structure
Course Code	BSCS0302[T]

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Basic understanding of computer fundamentals and programming in 'C'.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To Remember Have a comprehensive knowledge of the data structures**(BL1-Remember)** **CO2-** To Understand the importance of data and be able to identify the data requirements for an application**(BL2-Understand)** **CO3-** To apply have a practical experience of algorithmic design and implementation**(BL3-Apply)** **CO4-** To analysis develop projects requiring the implementation of various data structures.**(BL4-Analyze)** **CO5-** To Evaluate Have practical experience of developing applications that utilize data structures;**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Concept of data structure and analysis of algorithm, abstract data structure, introduction to stack and primitive operations on stack, stack as an abstract data type, stack application: infix, prefix, postfix and recursion, introduction to queues, primitive operation on queues, circular queue, de queue, priority queue and applications of queue.	White Board, Group Discussion	8
2	Introduction to linked list, basic operations on linked list, stacks and queues using linked list, doubly linked list, circular linked list, applications of linked list.	White Board, Group Discussion	8
3	Trees-basic terminology, binary trees, tree representations as array and linked list, basic operations on binary tree, traversal of binary trees:- inorder, preorder, postorder. Applications of binary tree, threaded binary tree, AVL tree, binary tree representations of trees	White Board, Group Discussion	8
4	Sequential search, binary search, insertion sort, selection sort, quick sort, bubble sort, heap sort, comparison of sorting methods.	White Board, Group Discussion	8
5	Hash Table, Collision resolution technique, Introduction to graphs, Definition, Terminology, Directed, Undirected and Weighted Graph, Representation of Graph, Graph Traversal-Depth first, Breadth first search, spanning tree, minimum spanning tree, shortest path algorithm.	White Board, Group Discussion	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Write a program to find the factorial of a given no using recursion.	Experiments	BL2-Understand	2
2	Write a program for bubble sorting.	Experiments	BL2-Understand	2
3	Write a program for linear search.	Experiments	BL2-Understand	2
4	Write a program for binary search.	Experiments	BL2-Understand	2
5	Write a program for selection sorting	Experiments	BL2-Understand	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	12
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	20	60	30

Part E

Books	Data Structure: By Lipschultz (Schaums Outline Series) Data Structure through C (A Practical Approach) by G.S. Baluja
Articles	
References Books	Fundamental of Data Structure by S. Sawhney & E. Horowitz
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	Object Oriented Programming Concept using C++
Course Code	BSCS0401[T]

Part A

					L	T	P	C
Year	2nd	**Semester**	4th	**Credits**	3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Students should have basic as well as practical knowledge of Programming and should be familiar with the concept of C.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To Remember the basics of C Programming Knowledge.**(BL1-Remember)** **CO2-** To Understand the concept of object oriented programming **(BL2-Understand)** **CO3-** To apply the various techniques for problem solving and will implement those ideas using C++ programs.**(BL3-Apply)** **CO4-** To analysis of C++ streams, Inheritance and Operator Overloading.**(BL4-Analyze)** **CO5-** To evaluate the aim of teaching this course is that students should have conceptual and practical knowledge of Object oriented methodology.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Concepts of object oriented programming, Need of Object Oriented Programming, Characteristics of OOP: Classes & Objects, Inheritance, Data Hiding, Encapsulation, Polymorphism, Overloading, Classes and Structures, Classes and Unions Overview of C++, Compiling & Debugging C++ Program, Basics : Preprocessor Directives, Header files, Input and Output Streams, Cout, Cin, Comments, Type Casting. Creating class, Data member, member function. Creating objects and accessing member function through objects.	White Board, Group Discussion	8
2	C++ streams, Formatted I/O: Formatting using the ios members, Setting and clearing the format flags, using manipulators to format I/O, Creating your own manipulators. Introduction to Constructor, Parameterized constructor, Multiple constructors, Default arguments constructor, Copy constructor, Destructor. Friend function, Friend classes, Inline function, Scope resolution operator, Static class members: Static data member, Static member function, passing objects to function, Returning objects, Object assignment.	White Board, Group Discussion	8
3	Function overloading, Function Signature. Overloading constructor function, finding the address of an overloaded function Operator Overloading: Overloading Unary Operators, Operator Keyword, Operator Arguments, Overloading Binary Operators: Arithmetic Operators, Concatenating Strings, Comparison Operators, Assignment Operators, Overloading Using friend function, Overloading Special Operators: New, Delete, <<.	White Board, Group Discussion	8
4	Inheritance: Base & Derived class, Accessing Base Class Member, Specifying Derived Class, Protected Specifier, Overriding Member Function. Virtual Functions, Pure Virtual Functions, Virtual Base Class, Late Binding, this pointer, Accessing Member data with this pointer. Abstract base class, Public and Private Inheritance, Levels of Inheritance.	White Board, Group Discussion	88
5	Containership: Classes within Classes Pointers: Address of Operator &, Pointer variable, Pointers and Arrays, Pointers and Functions, passing variables, Arrays, Pointer and Strings, Memory Management using new and delete, pointers to Objects: reference to members. Exception handling in CPP: types of exception handling. Command Line Arguments.	White Board, Group Discussion	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1		Experiments	BL2-Understand	
2		Experiments	BL2-Understand	
3		Experiments	BL2-Understand	
4		Experiments	BL2-Understand	
5		Experiments	BL2-Understand	
6		Experiments	BL2-Understand	
7		Experiments	BL2-Understand	
8		Experiments	BL2-Understand	

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	30	40	20

Part E

Books	Object Oriented Programming C++ C++
Articles	
References Books	R. Lafore E. Balguruswamy
MOOC Courses	
Videos	https://www.youtube.com/watch?v=wN0x9eZLix4

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	2	-	-	-	-	-	2	-	-	-	-
CO3	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	4	-	4	-	-	-	-	-	-	-	4	-	-	-
CO5	-	-	-	-	5	-	-	-	-	-	-	-	5	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	Computer system organization
Course Code	BSCS0402[T]

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Disciplinary Major							
Pre-Requisite/s	An Attendee of this course must be familiar with the following ❖ Digital Logic Gates ❖ Basic Computer Architecture ❖ Computer Number Systems			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Remembering : Basic computer architecture (Von Neumann Model) and functions of its various units**(BL1-Remember)** **CO2-** Understanding: Understand the basic operations of digital computer system, its microoperations .**(BL2-Understand)** **CO3-** Applying: Identify, compare and assess to Bus and memory, Register transfer logic and arithmetic operations, Summarize the types of micro operations.**(BL3-Apply)** **CO4-** Analyzing: different types of addressing modes, various types of IO mapping techniques .**(BL4-Analyze)** **CO5-** Evaluating: the performance issues of cache memory and virtual memory **CO6-** Create and design various hardware and software logics to make a computer system like ALU, Memory, Bus, etc.(Design)							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Register Transfer Language & micro-operations: Overview of Register Transfer Language & microoperations, Classification of Micro operations, Design of arithmetic, Logic and shift micro-operations.	Lectures with whiteboard/PPT, Recorded video/interactive videos, quiz	8
2	Architecture of a Processor: Von Newman architecture, Concept of ALU, Control Unit, Registers : Instruction Register, Control Word, Program Counter, Stack Organization, instruction set, instruction formats, addressing modes, instruction cycle, Interrupt and Interrupt cycle	Lectures with whiteboard/PPT, Recorded video/interactive videos, Quiz ,Group discussion	8
3	I/O Organization: Various I/O Devices, Data Transfer Mode: Program Controlled, Interrupt driven, DMA(Direct Memory Access).	Lectures with whiteboard/PPT, Recorded video/interactive videos, Quiz ,Group discussion	8
4	Memory organization-I: Definition, Memory Hierarchy System, Classification of memory: Primary Memory, Secondary Memory, Basic cells of RAM & ROM , Building large memories using chips.	Lectures with whiteboard/PPT, Recorded video/interactive videos, Quiz ,Group discussion	8
5	Memory organization-II: Concept of Associative memory, cache memory organization, virtualmemory organization	Lectures with whiteboard/PPT, Recorded video/interactive videos, Quiz ,Group discussion	8

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Project Base Learning
Computer System Organization
BCA 301

S.no	Activity Details	Outcomes of the Activity
1	Overview of Register Transfer Language & micro-operations, Classification of Micro operations,	This activity help to study for better understanding of computer hardware operation.
2	Design of arithmetic, Logic and shift micro-operations.	This activity help to understanding of Logic and Shift micro-operations.
3	Architecture of a Processor, Concept of ALU, Control Unit, Registers Instruction Register, Control Word, Program Counter, Stack Organization, instruction set, instruction formats, addressing modes, instruction cycle, Interrupt and Interrupt cycle	This activity help to understanding various function of Computer Hardware.
4	Data Transfer Mode, Program Controlled, Interrupt driven, DMA (Direct Memory Access).	This activity will help to understanding the various Activity perform by Data Transfer and DMA.
5	Memory organization, Concept of Associative memory, cache memory organization, virtual memory organization	This activity will help to understanding the Memory Management in Computer Hardware etc.

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	12
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Hayes, J. P. (2017). Computer System Architecture. McGraw Hill. Stallings, W. (2022). Computer Organization and Architecture. Prentice Hall.
Articles	
References Books	
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	1	2	-	-	2	-	-	-	-	-	-	-	2	3	3
CO3	3	1	-	-	2	-	-	-	-	-	-	-	3	3	3
CO4	-	1	1	2	1	-	-	-	-	-	-	-	2	2	3
CO5	-	1	-	-	1	-	-	-	-	-	-	-	2	2	2
CO6	3	1	-	-	-	-	-	-	-	-	-	-	2	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	Web Designing with PHP
Course Code	BSCS0501[T]

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember various Web Development Strategies using PHP and syntax rules of web Programming**(BL1-Remember)** **CO2-** To understand the basics of web architecture, Development techniques, knowledge about file system.**(BL2-Understand)** **CO3-** To implement: HTML, JavaScript and Arry, strings, database connectivity to create Web applications.**(BL3-Apply)** **CO4-** To analyze various Server-side programming techniques and OOPS Techniques**(BL4-Analyze)** **CO5-** To evaluate and improve the performance of the web application with the help of session handling Techniques**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG2(Zero hunger) SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introducing PHP – history and Basic development Concepts, PHP delimiters, creating user-defined variables, data types with PHP, type casting – Creating first PHP Scripts, declaring and using constants, Using Variable and Operators, – Storing Data in variables -Setting and Checking variables Data types, comments with php, useful readymade function of PHP. Controlling Program Flow: making decisions with if, else, and switchwriting More Complex Conditional Statements – Repeating Action with Loops and super global variables.	Lectures with whiteboard/PPT, Recorded video/interactive videos	8
2	Use of HTML for web design and JavaScript-, html scripts and form elements, embedding php with HTML, redirecting web pages, adding dynamic content using Java script, Working with Numeric Functions. Working with Arrays: Storing Data in Arrays – Numerically index array, associative and multi-decisional, array Processing Arrays with Loops and Iterations – Using Arrays with Forms - Working with Array Functions, Array sorting, converting array to scalar variables – Working with Dates and Times	Lectures with whiteboard/PPT, Recorded video/interactive videos	8
3	String Handling: formatting strings, joining and splitting a string comparing strings matching and replacing substrings, string functions, introduction of php regular expression. Exception Handling: exception handling structure, try…catch…throw Introduction to file system- file system and uses, saving program data for later use for file system, opening a file, creating and writing to a file closing a file and deletion operation on file, reading data from a file, file handling functions. Processing Directories.	Lectures with whiteboard/PPT, Recorded video/interactive videos	8
4	Using PHP Functions and Classes: Introduction to functions. Creating userdefined function parameters, returning values, calling by values versus calling by reference, using include () and require () functions. Creating PHP Classes – Using Advanced OOP Concept, creating a PHP class, object, methods, operations, class attributes, class method invocation, php static hinting, object cloning, inheritance, final keyword, php abstract class, and interface.	Lectures with whiteboard/PPT, Recorded video/interactive videos	8
5	Working with Database: working on MYSQL database, connection PHP with MySQL, creating database tables, implementing insert delete, update and select query using PHP script,	Lectures with whiteboard/PPT, Recorded video/interactive videos	8

PBL TOPICS

PHP

1. **Simple CMS (Content Management System):**
- Build a basic CMS using PHP where users can create, edit, delete, and manage content (e.g., articles, blog posts).
- Include features like user authentication, role-based access control, and a WYSIWYG editor for content creation.

2. **Online Quiz System:**
- Develop an online quiz application where users can take quizzes on various topics.
- Implement features such as user registration, quiz creation, multiple-choice questions, scoring, and result display.

3. **Online Task Management System:**
- Create a task management application where users can create tasks, assign them to others, set deadlines, and track progress.
- Include features like user authentication, task categorization, priority levels, and status updates.

4. **E-commerce Website:**
- Build a simple e-commerce platform using PHP where users can browse products, add them to cart, and make purchases.
- Implement features like user registration, product catalog, shopping cart functionality, and payment integration (e.g., PayPal).

5. **OnlineStudent Information System:**
- Develop a student information system for managing student records, course details, grades, and attendance.
- Include features such as user authentication, student enrolment, course registration, and grade management.

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	12
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	20

Part E

Books	VIKRAM VASWANI PHP A Beginner's Guide Tata McGraw-Hill
Articles	Steven Holzner The PHP Complete Reference – Tata McGraw-Hil
References Books	
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	1	2	-	-	-	-	-	-	-	1	2	1
CO2	2	2	-3	2	1	-	-	-	-	-	-	-	2	2	2
CO3	2	1	1	1	3	-	-	-	-	-	-	-	1	2	1
CO4	1	2	-1	2	2	-	-	-	-	-	-	-	2	2	1
CO5	2	2	2	1	2	-	-	-	-	-	-	-	1	2	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	Python programming
Course Code	BSCS0602[T]

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember the basic programming concept.**(BL1-Remember)** **CO2-** Understand the basics of Python like python origin downloading and installing and basic concepts of python.**(BL2-Understand)** **CO3-** Apply the various conditional and looping statement and functional programming.**(BL3-Apply)** **CO4-** Explain various objects numbers and sequence in python Analyze the concept of regular expression**(BL4-Analyze)** **CO5-** Evaluate the concept of object-oriented programming for better utilization of language**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG2(Zero hunger) SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
Unit 1	Introduction to Python programming Introduction, origin of Python, Downloading, Installing and Running Python, Python Basics: Comment, Identifier, Indentations, Basic data types, conversions, operators, Build in functions. I/O Statements, Condition Statements & Loops: If, else, elif), conditional expressions, while, for, break continue	Lectures	6
Unit 2	Data Structures in Python Lists: Introduction, Accessing list, Operations, Working with lists, Tuple: Introduction, Accessing tuples, Operations, Working with list, Dictionaries: Introduction, Accessing values in dictionaries, Working with dictionaries, Set: Introduction ,Accessing set, Operations, Working with sets	Lectures	6
Unit 3	Functions, Modules, File Handling Functions: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous function, Global and local variables, Recursion. Modules: Creating modules, Importing module, Packages, File Handling :Opening and closing files, Reading and writing files	Experiments	6
Unit 4	Exceptional Handling, Regular Expressions Exception Handling: Exception, Exception Handling, Try and Except clause,User Defined Exceptions, Exception handling in files). Regular Expressions: Introduction/motivation, special symbols and characters for REs , Match function, Search function., Matching VS Searching., Modifiers, Patterns.	Experiments	6
Unit -5	Object Oriented Programming in Python Introduction, OOPS Basics: Class and object Constructors, Need of Encapsulations, Attributes, default attributes, static attributes, static methods, initializing objects, Pass by reference, self. Relational-ships: Introduction, Aggregation, Dependency. Inheritance: Need of Inheritance, Overriding, Super, Types of Inheritance. Abstract Class, methods.	PBL	6

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
unit 1-5	PBL	PBL		4

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	20

Part E

Books	Gondaliya, V. (2019, August 30). Programming With Python. Vaibhav Gondaliya.
Articles	
References Books	Hetland, M. L. (2006, November 7). Beginning Python. Apress
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	-	2	2	-	-	-	-	1	-	1	-	1
CO2	1	1	-	2	2	2	-	-	-	2	-	-	1	2	3
CO3	-	2	-	-	-	-	-	-	-	-	-	-	3	2	3
CO4	-	2	-	2	1	-	-	-	-	-	-	-	3	2	3
CO5	-	2	-	2	1	-	-	-	-	-	-	-	3	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	Environmental Studies
Course Code	BSFC0201[T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					2	0	2	4
Course Type	Theory only							
Course Category	Interdisciplinary Major							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** -The course shall develop in student the scientific background needed to understand how the earth works and how we, as human beings, fit into that.**(BL1-Remember)** **CO2-** At the end of the course, it is expected that students will be able to identify and analyze environmental problems as well as the risks associated with these problems.**(BL2-Understand)** **CO3-** Ability to distinguish between various methods of various pollution analysis.**(BL3-Apply)** **CO4-** Students acquire skills for to communicate, prepare, plan and implement the environmental management project.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG5(Gender equality) SDG6(Clean water and sanitation) SDG7(Affordable and clean energy) SDG11(Sustainable cities and economies) SDG12(Responsible consuption and production) SDG13(Climate action) SDG14(Life below water) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours
Unit 1. Study of Environment and Ecology	(a) Environment – Definition and Its segments (Atmosphere, Lithosphere, Hydrosphere and Biosphere). (b) Environmental education- Definition, scope, importance, Need for Public Awareness & multidisciplinary nature of Environmental Science. (c) Elements of ecology (d) Ecosystem- Concepts, components, structure & function, energy flow, food chain, food web, ecological pyramids and types.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	6
Unit 2. Environmental Pollution and Population	(a) Air, water, noise, soil and nuclear pollution- definition, causes, effect and prevention of pollution. (b) Environmental issues (c) Population growth, disparities between countries. (d) Population explosion, family welfare program. (e) Environment and human health. Cleanliness and disposal of domestic waste	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	6
Unit 3. Natural resources, Problems and Conservation	(a) Natural resource- Definition and classification (b) Water resources, Forest resources, Land resources, Food resources and its management (c) Energy resources- Classification and alternatives of conventional energy resources (Solar energy, geothermal energy, wind energy, nuclear energy, biomass and biogas energy)	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	6
Unit 4. Bio-diversity and its Protection	(a) Introduction- Genetic, species and ecosystem diversity. (b) Value of bio-diversity- Consumable use: Productive use, Social, Moral and Aesthetic uses. (c) India as a nation of mega bio-diversity center, bio-diversity at national and local levels. (d) Threats to bio-diversity – Loss of habitat, poaching of wildlife, man and wildlife conflicts.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	6
Unit 5. Disaster Management and Environmental Laws	(a) Concepts of hazard, Vulnerability, Risks, Natural disasters (earthquake, cyclone, floods, volcanoes), and man made disaster (Armed conflicts and civil strip, Technological disasters, Human settlement, Slow disasters (famine, draught, epidemics) and Rapid onset disasters(Air crash, tidal waves, Tsunami) (b) Disaster Management: Prevention, Preparedness and Mitigation (c) Environmental legislations in India: Air conservation act, water conservation act, wildlife conservation act, environment protection act. Role of information technology in protecting environment and health	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	6

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100		40	12	60	30
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	B. S. Chauhan Environmental Science 2008 First Richards T. Wright & Dorothy F. Boorse Environmental Science: Toward a Sustainable Future 2016 S. K. Dhameja Environmental Engg. & Management 2000
Articles	
References Books	Gilbert M. Masters Introduction to Environmental Engineering and Science 1991 Stanley Manahan & Stanley E. Manahan Environmental Chemistry 2009
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	-	1	-	-	-	-	-	1	2	3
CO2	1	-	-	-	-	-	1	-	-	-	-	-	1	-	1
CO3	1	2	-	-	-	-	1	-	-	-	-	-	1	2	-
CO4	1	2	-	2	-	-	-	2	-	-	-	-	1	2	3
CO5	1	2	-	-	-	-	-	2	-	-	-	-	1	-	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	Calculus and Differential Equations
Course Code	BSMA0101[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Disciplinary Minor							
Pre-Requisite/s	calculus and differential equations include a strong foundation in algebra, trigonometry, pre-calculus, and analytical geometry. Understanding of functions, limits, and basic calculus concepts like derivatives and integrals is essential for success in these subjects.			**Co-Requisite/s**	calculus and differential equations often include concurrent enrollment in courses covering algebra, trigonometry, and pre-calculus. Additionally, a solid understanding of analytical geometry and basic calculus concepts such as limits, derivatives, and integrals is recommended for effective comprehension and application of these subjects.			
Course Outcomes & Bloom's Level	**CO1-** To get insight of fundamental knowledge of Differential, integration and differential equation.**(BL1-Remember)** **CO2-** To understand various techniques to solve real life problems through examples.**(BL2-Understand)** **CO3-** To apply notation of derivative in identifying increasing/ decreasing function, extreme values, concavity, convexity and also higher order derivatives which arise in all applied sciences.**(BL3-Apply)** **CO4-** To analyze behavior of curve through tracing and solution of ordinary differential equation.**(BL4-Analyze)** **CO5-** To evaluate Area, Quadrature, Rectification and Orthogonal trajectories of curves.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Successive differentiation, Leibnitz theorem, Maclaurin's and Taylor's series expansions, asymptotes.	Audio/Video clips, group discussion, lecture with ppt, quiz	8
2	Curvature, tests for concavity and convexity, Points of inflexion, Multiple points, Tracing of curves in Cartesian and polar coordinates.	Audio/Video clips, group discussion, lecture with ppt, Review Analysis	8
3	Integration of transcendental functions, Definite integrals, Reduction formulae, Quadrature, Rectification.	Audio/Video clips, group discussion, lecture with ppt, classroom presentations, Analysis	8
4	Linear differential equations and equations reducible to the linear form, Exact differential equations, First order and higher degree equations solvable for x, y and p, Clairaut's equation and singular solutions, Geometrical meaning of a differential equation, Orthogonal trajectories.	Audio/Video clips, group discussion, lecture with ppt, quiz	8
5	Linear differential equation with constant coefficients, Homogeneous linear ordinary differential equations, Linear differential equations of second order, Transformation of equations by changing the dependent variable independent variable, Method of variation of parameters.	Audio/Video clips, group discussion, lecture with ppt, quiz	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	12
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	G. F. Simmons Differential Equations Tata McGraw Hill, 1972.
Articles	
References Books	H. T. H. Piaggio Elementary Treatise on Differential Equations and their Application C.B.S. Publisher & Distributors, Delhi, 1985
MOOC Courses	https://onlinecourses.nptel.ac.in/noc24_ma12/preview https://onlinecourses.nptel.ac.in/noc24_ma37/preview
Videos	https://onlinecourses.nptel.ac.in/noc24_ma12/preview https://onlinecourses.nptel.ac.in/noc24_ma20/preview https://onlinecourses.nptel.ac.in/noc24_ma37/preview https://onlinecourses.nptel.ac.in/noc24_ma37/preview

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	2	-	1	-	-	-	-	1	-	1
CO2	3	3	1	3	3	2	-	1	-	1	-	-	2	-	2
CO3	3	2	-	1	3	-	-	-	-	-	-	-	1	3	2
CO4	3	2	-	2	-	-	-	-	-	-	-	-	-	3	1
CO5	2	2	-	1	-	-	-	-	-	-	-	-	-	2	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	Abstract Algebra
Course Code	BSMA0201[T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Disciplinary Minor							
Pre-Requisite/s	Basic Knowledge of Set theory and Basic understanding of elementary mathematics.			**Co-Requisite/s**	Understanding of sets, subsets, operations on sets, and basic set operations such as union, intersection, and complement. Familiarity with fundamental algebraic structures such as groups, rings, and fields, including their definitions, properties, and basic examples.			
Course Outcomes & Bloom's Level	**CO1-** CO1: To remember the basic knowledge of the Groups, Subgroups, Normal Subgroups, Cyclic Groups, Homomorphism and Isomorphism of groups, Automorphisms, Ring and Field.**(BL1-Remember)** **CO2-** CO2: To understand the fundamental concept and properties of Groups, Rings, Fields and integral domains.**(BL2-Understand)** **CO3-** CO3: To apply the knowledge of groups, rings, fields and integral domains in all the fields of learning including higher research and extensions.**(BL3-Apply)** **CO4-** CO4: To analyze and solve the well-defined problems in mathematics related to the different groups, rings, and fields.**(BL4-Analyze)** **CO5-** CO5: To evaluate the studied problems from application point of view by using the results of the different theorems.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Definition and basic properties of groups, subgroups, Subgroups generated by a subset, Cyclic groups and simple properties.	Audio/Video clips, group discussion, lecture with ppt, quiz	8
2	Coset decomposition, Lagrange's theorem and its corollaries including Fermat's theorem, Normal subgroups and Quotient groups.	Audio/Video clips, group discussion, lecture with ppt, Review Analysis	9
3	Homomorphism and Isomorphism of groups, Fundamental theorem of homomorphism, Transformation and Permutation group, sn (Various subgroups of Sn n< 5 to be studied),Cayley's theorem.	Audio/Video clips, group discussion, lecture with ppt, classroom presentations, Analysis	10
4	Group Automorphisms, Inner Automorphism, Group of Automorphisms,Conjugacy relation and Centralizer,Normaliser, Counting principle and class equation of a finite group, Cauchy's theorem for finite abelian groups and non- abelian groups.	Audio/Video clips, group discussion, lecture with ppt, quiz	9
5	Definition and basic properties of rings, Ring homomorphism subrings, Ideals and Quotient rings, Polynomial rings & its properties, Integral domain and Field.	Audio/Video clips, group discussion, lecture with ppt, quiz	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	I. N. Herstein, Topics in Algebra Wiley Eastern Ltd. New Delhi,
Articles	
References Books	Shantinarayan A Text Book of Modern Abstract Algebra S. Chand and Company, New Delhi
MOOC Courses	https://onlinecourses.nptel.ac.in/noc24_ma06/preview
Videos	https://onlinecourses.nptel.ac.in/noc24_ma06/preview

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	3	-	-	-	-	1	-	-	-	-	-	-
CO2	1	-	-	2	-	-	-	-	1	-	-	-	-	-	-
CO3	-	2	-	-	1	-	-	-	-	2	-	-	-	-	-
CO4	2	-	1	-	-	-	-	2	-	-	-	-	-	-	-
CO5	1	-	-	2	-	-	-	2	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	Vector Analysis & Linear Algebra
Course Code	BSMA0301[T]

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Disciplinary Minor							
Pre-Requisite/s	Basic knowledge of Matrix & vectors			**Co-Requisite/s**	Basic knowledge of LI, LD, dot and cross product			
Course Outcomes & Bloom's Level	**CO1-** CO1: To get insight of fundamental knowledge of matrix, group theory and transformations.and basic concept of vector analysis **(BL1-Remember)** **CO2-** CO2: To understand various techniques to solve real life problems through examples.**(BL2-Understand)** **CO3-** CO3: To apply the concepts of matrix, vector space, linear transformation and Gauss theorem , stock theorem , green theorem and other concept of vector analysis on many branches of Physics, Engineering, Social sciences and Mathematics **(BL3-Apply)** **CO4-** CO4To analyze the concept of Gauss theorem , stock theorem , green theorem and other concept of vector analysis .**(BL4-Analyze)** **CO5-** CO5: To evaluate gradient ,divergence ,curl andInverse, Eigen value and Eigen vector of matrix **(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
Unit 1	Rank and Nullity of matrix, Solution of simultaneous equation by elementary transformation, consistency of equations, Eigen value and Eigen vectors, Calley Hamilton theorem, Inverse matrix, Digonlization.	Audio/Video clips, group discussion, lecture with PPTs, quiz	8
Unit 2	Definition and examples of vector spaces, subspaces, sum and direct sum of subspaces, Linear span, Linear dependence, Independence and their basic properties, Basis, Existence Theorem for basis, Extension theorem, Invariance of the number of elements of a basis, Dimension, Finite dimensional vector spaces, Existence of complementary subspaces of a subspace of a finite dimensional vector space, Dimension of sum of subspaces, Quotient space and its dimension.	Audio/Video clips, group discussion, lecture with PPTs, quiz	8
Unit 3	Linear transformations, Properties of linear transformation, Range and Kernel, The rank and nullity of linear transformations, Rank-Nullity theorem and its consequence, The matrix representation of a linear transformation, change of basic, dual space, bi-dual space and natural isomorphism, adjoint of a linear transformation.	Audio/Video clips, group discussion, lecture with PPTs, classroom presentations, Analysis	8
Unit 4	Scalar and vector product of three vectors, product of four vectors, Reciprocal vectors, vector differentiation, Gradient, Divergence and curl	Audio/Video clips, group discussion, lecture with PPTs, Quiz	8
Unit 5	Vector Integration, Greens Theorem, Stokes Theorems and Gauss divergence Theorem and problems based on them	Audio/Video clips, group discussion, lecture with PPTs, Quiz	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	1. K.B. Datta, Matrix and Linear Algebra, Pratice Hall of India Pvt. Ltd. New Delhi, 2000 2. K. Haffiman and R. Kunze, Linear Algebra, 2nd Edition. Prentice Hall Englewood Cliffs. New Jersey,1971 N. Saran and S. N. Nigam,Introduction to Vector Analysis,Pothishala Pvt. Ltd. Allahabad
Articles	
References Books	1. Marc Lipson and Seymour Lipschutz, Schaum'S Outline Of Linear Algebra, Key College Publishing (Springer – Verlag) 2001 2. S, Kumarsaran, Linear Algebra, A Bermetric Approach Prentice Hall of India, 2000 Shanti Narayan,A Text Book of Vector Calculus,S. Chand & Co. New Delhi
MOOC Courses	https://onlinecourses.nptel.ac.in/noc24_ma13/preview
Videos	https://onlinecourses.nptel.ac.in/noc24_ma04/preview https://onlinecourses.nptel.ac.in/noc24_ee48/preview https://onlinecourses.nptel.ac.in/noc24_ma11/preview

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	2	-	1	-	-	-	-	-	-	-
CO2	3	3	1	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	1	3	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	2	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	-	1	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	Advance Calculus and Differential equations
Course Code	BSMA0401[T]

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Disciplinary Minor							
Pre-Requisite/s	Basics Differentiation , Integrations, , Continuity ,convergence and divergence of Sequence and Series ,partial differentiation			**Co-Requisite/s**	Function,, Limit , Sequence and Series and derivative			
Course Outcomes & Bloom's Level	**CO1-** To remember basic concept of Real Analysis ,Partial Differentiationwhich used in various problems of sciences. **(BL1-Remember)** **CO2-** To understand and identify the Convergence of sequences various test for convergence of sequences , limit ,continuity and differentiability of function partial differentiation, Envelops , maxima and minima , Double and Triple Integral volume and surface of solids.also**(BL2-Understand)** **CO3-** To apply the concept of limit continuity and differentiability partial differentiation ,Taylors theorem , LaGrange's method , double and triple integrals to solve various problems of physical and allied sciences**(BL3-Apply)** **CO4-** To analyze and draw connection among the ideas of LaGrange's theorem and Beta Gama function , volume and surface and there properties to solve various problems of physical and allied sciences also Analyze behavior of the solution of the well-defined problems of differentiation **(BL4-Analyze)** **CO5-** To evaluate Double and Triple integral , Partial differentiation , Convergence of series also identifying and provide the various applications related to them also **(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕			**SDG (Goals)**	SDG4(Quality education)			

Part B

Modules	Contents	Pedagogy	Hours
UNIT01	Definition of a sequence, , Bounded and monotonic sequences, Theorems on limits of sequences, Cauchy's convergence criterion, series of non-negative terms, comparison test, Cauchy's integral test, Cauchy's root test, Ratio tests, Raabe's tests, Logarithmic tests, Alternating series, Leibnitz's test, Absolute and Conditional convergence	Audio/Video clips, group discussion, lecture with PPTs, quiz	10
UNIT02	imit and continuity of functions of two variables, Partial differentiation, Change of variables, Euler's theorem on homogeneous functions, Taylor's theorem for functions of two variables, Jacobins,, Maxima and Minima of functions of two variables	Audio/Video clips, group discussion, lecture with ppt	10
UNIT03	Beta and Gama function ,Double and triple integrals, Volumes and surfaces of solids of revolution, Change of order of integration in double integrals.	Audio/Video clips, group discussion, lecture with PPTs, classroom presentations, Analysis	10
UNIT04	Partial differential equations of the first order, Lagrange's solution, Some special types of equations which can be solved easily by methods other than the general method, Charpit's general method	Audio/Videoclips, group discussion, lecture with PPTs, Quiz	8
UNIT05	Partial differential equations of second and higher orders, Classification of partial differential equations of second order, Homogeneous and non-homogeneous equations with constant coefficients, Partial differential equations reducible to equations with constant coefficients.	Audio/Video clips, group discussion, lecture with PPTs, Quiz	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	R. R. Goldbeg,Real Analysis,Oxford & I. B. H. Publishing Co. New Delhi Sharma and Gupta ,Integral Transform,Pragati, Prakashan Meerut
Articles	
References Books	D. Soma Sundaram and B. Choudhary,A first Course in Mathematical Analysis,Narosa Publishing House, New Delhi, 1997 D. A. Murray,Introductory Course in Differential Equation,Orient Longman, India, 1967.
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	2	2	-	2	-	-	-	-	1	-	1
CO2	3	3	1	3	3	2	-	1	-	1	-	-	2	-	2
CO3	3	2	-	1	3	-	-	-	-	-	-	-	1	3	2
CO4	3	2	-	2	-	-	-	-	-	-	-	-	-	3	1
CO5	2	1	-	1	-	-	-	-	-	-	-	-	-	2	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	Computer Oriented Statistical Methods
Course Code	BSMA0501[T]

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Disciplinary Minor							
Pre-Requisite/s	Understanding of algebra, basic calculus, and probability theory. Familiarity with descriptive statistics, such as measures of central tendency and dispersion, is necessary. Basic computer skills are helpful for using statistical software like R or Python. Critical thinking, problem-solving, and logical reasoning skills are essential for analyzing data and drawing valid conclusions. Continuous learning and practice are crucial in statistics due to its dynamic nature.			**Co-Requisite/s**	Concurrent study of experimental design, to understand how data is collected and its impact on analysis. Familiarity with a programming language such as Python or R is beneficial for data manipulation and analysis. Basic knowledge of probability theory, calculus, and algebra supports a deeper understanding of statistical concepts. An understanding of research methods aids in interpreting statistical results within context. Additionally, critical thinking skills are essential for evaluating the validity of statistical methods and conclusions. Practical experience applying statistical techniques to real-world problems enhances understanding and proficiency.			
Course Outcomes & Bloom's Level	**CO1-** To remember the data collection plans and basic tools of descriptive statistics **(BL1-Remember)** **CO2-** To analyze the relationship between two variables using scatter plot and Interpret a simple correlation. **(BL4-Analyze)** **CO3-** To apply the concept of sampling distribution of a statistic and hypothesis**(BL3-Apply)** **CO4-** TO Understand the concept of sampling distribution of a statistic and its properties, difference between parameter and statistic**(BL2-Understand)** **CO5-** To evaluate the correlation and regression analysis and measure of central tendency**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction: Frequency distribution and Frequency charts, Histogram, Frequency polygons, Frequency curves and Cumulative frequency distribution. Measures of Central Tendency: Arithmetic mean median, mode.	Audio/Video clips, group discussion, lecture with ppt, quiz	8
2	Measures of Dispersion: Moments, Skewness and kurtosis, Range, mean deviation, standard deviation, coefficient of variation	Audio/Video clips, group discussion, lecture with ppt, Review Analysis	10
3	Combinatorics: Permutation and Combination, Repetition and Constrained Repetition, Binomial Coefficients, Binomial Theorem. Elementary Probability Theory: Sample space, events, classical definition of probability, theorems on total and compound probability, independent and dependent events, mutually exclusive events	Audio/Video clips, group discussion, lecture with ppt, classroom presentations, Analysis	8
4	Regression and Correlation: Coefficient of correlation, rank Correlation, Regression analysis, Curve fitting: Method of Least square	Audio/Video clips, group discussion, lecture with ppt, quiz	8
5	Testing of Hypotheses: Simple and composite hypothesis, errors of kind-I and kind-II, critical region, level of significance. Tests of Significance: Tests for simple hypotheses, Student's t test, F-test and applications.	Audio/Video clips, group discussion, lecture with ppt, quiz	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	H. C. Saxena and J. N. Kapoor Mathematical Statistics S. Chand and sons Co.
Articles	
References Books	M. Ray Statistical Methods Ram Prasad Publication
MOOC Courses	https://onlinecourses.nptel.ac.in/noc24_ec03/preview
Videos	https://onlinecourses.nptel.ac.in/noc24_ec03/preview

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	2	-	-	-	-	-	-	1	-	1
CO2	3	3	1	3	3	2	-	-	-	1	-	-	2	-	2
CO3	3	2	-	1	3	-	-	-	-	-	-	-	1	3	2
CO4	3	2	-	2	-	-	-	-	-	-	-	-	-	3	1
CO5	2	2	-	1	-	-	-	-	-	-	-	-	-	2	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	Properties of Matter
Course Code	BSPH0101[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Disciplinary Major							
Pre-Requisite/s	Knowledge of Physics upto Class 12			**Co-Requisite/s**	Knowledge of Mathematics upto Class 12			
Course Outcomes & Bloom's Level	**CO1-** To remember the basic laws of Properties of Matter. **(BL1-Remember)** **CO2-** Understand the basic concepts of Properties of Matter **(BL2-Understand)** **CO3-** To enable students to apply the Laws of Properties of Matter **(BL3-Apply)** **CO4-** To analyze the applications of Laws of Properties of Matter**(BL4-Analyze)** **CO5-** To evaluate the laws of Properties of Matter and its application to various mechanical systems.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Unit-I Elasticity Elasticity, Effect of Temperature and Impurities, Hooks law and Stress strain curve, Young Modulus, Bulk Modulus, and Modulus of rigidity, Poisson's ratio, relation among various Elastic moduli, Determination of Young Modulus	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
2	Unit II Rigidity and bending Torsion of Cylindrical rod and Torsional rigidity, Torsion pendulum, Determination of Modulus of Rigidity by Torsional oscillations, Bending of beams, Cantilever loaded at free end, Cantilever supported at end loaded in the middle, determination of Y by bending od beam	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
3	Unit III Surface tension Surface Tension: Surface Tension, Angle of Contact, Capillary Rise Method; Energy required to raise a liquid in the capillary tube; Factors affecting surface tension; Jaeger's method for Determination of surface tension; Applications of Surface Tension.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
4	Unit-IV Viscosity Concept of Viscous Forces and Viscosity; Steady and Turbulent Flow, Reynolds's number; Equation of Continuity; Bernoulli's Principle; Application of Bernoulli's equation - (i) Speed of Efflux (ii) Venturi meter (iii) Aspirator Pump(iv) Change of plane of motion of a spinning ball.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
5	Unit-V Ultrasonic and Acoustics Ultrasonic waves, production of ultrasonic waves, Detection and application of ultrasonic, Acoustics- Reverberation time and its measurement- Sabine's formulaAbsorption coefficient and its determination- Factors affecting architectural acoustics and their remedy, Sound absorbing materials.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	University Physics by Sears and Zeemansky
Articles	
References Books	General Properties of matter by D S Mathur
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	3	3	2	-	1	1	-	-	-	-	-
CO2	2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	-	-	3	-	2	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	Optics
Course Code	BSPH0301[T]

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Knowledge of Physics upto BSc first Year(Second semester)			**Co-Requisite/s**	Knowledge of Mathematics upto BSc first Year(Second semester)			
Course Outcomes & Bloom's Level	**CO1-** To remember the basic laws of Optics**(BL1-Remember)** **CO2-** Understand the basic concepts of Optics**(BL2-Understand)** **CO3-** To apply the concepts of Optics to different system. **(BL3-Apply)** **CO4-** To Analyze the laws of Optics**(BL4-Analyze)** **CO5-** To evaluate the laws of Optics**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Unit-I Geometric Optics and its applications: Ray optics, Plane and spherical Mirrors, Lens, image formation, Lens formula, combination of thin lenses and equivalent focal length. Dispersion and dispersive power, chromatic and achromatic aberration, need of multiple lenses in eyepieces, Ramsdens and Huygens eye-piece	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
2	Unit-II Interference: Principle of Superposition, Conditions for sustained interference, Theory of interference, Lloyd's mirror, Achromatic fringes. Interference in parallel and wedge shaped films, Colour of thin films. Newton's rings and Michelson interferometer and their applications. Multiple beam interference in parallel film and Fabry-Perot interferometer.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
3	Unit-III Diffraction: Frenel's diffraction, Zone plate, diffraction due to straight edge. Fraunhoffer diffraction due to single and double slits, plane transmission grating, Resolving power of grating, telescope and Microscope Diffraction Grating: Diffraction at N-parallel slits Intensity distribution, Plane diffraction grating, Concave grating and its mountings. Resolving power of a grating and comparison with resolving power of prism and of a Fabry Parot etalon.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
4	Unit-IV Polarization: Transverse nature of light waves, Polarization of electromagnetic waves, Plane polarized light – production and analysis, Description of Linear, circular and elliptical polarization. Propagation of em waves in anisotropic media, uniaxial and biaxial crystals, symmetric nature of dielectric tensor, Double refraction, Hygen's principle, Ordinary and extraordinary refractive indices, Fresnel's formula, light propagation in uniaxial crystal, Nicol prism, Production of circularly and elliptically polarized light, Babinet compensator and applications, Optical rotation, Optical rotation in liquids and its measurement through Polari meter.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
5	Unit-V Lasers and Photo Sensors A brief history of lasers, characteristics of laser light, Einstein prediction, Relationship between Einstein's coefficients (qualitative discussion only), Pumping schemes, Resonators, Ruby laser, He-Ne laser, Applications of lasers, Principle of Holography	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	To find out the Focal length of combination of lenses with Nodal slide experiments	Experiments	BL3-Apply	3
2	To determine the wavelength of Sodium light by using Newtons ring experiments	Experiments	BL4-Analyze	3
3	To determine the wavelength of Laser light by using diffraction grating	Experiments	BL3-Apply	3
4	To determine the specific rotation of Sugar solution by using polarimeter	Experiments	BL3-Apply	3
5	To find the numerical aperture of given fiber	Experiments	BL3-Apply	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Fundamental of Optics by N Subramanyam and Brijlal.
Articles	
References Books	(i) Principles of Optics by BK Mathur, (ii) Optics by Ajay Ghatak
MOOC Courses	(i) https://nptel.ac.in/courses/115107131 (ii)https://nptel.ac.in/courses/115107131 (iii) https://nptel.ac.in/courses/115107095
Videos	(i) https://nptel.ac.in/courses/115107131 (ii)https://nptel.ac.in/courses/115107131 (iii) https://nptel.ac.in/courses/115107095

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	1	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	3	2	2	-	-	-	-	-	-	-	-	-	-
CO4	1	2	3	2	2	-	-	-	-	-	-	-	-	-	-
CO5	2	1	3	2	2	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	Electricity and Magnetism
Course Code	BSPH0401{T]

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Knowledge of Physics upto III Semester			**Co-Requisite/s**	Knowledge of Calculus			
Course Outcomes & Bloom's Level	**CO1-** To remember the basic laws of Electricity and Magnetism**(BL1-Remember)** **CO2-** Understand the basic concepts of Electricity and Magnetism**(BL2-Understand)** **CO3-** To apply the concepts of Electricity and Magnetism to different system. **(BL3-Apply)** **CO4-** To Analyze the laws of Electricity and Magnetism**(BL4-Analyze)** **CO5-** To evaluate the laws of Electricity and Magnetism**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Unit-I Vector Calculus : Differentiation of vectors, scalar and vector fields, conservative fields and potentials, line integrals, gradient of a scalar field, divergence of a vector field and divergence theorem, curl of a vector field and its physical significance, Stokes' theorem, combination of grad, div and curl	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
2	Unit- II Electric Field and Electric Potential: Electric field, electric field lines electric flux Gauss law with applications to charge distributions with Spherical, Cylindrical and Planer symmetry. Conservative nature of electrostatic field, electrostatic Potential, Potential and electric field of a dipole Force and Torque on a diploe	Audio/Video clips, group discussion, lecture with ppt, on white board	8
3	Unit-III Electrostatic energy and Capacitance of a System Electrostatic energy of system of charges, Electrostatic energy of a charged sphere, Conductors in an electrostatic field, Surface charge and force on a conductor, Capacitance of a System of charged conductors, Parallel plate capacitor	Audio/Video clips, group discussion, lecture with ppt, on white board	8
4	Unit-IV Magnetic Field Magnetic force between current elements and definition of magnetic field B Biot Savart's Law and its application to straight wire and circular loop. Dipole Moment and its analogy with electric dipole Ampere's Circuital law and its application to Solenoid.	Audio/Video clips, group discussion, lecture with ppt, on white board	8
5	Unit-V Electromagnetic Induction and Electrical Circuits Faraday's Law, Lenz's law, Self and Mutual Inductances Introduction to Maxwell equation charge conservation and displacement current. Electrical Circuits: Kirchhoff's law Complex reactance and impedance series and parallel LCR Circuit:: (1) Resonance (2) Power dissipation (3) Quality factor and (4) Band width	Audio/Video clips, group discussion, lecture with ppt, on white board	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Series Resonance for Different values of resistances, capacitances, Inductances and plotting of resonance curves and Q factor.	Experiments	BL4-Analyze	3
2	Measurement of Q factor for both Parallel resonances.	Experiments	BL2-Understand	3
3	To verify Kirchoff's Current and Voltage Law for D.C. Circuit	Experiments	BL2-Understand	3
4	To determination the resistance per unit length using Carey Foster's bridge wire.	Experiments	BL4-Analyze	3
5	To determine the value of unknown resistance using post office box.	Experiments	BL2-Understand	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Electricity and Magnetism and Electromagnetic Theory by S Mahajan and Choudhury
Articles	
References Books	Introduction to Electrodynamics by D J Griffith
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	2	2	-	2	-	-	-	-	-	-	-	-
CO2	2	3	2	2	2	-	-	-	-	-	-	-	-	-	-
CO3	2	2	2	3	1	-	1	-	-	-	-	-	-	-	-
CO4	1	1	3	2	3	-	-	-	-	-	-	-	-	-	-
CO5	3	2	1	1	1	-	3	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	Java Programing
Course Code	BSPH0502[T]

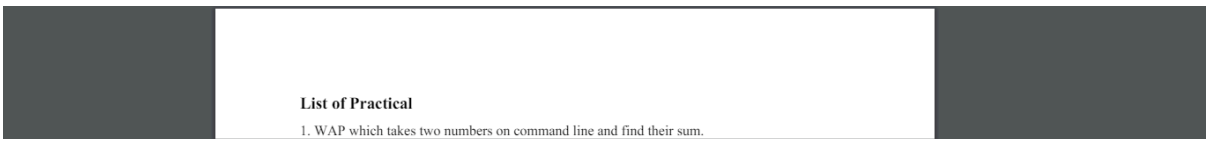
Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	basic knowledge of any one programming language such as C/C++			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember various syntax rules of java programming**(BL1-Remember)** **CO2-** To understand various Object-Oriented Concepts, Exception handling, Multithreading, networking and database connectivity techniques**(BL2-Understand)** **CO3-** To implement java AWT and Swing and for GUI Programming and Event handling, java IO for Input and output handling, jdbc for database connectivity**(BL3-Apply)** **CO4-** To analyze various Error ,and Database Handling techniques to learn how to improve the performance of the java application**(BL4-Analyze)** **CO5-** To evaluate and compare various application Development techniques**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG2(Zero hunger) SDG4(Quality education) SDG8(Decent work and economic growth)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction of java Introduction to JAVA History of Java: Comparison of Java and C++; Java as an object oriented language: Java buzzwords; JVM and JRE;A simple program, its compilation and execution; the concept of path and class path: Java Basics: Data types; Operators- precedence and associatively; Type conversion; decision making controls – if, if ..else, switch; loops – for, while, do…while; advanced for loop. Special statements–return, break, continue, Modular programming: methods and method overloading, memory allocation and garbage collection, static keyword	Lectures with whiteboard/PPT, Recorded video/interactive videos	15
2	Object Oriented Programming in Java: Class fundamentals, java Packages, Access specifies, Constructors; Copy constructor; this pointer; finalize () method, array and String, mutable and immutable; String Buffer and String Builder; Java Inheritance: Inheritance basics, method overriding and final keyword, polymorphism, static and dynamic polymorphism Abstract Class & Interfaces: abstract classes, uses of abstract classes, implementation of abstract class, defining an interface, implementing & applying interfaces, extending interfaces	Lectures with whiteboard/PPT, Recorded video/interactive videos	10
3	Exception Handling; understanding Exception and its classes; class hierarchy for Throwable, call stack mechanism, checked and unchecked Exception. Try, catch and finally block, throw and throws claus Multithreading: Basic idea of a Thread, differences between process and Thread, multithreaded programming; different states of a Active thread, The lifecycle of a thread; Creating thread with the thread class and runnable interface, thread constructor and thread methods; Thread synchronization; Thread scheduling; Producer consumer relationship; Daemon thread, Selfish threads, interthread communication.	Lectures with whiteboard/PPT, Recorded video/interactive videos	9
4	Java AWT: The class hierarchy of window fundamentals; The basic user interface components Label, Button, Check Box, Radio Button, menu and Choice menu, Text area, Frame; Layout managers Java Applets: Introduction of java Applet, Life cycle of applet; HTML Tags for applet. Java Event Handling Model: Java's event delegation model event source, Event listeners: ActionListener, MouseListener, KeyListener	Lectures with whiteboard/PPT, Recorded video/interactive videos	7
5	Collection Framework: Introduction to collections framework, collection interfaces, collection classes JAVA Database Connectivity (JDBC): JDBC Drivers, Connection Interface, Result set types of Result Set, applying insert, delete, display and update operation	Lectures with whiteboard/PPT, Recorded video/interactive videos	4

Part C



Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	20

Part E

Books	Naughton & Schildt The Complete Reference Java 2 Tata McGraw Hill
Articles	
References Books	Horstmann & Cornell "Core Java 2" (Vol I & II) Sun Microsystems
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	3	2	-	-	-	-	-	-	-	-	-	1
CO2	2	2	1	1	2	-	-	-	-	-	-	-	3	-	3
CO3	1	1	1	-	1	-	-	-	-	-	-	-	3	2	3
CO4	-	2	-	2	1	-	-	-	-	-	-	-	3	3	3
CO5	-	1	-	-	1	-	-	-	-	-	-	-	2	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	NCC
Course Code	NCC0101[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					2	0	2	4
Course Type	Theory only							
Course Category	Generic Elective							
Pre-Requisite/s	Should be acquainted with the basics knowledge of General Awareness about Leadership Quality, Personality Development, Defense system etc			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Develop the qualities of social skills.**()** **CO2-** Imbibe leadership qualities. **()** **CO3-** Be motivated to serve the nation by joining Armed forces. **()** **CO4-** Contribute in environmental awareness and conservation activities**()** **CO5-** Keep abreast of current affairs & general awareness.**()** **CO6-** Effectively contribute in managing disaster relief tasks**()**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG6(Clean water and sanitation) SDG13(Climate action) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours
Unit 1. Personality Development	Group Discussions – Social Skills & Time management.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 2. Leadership Development	Case Studies – Case Studies – Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965 war.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 3. Disaster management	(i) Initiative Trg, Organising Skills. (ii) Dos and Don'ts. (iii) Natural Disasters. (iv) Man Made Disasters. (v) Fire Services and Fire Fighting.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit-4.Environmental Awareness	Adventure Environmental Awareness and Conservation, Local and global approaches to conserve nature.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 5. General Awareness & Armed Forces	General Awareness, Army, Navy, Air Force and Central Armed Police Forces.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	R Gupta ; NCC National Cadet Corps A, B & C Certificate Examination Book; Ramesh Publishing House, 2018.
Articles	https://indiancc.mygov.in/
References Books	Singh, Neeraj; A Hand Book of NCC; Kanti Prakashan Publisher Cadet training hand book specialised subjects (2017)
MOOC Courses	
Videos	https://www.youtube.com/watch?v=eBA5t4iepAA

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	NCC (optional)
Course Code	NCC0201[T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					2	0	2	4
Course Type	Theory only							
Course Category	Generic Elective							
Pre-Requisite/s	Should be acquainted with the basics knowledge of General Awareness about Leadership Quality, Personality Development, Defense system etc			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Develop the qualities of social skills.**()** **CO2-** Imbibe leadership qualities. **()** **CO3-** Be motivated to serve the nation by joining Armed forces. **()** **CO4-** Contribute in environmental awareness and conservation activities**()** **CO5-** Keep abreast of current affairs & general awareness.**()** **CO6-** Effectively contribute in managing disaster relief tasks**()**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG6(Clean water and sanitation) SDG13(Climate action) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours
Unit 1. Personality Development	Group Discussions – Social Skills & Time management.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 2. Leadership Development	Case Studies – Case Studies – Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965 war.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 3. Disaster management	(i) Initiative Trg, Organising Skills. (ii) Dos and Don'ts. (iii) Natural Disasters. (iv) Man Made Disasters. (v) Fire Services and Fire Fighting.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit-4.Environmental Awareness	Adventure Environmental Awareness and Conservation, Local and global approaches to conserve nature.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 5. General Awareness & Armed Forces	General Awareness, Army, Navy, Air Force and Central Armed Police Forces.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	R Gupta ; NCC National Cadet Corps A, B & C Certificate Examination Book; Ramesh Publishing House, 2018.
Articles	https://indiancc.mygov.in/
References Books	Singh, Neeraj; A Hand Book of NCC; Kanti Prakashan Publisher Cadet training hand book specialised subjects (2017)
MOOC Courses	
Videos	https://www.youtube.com/watch?v=eBA5t4iepAA

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_ComputerScience

Title of the Course	India in 21st centuary
Course Code	VAC0101[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Add-On Courses							
Pre-Requisite/s	1. *Understanding of Sociological Concepts*: A foundational knowledge of sociological concepts is essential to grasp the composition of Indian society discussed in Unit I. This includes understanding social institutions, cultural environments, and threats to national integration. 2. *Historical Background*: Familiarity with the history of India, particularly the Indian Freedom Movement, is crucial for comprehending Unit II. Knowledge of events such as the Revolt of 1857, the emergence of nationalism, and the various phases of the freedom struggle provides context for understanding the birth of the Indian nation-state. 3. *Awareness of Political Movements*: A basic understanding of political movements in India, particularly those led by figures like Gandhi, is necessary for Unit III. Familiarity with concepts like non-cooperation, civil disobedience, and the Quit India movement aids in analyzing the dynamics of Indian freedom and partition. 4. *Knowledge of Post-Independence Era*: Understanding the phases of nation-building since independence is vital for Unit IV. This includes awareness of the planned progress era, populist policies, and the paradigm shift towards liberalization and globalization. Knowledge of responses from different societal groups and regions enriches the understanding of India's post-independence journey. 5. *Global Awareness*: Unit V delves into global concerns such as environmental issues, globalization, and movements for democracy and sustainability. A broad understanding of global trends and their impact on nations is necessary to engage with this content effectively.			**Co-Requisite/s**	Here are five co-requisites for the course outlined: 1. *Foundational Understanding of Sociological Concepts*: - Understanding social institutions, cultural environments, and threats to national integration is fundamental. - Familiarity with sociological theories such as functionalism, conflict theory, and symbolic interactionism can provide a deeper comprehension of societal dynamics. 2. *Historical Context of India*: - Knowledge of Indian history, including the colonial period, the struggle for independence, and post-independence developments, offers context for understanding the evolution of Indian society. - Understanding the socio-economic impacts of colonial rule and the transition to independence enhances insight into contemporary social issues. 3. *Understanding of Political Movements in India*: - Knowledge of key figures, ideologies, and strategies of political movements in India, including those led by Gandhi, Nehru, and other prominent leaders, is essential. - Awareness of the socio-political context of colonial India and the role of various stakeholders in the struggle for independence enriches understanding. 4. *Familiarity with Post-Independence Developments*: - Understanding the socio-economic and political changes in post-independence India, including the Nehruvian era, economic reforms, and social movements, is crucial. - Awareness of key policies, such as the Green Revolution, reservation system, and economic liberalization, provides insights into contemporary Indian society. 5. *Global Perspective and Awareness*: - Knowledge of global trends in areas such as technology, economics, environment, and geopolitics enhances understanding of India's position in the global context. - Understanding global issues like climate change, international trade, and human rights movements enables students to analyze their impact on India and vice versa.		
Course Outcomes & Bloom's Level	**CO1-** 1. Students are able to define, identify and explain the process of Indian Freedom movement and development of political Institutions.**(BL1-Remember)** **CO2-** 2. Students are able to summarize and extract the time before Independence and after Independence India.**(BL2-Understand)** **CO3-** 3. Students are able to evaluate India society, Its nature and agencies of social change with reference to modernization.**(BL5-Evaluate)** **CO4-** 4. Students are able to write the historical accounts that shaped the very nature and character of 20 and 21 st century India with reference to Nation Building and constitution**(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✓ Gender ✓ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG5(Gender equality) SDG10(Reduced inequalities) SDG12(Responsible consuption and production) SDG13(Climate action)				

Part B

Modules	Contents	Pedagogy	Hours
1	Composition of Indian Society Society- (a) Introduction of Nature of India society and Indian nation state. (b) Major Social Institutions and Organization and threats to national integration (c) Social and Cultural Environment of India Society in 19th ,20th and 21st century.	● Lectures and visual PowerPoint slides ● Students read text and commentary on assigned topics as well as published research articles before the lectures ● Students read cases discussed in the text-books, as well as more detailed articles. ● Students participate in class discussions to crystallize the concepts	5
2	Unit II Indian Freedom Movement- emergence. 1) Revolt of 1857 , Rise of nationalism & Birth of Congress 2). Partition of Bengal & swadeshi movement, Home rule movement Round table conferences 3) Revolutionary movements, Gandhian movements (i) Non-Cooperation (ii) Civil Disobedience (iii) Quit India movement	Lectures and visual PowerPoint slides ● Students read text and commentary on assigned topics as well as published research articles before the lectures ● Students read cases discussed in the text-books, as well as more detailed articles. ● Students participate in class discussions to crystallize the concept	5
3	Unit 3 Indian freedom and Partition 1.) Communalism – Rise & spread (11.) Muslim league & its politics , Hindu communalism . 111.) India's partition & independence References	Lectures and visual PowerPoint slides ● Students read text and commentary on assigned topics as well as published research articles before the lectures ● Students read cases discussed in the text-books, as well as more detailed articles. ● Students participate in class discussions to crystallize the concept	5
4	UNIT IV Nation building Since Independence 3 stages of making of the Indian Nation state: - . Era of planned progress. (1951-1971) Period of Populist policies and programmes (1971 to 1992) Period of paradigm shift towards liberalization and globalization (since 1992). Responses of various classes, communities and regions.	Lectures and visual PowerPoint slides ● Students read text and commentary on assigned topics as well as published research articles before the lectures ● Students read cases discussed in the text-books, as well as more detailed articles. ● Students participate in class discussions to crystallize the concept	5
5	Unit V Nation Building and Global Concern a. Environmental concerns in 21st century b. Question of Globalization and its Impact c. Global Movement for Democracy and sustainability	Lectures and visual PowerPoint slides ● Students read text and commentary on assigned topics as well as published research articles before the lectures ● Students read cases discussed in the text-books, as well as more detailed articles. ● Students participate in class discussions to crystallize the concept	4

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1 Quiz & Flip Class room		PBL		2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	28	40	12
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
00	00	00		00	

Part E

Books	1. Bose, N.K. 1967, Culture and Society in India. Bombay: Asia Publishing House 2. Dube, S.C. 1990, Indian village.(New Delhi: National Book Trust.) 3. Percival Spear : History of Indian Society , Penguin , 1966. 4. Uberoi, Patrica : Family , kinship and Marriage , New Delhi : oxford University Press , 1995 , PP 50 to 73 , 416 to 451 5. Gandhi , M K : Removal of Untouchability , Navjeevan Publishing House , Ahmadabad , 1954
Articles	
References Books	1. A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
MOOC Courses	
Videos	1.https://www.youtube.com/watch?v=i8N6YRTJsDk 2. https://youtu.be/MWsT7x3qd3E 3.https://www.youtube.com/watch?v=pQghqJSUAK4&list= 4.https://youtu.be/9BEU8A_JZPU 5.https://youtu.be/pPsKQwaZ4dg

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	2	2	1	1	-	2	1	-	-
CO2	-	-	-	-	-	1	2	2	1	2	-	1	-	-	-
CO3	-	-	-	-	-	1	2	1	1	1	-	1	-	1	1
CO4	-	-	-	-	-	1	3	1	1	1	-	1	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Bakery & confectionery [T]
Course Code	BSFT-0402 [T]

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Student must have studies Cereals, Pulses and Oilseeds in the previous semesters			**Co-Requisite/s**	Knowledge of manufacuring of bakery and confectionery products			
Course Outcomes & Bloom's Level	**CO1-** To remember the various ingredients required for bakery and processing methods of bakery and confectionery products, various product faults and their remedies**(BL1-Remember)** **CO2-** To understand the scientific principles in the processing technologies, product specification and regulations, hierarchy of bakery department and different working temperatures for bakery products**(BL2-Understand)** **CO3-** To provide students an experimental basis and a specialized knowledge and understanding in the development and quality control of bakery and confectionery products**(BL3-Apply)** **CO4-** To apply the subject knowledge in future perspectives i.e. such as in research and development in bakery products**(BL4-Analyze)** **CO5-** To evaluate the real life knowledge gained and properties and implement the same to create new bakery and confectionery products**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG2(Zero hunger) SDG3(Good health and well-being)				

Part B

Modules	Contents	Pedagogy	Hours
1	Bakery industry; Current status, growth rate, and economic importance of Bakery Industry in India. Major bakery industries in India Role of Raw Materials Required for Bakery & Confectionery: Wheat flour, sugar, fat, eggs, Essential ingredients: flour, sugar, shortening, eggs, Optional ingredients: baking powder, milk, milk products, dry fruits, baking soda, dairy products, yeast etc used in bakery and confectionery. Role of yeast in bakery industry.	Lecture method, industrial visit	7
2	Small and large equipment used in manufacturing of bakery and confectionary products - Different types of ovens and other heating equipments, proofing chamber, measuring tools, Preparatory tools, mixing tools, Cutting tools, baking pans and other tools. Bread-Introduction, Types of bread, Manufacturing techniques, faults and corrective measures, Quality Characteristics.	Lecture method, Quiz, Illustrate with analogies.	8
3	Cakes: Introduction, Types of cake, Manufacturing: Sugar batter method, Flour batter method, Genoese. Blending, faults and corrective measures. Modified Bakery Products: Modification of bakery products for people with special nutritional requirements e.g., high fiber, low sugar, low fat, gluten free bakery products	Audion-video clips, Expert Lecture	10
4	Introduction to Confectionery: Scope of confectionery, Confectionery terms, technology for manufacture of flour, fruit, milk, sugar, chocolate, based confectionery products; cooler, flavor and texture of confectionery; standards and regulations	Lecture method, Audio/Video clips, group discussion, quiz	12
5	Sugar Confectionaries: Caramels, Chocolates, Fondant, Fudge, Hard candy(lollipops, jawbreakers), Jelly candies, Marshmallow, Principles of production, Quality Characteristics	Audio/Video clips, group discussion, lecture with ppt, quiz	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	To study the leavening action of baking powder, sodium- bicarbonate and ammonium-bicarbonate.	Experiments	BL2-Understand	2
2	Determination dough rising capacity of yeast	Experiments	BL3-Apply	2
3	Preparation of biscuits and cookies	Experiments	BL3-Apply	2
4	Preparation of bread-different types	Experiments	BL3-Apply	2
5	To identify the external and internal characteristics of bread	PBL	BL4-Analyze	3
6	Preparation of cake-different types	Experiments	BL3-Apply	2
7	Preparation of low fat cake and cookies	Experiments	BL3-Apply	2
8	Preparation of toffees	Experiments	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	0	60	30	40	0

Part E

Books	Dubey, S. C. (1980, January 1). Basic Baking.
Articles	
References Books	Chopra, U. R. S. K. V. N. S. T. S. S. V. S. (2010, January 1). Basic Food Preparation: A Complete Manual. Manay, N. S., & Shadaksharaswamy, M. (2008, January 1). Food: Facts and Principles. New Age International. Khan, R. (2012, December 6). Low-Calorie Foods and Food Ingredients. Springer Science & Business Media.
MOOC Courses	https://nptel.ac.in/courses/126105027
Videos	https://www.youtube.com/watch?v=Dm3yP7FF4nI

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	-	1	1	-	1	1	-	-	3	1	1
CO2	2	2	1	1	1	-	1	1	-	1	2	-	3	2	2
CO3	2	2	2	2	1	1	-	1	-	1	-	-	3	2	2
CO4	2	2	2	1	1	-	1	1	1	1	2	-	3	2	2
CO5	3	2	2	2	1	1	1	1	1	1	1	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	English II [T]
Course Code	AEC III

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Discipline Electives							
Pre-Requisite/s	1.Basic Language Proficiency 2.Educational Background 3.Motivation and Willingness to Learn Time Commitment 4.Technology Proficiency			**Co-Requisite/s**	1.Communication Skills Workshop 2.Emotional Intelligence Training 3.Conflict Resolution Seminar 4.Leadership Development Program 5.Cross-Cultural Competency Training 6.Career Development Workshops			
Course Outcomes & Bloom's Level	**CO1-** Determine interpersonal skills and be an effective goal-oriented team player.**(BL1-Remember)** **CO2-** Elaborate creativity and lateral thinking.**(BL2-Understand)** **CO3-** Examine attitudes, emotional intelligence and understand its influence on behavior.**(BL3-Apply)** **CO4-** Justify approaches to conflict resolution**(BL4-Analyze)** **CO5-** Evaluate goal setting, management, decision-making skills.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG4(Quality education) SDG8(Decent work and economic growth)				

Part B

Modules	Contents	Pedagogy	Hours
1	Self Analysis - SWOT Analysis, who am I, Attributes, Importance of Self Confidence, Self Esteem. Interpersonal Skills - Gratitude Understanding the relationship between Leadership Networking & Teamwork. Assessing Interpersonal Skills Situation description of Interpersonal SkillTeamwork: Necessity of Team Work Personally, Socially and Educationally	Lecture method	6
2	Creativity - Out of box thinking, Lateral Thinking.Leadership - Skills for a Good Leader, Assessment of Leadership Skills	PPT, Audio Video Mode	6
3	Attitude- Factors influencing Attitude, Challenges, and lessons from Attitude, Etiquette. Emotional Intelligence What is Emotional Intelligence, emotional quotient why Emotional Intelligence matters, Emotion Scales. Managing Emotions.	Mind Maps	6
4	Motivation - Factors of motivation, Self-talk, Intrinsic & Extrinsic Motivators. Conflict Resolution - Conflicts in Human Relations – Reasons Case Studies, Approaches to conflict resolution.	Lecture method, Audio Video Mode	8
5	Goal Setting - Wish List, SMART Goals, Blueprint for success, Short Term, Long Term, Lifetime Goals. Time Management Value of time, Diagnosing Time Management, Weekly Planner To-do list, Prioritizing work. Extempore Decision Making - Importance and necessity ofDecision Making, Process and practical way of Decision Making, Weighing Positives & Negatives. Technical Topic Presentation.	Audio Video Mode	10

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	Carnegie Dale, How to win Friends and Influence People, New York: Simon & Schuster, 1998. ThomasA Harris, I am ok, You are ok, New York-Harper and Row, 1972
Articles	https://www.frontiersin.org/articles/10.3389/feduc.2019.00087/full https://www.cii.co.uk/media/6158020/a-useful-guide-to-swot-analysis.pdf http://www.mmmut.ac.in/News_content/35141tpnews_10142020.pdf
References Books	Covey Sean, Seven Habit of Highly Effective Teens, New York, Fireside Publishers, 1998. Carnegie Dale, How to win Friends and Influence People, New York: Simon & Schuster, 1998. Thomas A Harris, I am ok, You are ok, New York-Harper and Row, 1972 Daniel Coleman, Emotional Intelligence, Bantam Book, 2006
MOOC Courses	https://www.edx.org/learn/leadership/catalyst-leading-with-effective-communication-inclusive-leadership-training?hs_analytics_source=referrals&utm_source=mooc.org&utm_medium=referral&utm_campaign=mooc.org-course-list https://www.edx.org/learn/writing/university-of-california-berkeley-academic-and-business-writing?hs_analytics_source=referrals&utm_source=mooc.org&utm_medium=referral&utm_campaign=mooc.org-course-list
Videos	https://www.youtube.com/watch?v=fq98P9N9Hbg https://www.youtube.com/watch?v=uA5YeqgsjmYhttps://www.youtube.com/watch?v=eBSeCp__xhI

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	2	2	-	-	-	-	-	2	-	-	-	1	-	2
CO2	-	2	1	-	-	-	-	-	-	-	-	-	3	-	2
CO3	-	3	-	-	-	-	-	-	-	-	2	-	-	2	-
CO4	-	-	-	-	-	-	2	-	3	-	-	-	-	-	-
CO5	-	2	-	2	-	-	-	-	-	-	-	-	2	-	3
CO6	-	3	-	3	-	-	-	-	-	-	-	-	-	3	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Hindi II [T]
Course Code	AEC IV [T]

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Ability Enhancement Courses							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** भारतीय ज्ञान परम्परा सेवि द्यार्थि यों को अवगत कराना । **(BL1-Remember)** **CO2-** उत्कृष्ट साहित्यि क पाठों के अध्ययन सेरूचि का वि कास करना**(BL2-Understand)** **CO3-** सांस्कृति क चेतना और राष्ट्रीय भावना का विकास करना ।**(BL3-Apply)** **CO4-** भाषा-ज्ञान**(BL4-Analyze)** **CO5-** सामान्य शब्दावली और वि शेष 'शब्दावली के अध्ययन द्वारा भाषा एवंसंस्कृति बोध का वि कास करना**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	1. समसामयि क सं दर्भ- श्रीमद्भगवद्गीता-कर्मयोग 2. सूर्यकांत त्रि पाठी नि रासा- परि चय पाठ:- जागो फि र एकबार (दो) कवि ता 3. अमरकांत - परि चय पाठ दोपहर का भोजन (कहानी) 4 महादेवी वर्मा :- परि चय पाठ :- गि ल्लू(रेखांकि त)	Audio/Video clips, group discussion, lecture with ppt, quiz	4
2	1. हजारी प्रसाद द्वि वेदी, - परि चय पाठ :- नाखून क्यों बढ़तेहैं, ललि त नि बं ध) 2. मध्य प्रदेश की लोक कलाएँ (सं कलि त) 3. मध्य प्रदेश का लोक-साहि त्य (सं कलि त)	Audio/Video clips, group discussion, lecture with ppt, Review Analysis	4
3	1. मुहावरेऔर कहावते(भाषा) 2. समास : परि भाषा और भेद (शब्द रचना / व्याकरण) 3. बीज शब्द. (Keywords) अवधारणा मूलक शब्द उद्योग, सभ्यता, सं स्कृति , शि क्षा, सूचना-समाज	Audio/Video clips, group discussion, lecture with ppt, Review Analysis	5
4	1.मांडव (यात्रा वृतांत): पं रामनारायण उपाध्याय 2 शि रीष के फूल (नि बं ध):- आचार्य हजारी प्रसाद द्वि वेदी 3. जवानी (काव्ये) : श्रीमाखनलाल चतुर्वेदी .	Audio/Video clips, group discussion, lecture with ppt, Review Analysis	5
5	1. मध्यप्रदेश के पर्यटन स्थल 2. उसनेकहा था (कहानी): श्री चन्द्रधर शर्मा - गुलेरी" 3. जनजातीय जीवन,	Audio/Video clips, group discussion, lecture with ppt, Review Analysis D.TEXT BOOKS:	4

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	भाषा और संस्कृति- मध्य प्रदेश शासन
Articles	
References Books	भाषा और संस्कृति- मध्य प्रदेश शासन
MOOC Courses	https://nptel.ac.in/courses/126104007
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	1	-	2	-	3	-	-	3	1	1
CO2	3	1	1	1	1	1	-	2	-	3	-	-	3	1	1
CO3	3	1	1	1	1	1	-	2	-	3	-	-	3	1	1
CO4	3	1	1	1	1	1	-	2	-	3	-	-	3	1	2
CO5	3	1	1	1	1	1	-	2	-	3	-	-	3	1	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Communication skills [T]
Course Code	AEC-2 [T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Foundation core							
Pre-Requisite/s	Should be acquainted with the basics knowledge of food and the technology behind the processing of them			**Co-Requisite/s**	Opportunities for students to develop their reading and writing skills over the course of the semester through practices such as portfolios, revision assignments, collaborative work, and low-stakes assignments			
Course Outcomes & Bloom's Level	**CO1-** Comprehend and summarize characteristics & various structural principles prerequisite to Technical Communication**(BL1-Remember)** **CO2-** Classify and formulate the elementary intricacies of Scientific and Technical Writing using applicative grammar construct.□**(BL2-Understand)** **CO3-** Create cohesive technical paragraphs & text.**(BL3-Apply)** **CO4-** Paraphrase text(s) and use appropriate referencing styles**(BL4-Analyze)** **CO5-** Evaluate goal setting, management, decision-making skills.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
Module 1	Introduction to Communication Definition, Process, Principles and Types Forms & Grapevine Barriers & Noise	Classroom Lecture, PPts, Videoes	4
Module 2	Language Know-how Common Errors Learning through examples Functional Grammar & Contemporary usage	Classroom Lecture, PPts,	6
Module 3	Paragraph Development Techniques Principles & Methods Instruments for Cohesive Writing Creating Mind Maps and Infographics	Classroom Lecture, PPts,	8
Module 4	Writing skills Introduction to writing skills. Tone, Orientation, Attitude, Formal vs Informal, general writing, technical writing • Letter/ Application/e-mail, Format, and content Indianisms in Email Writing Writing for the Web: Do's & Don'ts of Email Writing, Netiquette	Classroom Lecture, PPts,	6
Module 5	Writing skills, Introduction to writing skills. Tone,Orientation, Attitude,Formal vs Informal,general writing,technical writing •Letter/ Application/e-mail, Format, andcontent • Indianismsin Email Writing •Writing for the Web:Do's & Don'ts of Email Writing,Netiquette	Classroom Lecture, PPts,	6

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
NA	NA	PBL		NA

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	Prasad, V., "Advanced Communication Skills", Atma Ram Publications, New Delhi
Articles	https://www.worldwidejournals.com/indian-journal-of-applied-research-(IJAR)/recent_issues_pdf/2020/February/communication-skills-and-personality-development_February_2020_1580551794_4219373.pdf http://ijrar.com/upload_issue/ijrar_issue_140.pdf
References Books	Rutherford, Andrea, J., "Basic Communication Skills for Technology", Pearson Education Asia
MOOC Courses	https://nptel.ac.in/courses/109103020
Videos	https://www.youtube.com/watch?v=DSaj9qMwvLI https://www.youtube.com/watch?v=pJ7RgUCEd5M

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	2	-	-	-	2	-	-	1	-	1
CO2	2	2	1	2	2	2	-	-	-	2	-	-	1	-	3
CO3	2	1	1	-	1	-	-	-	-	2	-	-	3	2	3
CO4	3	2	-	2	1	-	-	-	-	2	-	-	2	3	3
CO5	3	2	-	2	1	-	-	-	-	2	-	-	2	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	English I [T]
Course Code	AEC-I [T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Foundation core							
Pre-Requisite/s				**Co-Requisite/s**	Opportunities for students to develop their reading and writing skills over the course of the semester through practices such as portfolios, revision assignments, collaborative work, and low-stakes assignments			
Course Outcomes & Bloom's Level	**CO1-** Comprehend and summarize characteristics & various structural principles prerequisite to Technical Communication**(BL1-Remember)** **CO2-** Classify and formulate the elementary intricacies of Scientific and Technical Writing using applicative grammar construct.□**(BL2-Understand)** **CO3-** Create cohesive technical paragraphs & text.**(BL3-Apply)** **CO4-** Paraphrase text(s) and use appropriate referencing styles**(BL4-Analyze)** **CO5-** Evaluate goal setting, management, decision-making skills.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✕	**SDG (Goals)**	SDG4(Quality education)					

Part B

Modules	Contents	Pedagogy	Hours
Module 1	Introduction to Communication Definition, Process, Principles and Types Forms & Grapevine Barriers & Noise	Classroom Lecture, PPts, Videoes	4
Module 2	Language Know-how Common Errors Learning through examples Functional Grammar & Contemporary usage	Classroom Lecture, PPts,	6
Module 3	Paragraph Development Techniques Principles & Methods Instruments for Cohesive Writing Creating Mind Maps and Infographics	Classroom Lecture, PPts,	8
Module 4	Writing skills Introduction to writing skills. Tone, Orientation, Attitude, Formal vs Informal, general writing, technical writing • Letter/ Application/e-mail, Format, and content Indianisms in Email Writing Writing for the Web: Do's & Don'ts of Email Writing, Netiquette	Classroom Lecture, PPts,	6
Module 5	Writing skills, Introduction to writing skills. Tone,Orientation, Attitude,Formal vs Informal,general writing,technical writing •Letter/ Application/e-mail, Format, andcontent • Indianismsin Email Writing •Writing for the Web:Do's & Don'ts of Email Writing,Netiquette	Classroom Lecture, PPts,	6

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
NA	NA	PBL		NA

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	Prasad, V., "Advanced Communication Skills", Atma Ram Publications, New Delhi
Articles	https://www.worldwidejournals.com/indian-journal-of-applied-research-(IJAR)/recent_issues_pdf/2020/February/communication-skills-and-personality-development_February_2020_1580551794_4219373.pdf http://ijrar.com/upload_issue/ijrar_issue_140.pdf
References Books	Rutherford, Andrea, J., "Basic Communication Skills for Technology", Pearson Education Asia
MOOC Courses	https://nptel.ac.in/courses/109103020
Videos	https://www.youtube.com/watch?v=DSaj9qMwvLI https://www.youtube.com/watch?v=pJ7RgUCEd5M

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	2	-	-	-	2	-	-	1	-	1
CO2	2	2	1	2	2	2	-	-	-	2	-	-	1	-	3
CO3	2	1	1	-	1	-	-	-	-	2	-	-	3	2	3
CO4	3	2	-	2	1	-	-	-	-	2	-	-	2	3	3
CO5	3	2	-	2	1	-	-	-	-	2	-	-	2	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Hindi I [T]
Course Code	AEC-II [T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Ability Enhancement Courses							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** भारतीय ज्ञान परम्परा सेवि द्यार्थि यर्थि ों को अवगत कराना**(BL1-Remember)** **CO2-** उत्कृष्ट साहि त्यि क पाठों के अध्ययन सेरूचि का वि कास करना**(BL2-Understand)** **CO3-** सांस्कृति क चेतना और राष्ट्रीय भावना का वि कास करना ।**(BL3-Apply)** **CO4-** भाषा-ज्ञान**(BL2-Understand)** **CO5-** सामान्य शब्दावली और वि शेष 'शब्दा वली के अध्ययन द्वा रा भा षा एवं संस्कृति बो ध का वि का स करना**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being)				

Part B

Modules	Contents	Pedagogy	Hours
1	1.. स्वतंत्रता पुकारती 2. पुष्प की अभि ला 3. वा क्य संरचना और अशुद्धि याँ	Lecture method, audio/video clips, group discussion, quiz	5
2	पर्या यवा ची वि लो म, एकार्थी , अनेकार्थी , शब्दयुग्म शब्द 3. वह तो ड़ती पत्थर, 4. वर्ण-वि चा र (स्वर व्यंजन वर्गी करण उच्चा रण स्था न)	Lecture method, audio/video clips, group discussion, Review Analysis	4
3	भगवा न बुद्ध:- स्वामी वि वेकानंद 2. लो क तंत्र एक धर्म है.है 3. पल्लवन	lecture method, audio/video clips, group discussion, Review Analysis	5
4	1.अफसर 2 संक्षेपण 3 ना री त्व का अभि शा प 4. वि रा म चि ह्न	Audio/Video clips, group discussion, lecture with ppt, Review Analysis	4
5	1.नैति क मूल्य परि चय एवं वर्गी करण २. अंतर्ज्ञा न और नैति क जी वन, 3. अप्प दी पो भव	Audio/Video clips, group discussion, lecture with ppt, Review Analysis	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	हिंदी भाषा एवं नैतिक मूल्य- मध्य प्रदेश शासन
Articles	
References Books	हिंदी भाषा एवं नैतिक मूल्य- मध्य प्रदेश शासन
MOOC Courses	https://nptel.ac.in/courses/109106201
Videos	https://youtu.be/gHhQMNYvQXY?si=ZWLQBB-UwudAXFVm

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	1	-	2	-	3	-	-	3	1	1
CO2	3	1	1	1	1	1	-	2	-	3	-	-	3	1	1
CO3	3	1	1	1	1	1	-	2	-	3	-	-	3	1	1
CO4	3	1	1	1	1	1	-	2	-	3	-	-	3	1	2
CO5	3	1	1	1	1	1	-	2	-	3	-	-	3	1	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Introduction To Food Technology [T]
Course Code	BSFT-0101[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Students must have passed class 12 or equivalent from a recognised board with Physics, Chemistry, and Biology/Home Science as compulsory subjects			**Co-Requisite/s**	Students should have basic knowledge of physics, chemistry and biology.			
Course Outcomes & Bloom's Level	**CO1-** To remember the importance of health food, ethnic food, organic food, functional food, nutraceuticals, fabricated foods, convenience foods, GM foods, space foods**(BL1-Remember)** **CO2-** To understand the food science concepts and food adulteration**(BL2-Understand)** **CO3-** To provide experimental basis and processing ideas of fruits and vegetables technology **(BL3-Apply)** **CO4-** To evaluate the applications of food laws in different food products**(BL4-Analyze)** **CO5-** To apply the understanding of food technology in developing new food products and evaluating the food quality**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕			**SDG (Goals)**	SDG3(Good health and well-being) SDG6(Clean water and sanitation) SDG12(Responsible consuption and production)			

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to Food Science, Food: Definition, functions and types, Different kinds of Food Industries, Components or segments of food industries and their market size and trends, Scope of food processing and technology	Lecture method, audio/video clips, group discussion, quiz, industrial visit	9
2	Classification of animal foods. Composition and processing of milk –pasteurization and sterilization; meat and poultry -slaughtering, fish – structure and types, and eggs - structure	Lecture method, audio/video clips, group discussion	9
3	Classification of plant foods. Composition and processing of cereals, pulses and oilseeds – milling, oil extraction, different by-products	lecture method, audio/video clips, group discussion, lecture with ppt	10
4	Proximate composition and food properties: study of physico-chemical properties of foods, moisture content in fruits and vegetables, boiling point determination of milk and fruit juice, smoke point determination of oils and ghee, surface tension of viscous fluids, osmosis process in grapes, specific gravity of brewed coffee. Colloidal systems in foods, functional food, nutraceuticals	audio/video clips, group discussion, lecture with ppt, quiz	12
5	Food safety and quality assurance- definition, Evaluation of food-subjective and objective, Food standards - PFA, BIS, AGMARK, FPO, FSSAI.	Industrial visit, audio/video clips, group discussion, lecture with ppt, quiz	10

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Familiarization with Food Technology Lab and general laboratory guidelines	Experiments	BL2-Understand	2
2	To determine moisture content in given food sample	Experiments	BL4-Analyze	2
3	To determine ash content in given food sample	Experiments	BL4-Analyze	2
4	To determine crude fat content in given food sample	Experiments	BL4-Analyze	2
5	To determine crude protein content in given food sample	Experiments	BL4-Analyze	2
6	To determine crude fibre content in given food sample	Experiments	BL4-Analyze	2
7	To determine Total Soluble Solids (TSS), pH, and titratable acidity in given samples	Experiments	BL4-Analyze	2
8	To determine physical properties of food grains	Experiments	BL4-Analyze	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0

Part E

Books	Potter, N. N., & Hotchkiss, J. H. (2012, December 6). Food Science. Springer Science & Business Media.
Articles	https://www.ift.org/news-and-publications/food-technology-magazine
References Books	Vaclavik, V. A., & Christian, E. W. (2007, December 3). Essentials of Food Science. Springer Science & Business Media.
MOOC Courses	https://nptel.ac.in/courses/126105013
Videos	https://youtu.be/i5VwdkggtWU

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1	-	-	-	-	-	-	3	1	1
CO2	3	3	2	3	2	1	1	-	-	-	1	-	3	1	1
CO3	3	2	3	3	2	1	1	-	-	-	1	-	3	1	1
CO4	3	2	1	1	1	1	-	-	-	-	-	-	3	3	3
CO5	3	2	2	2	1	1	1	-	-	-	1	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Food Microbiology [T]
Course Code	BSFT-0102[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Students must have studied Physics, Chemistry, and Biology/Home Science as compulsory subjects			**Co-Requisite/s**	Students should have basic knowledge of microorganisms and their classifications and structures (as studied in biology)			
Course Outcomes & Bloom's Level	**CO1-** To remember the interactions between microorganisms and the food environment, and factors influencing their growth and survival**(BL1-Remember)** **CO2-** To understand the significance and activities of microorganisms in food and characteristics of foodborne, waterborne and spoilage microorganisms, and methods for their isolation, detection and identification**(BL2-Understand)** **CO3-** To provide experimental basis, and to enable students to acquire a specialized knowledge and understanding in the field of food microbiology.**(BL3-Apply)** **CO4-** To apply the subject knowledge in future perspectives i.e. such as in food production, fermentation and how it influences the microbiological quality **(BL4-Analyze)** **CO5-** To evaluate the application of microbiological methods and microbiological analysis of food in practice to ensure proper food quality measurement.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG6(Clean water and sanitation)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to microbiology: Scope of food microbiology, Characteristics and morphology of Lactic acid bacteria, Acetic acid bacteria, Clostridium, Proteolytic bacteria, Lipolytic bacteria, fungi, and algae. Control of micro-organisms- Growth curve; Influence of environmental factors on growth- pH, Water activity, O2 availability, Temperature, Pressure and Radiation.	Lecture Method, Ice Breaking session, Review Summarizing, Tutorials sessions	10
2	Contamination and spoilage of different foods: Cereals, sugar and their products, Milk and milk products, Fruits and vegetables, canned foods, meat, fish, eggs and poultry.	Lecture Method, Quiz, Illustrate with analogies, Interactive videos	8
3	Fermented foods: different fermented foods (Sauerkraut, Sausages, Bread, Soysauce, Idli, Tempeh, Poi, Dairy products -basic concepts of all briefly). Different microbial enzymes in industry; concept of probiotics, prebiotics, postbiotics and parabiotic	Lecture method, Summarizing, Quiz, Tutorials sessions, Expert Lecture	10
4	Food borne illness: Food intoxication- Staphylococcal intoxication, botulismFood infection- Salmonellosis, Clostridium perfringens, Bacillus cereus gastroenteritis, E.coli infection, Yersinia enterocolitica, Listeria monocytogenes and Campylobacter jejuni and others. Pre-biotic and pro-biotic	Audio/Video clips, group discussion, lecture with ppt, quiz	9
5	Microorganisms as food: Single cell protein, algae as food, and mycoprotein from fungi for use as food and feed, mushroom cultivation	Audio/Video clips, group discussion, lecture with ppt, quiz	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Introduction to Microbiology Laboratory Safety, use of equipment and perform sterilization techniques	Experiments	BL2-Understand	2
2	To study different parts of microscope and its working	Experiments	BL2-Understand	2
3	To prepare culture media (Nutrient broth and agar)	Experiments	BL3-Apply	2
4	To perform simple and Gram's staining	Experiments	BL3-Apply	2
5	To perform different streaking techniques	Experiments	BL5-Evaluate	2
6	To evaluate microbiological quality of water	Experiments	BL5-Evaluate	2
7	To enumerate Lactic acid bacteria from fermented foods	Experiments	BL5-Evaluate	2
8	To examine the microbial load of different food samples	Experiments	BL4-Analyze	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	

Part E

Books	Frazier, W. C. (1967, January 1). Food Microbiology. McGraw-Hill Companies.
Articles	https://agsci.psu.edu/global/ifsi/ukraine-food-safety-short-course-materials/fssc-case-studies/food-microbiology-case-study.pdf
References Books	Khetarpaul, N. (2006, January 1). Food Microbiology. Daya Books.
MOOC Courses	https://nptel.ac.in/courses/105107173
Videos	https://www.youtube.com/watch?v=zIRXDi-6j-Y&t=2s

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	1	1	-	-	-	1	-	3	1	1
CO2	3	2	3	3	2	2	-	-	-	-	-	-	3	1	1
CO3	3	2	2	3	3	3	-	-	-	-	-	-	3	1	1
CO4	3	3	2	3	2	2	1	-	-	-	-	-	3	3	3
CO5	3	3	2	2	3	2	-	-	-	-	1	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Technology of Food Processing and Preservation [T]
Course Code	BSFT-0201 [T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Students must have studies Introduction to Food Technology and Basic chemistry in previous semester			**Co-Requisite/s**	Knowledge of chemical preservatives used in different foods and processing parameters applied to extend the shelf-life of product			
Course Outcomes & Bloom's Level	**CO1-** To remember the major food preservation principles, techniques and their merits and demerits**(BL1-Remember)** **CO2-** To understand the basic concepts of thermal as well as novel food processing methods including non-thermal food processing techniques using pressure, light, sound and microwave**(BL2-Understand)** **CO3-** To provide experimental basis, and to enable students to acquire a specialized knowledge and understanding in the field of food processing**(BL3-Apply)** **CO4-** To apply the subject knowledge in future perspectives i.e. developing new product, preserving fresh produce, killing microbes in food, etc.**(BL4-Analyze)** **CO5-** To evaluate the application of food preservation principles in various fields such as research and food industries**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG2(Zero hunger) SDG3(Good health and well-being) SDG6(Clean water and sanitation)				

Part B

Modules	Contents	Pedagogy	Hours
1	Preservation-Introduction, Preservatives - Natural preservatives-Mode of action, Chemical preservatives- Sulphur dioxide, Benzoic acid, Sorbic acid, Antioxidants. Gaseous chemical food preservatives, factors influencing action of preservatives concept of Packaging.	Lecture, discussion, ppt	8
2	Concept, need of processing in preservation, Processing-concept and levels, effects of processing. Thermal Processing Principles and application–Blanching, Pasteurization, Sterilization, Ultra high temp sterilization, Aseptic processing.	Lecture, discussion, ppt	12
3	Drying- Significance: Natural drying- Solar drying, Artificial drying- Hot air drying, Drum drying, Spray drying, Freeze drying Pretreatments blanching, sulphuring	Quiz, Lecture, discussion, ppt, Expert Lecture	10
4	Freezing: Refrigeration, Effect of low temperature on Fresh Fruits, Vegetables, Meat and Fish products, Chill injury. Freezing, Freezing rate Quick freezing, Slow freezing, Air blast freezing, Contact freezing, Immersion freezing, Cryogenic freezing, Quality of frozen foods-Retrogradation, Protein denaturation, Freezer burn.	Audio/Video clips, group discussion, lecture with ppt, quiz	10
5	New trends in processing: Concept of Hurdle Technology- microwave processing, Cold Pasteurization Techniques, Radiation and its effect on food. Ohmic heating. High Pressure Processing, Plasma Technology, Extrusion, ultrasound processing	Audio/Video clips, group discussion, lecture with ppt, quiz	6

<4d style="border: 1px solid black;">Experiments

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Familiarization with Food Technology Lab and general laboratory guidelines	Industrial Visit	BL2-Understand	3
2	Study the blanching process and determine catalase/peroxidase activity	Experiments	BL2-Understand	2
3	Study the effect of blanching on vitamin C content in given food sample	Experiments	BL3-Apply	2
4	Examination of the enzymatic browning in fruits and vegetables.	Experiments	BL3-Apply	2
5	Determination of Total Soluble Solids (TSS), pH, and titratable acidity in given samples	Experiments	BL3-Apply	2
6	Preparation of osmotic dehydrated fruits and vegetables	Experiments	BL3-Apply	2
7	Preservation of seasonal fruits/vegetables by natural preservatives	PBL	BL4-Analyze	3
8	Estimation of sodium benzoate in food sample (qualitative and quantitative determination)	BL3-Apply	2	

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	18	40	0

Part E

Books	Khader, V. (2004) Text book on Food Storage and preservation. Ludhiana: Kalyani Publishers.
Articles	
References Books	DESROSIER, N.W. (2018) Technology of Food Preservation. ED-TECH. Fennema, O.R. (1976) Principles of Food Science. New York: Dekker.
MOOC Courses	https://nptel.ac.in/courses/127105231
Videos	https://www.youtube.com/watch?v=vznRdbIDl5w&t=1s

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	1	-	1	1	-	-	3	1	1
CO2	3	2	1	1	1	1	2	1	2	1	-	-	3	1	1
CO3	3	2	2	1	1	-	1	-	-	-	-	-	3	2	2
CO4	3	2	2	2	2	1	1	1	-	1	-	-	3	2	2
CO5	3	2	2	2	2	1	1	-	1	1	-	-	3	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Food Additives [T]
Course Code	BSFT-0202 [T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	Candidates must have studied food chemistry and food microbiology in previous semesters.			**Co-Requisite/s**	Students should have prior knowledge of preservatives, chemical compounds etc.			
Course Outcomes & Bloom's Level	**CO1-** To remember the food additives, their classification, properties, usage limit and their importance. **(BL1-Remember)** **CO2-** To understand the applications of different additives in food processing and nutrition in addition to their stabilization and protection techniques**(BL2-Understand)** **CO3-** To provide the students a specialized knowledge and understanding in the field of food additives and their utilization**(BL3-Apply)** **CO4-** To apply the subject knowledge in future perspectives i.e. such as in food processing and new product development.**(BL4-Analyze)** **CO5-** To evaluate the theoretical knowledge in different commercialized products and implement the same to create processed and value added food products**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG2(Zero hunger) SDG3(Good health and well-being) SDG6(Clean water and sanitation)				

Part B

Modules	Contents	Pedagogy	Hours
1	Definitions, classification and functions, need for food additives, Safety concerns, regulatory authorities; Food preservatives- classifications, antimicrobial agents (types, mode of action and their application), Antioxidants (synthetic and natural, mechanism of oxidation inhibition), Chelating agents: types, uses and mode of action	Lecture method, quiz, seminar	8
2	Nutrient supplements, bulking agents, antifoaming agents, Flour improvers, leavening agents, humectants, buffering agents, and anticaking agents. Sweeteners: Introduction, types, properties and uses of saccharin, acesulfame-K, aspartame, HFCS, invert sugar, and sugar alcohols (polyols) as sweeteners in food products	Lecture method, quiz, seminar, quiz	12
3	Flavoring agents: Introduction, types and flavor extraction and stabilization; Flavor enhancers- Introduction and types Coloring agents: Introduction, types, sources, applications, permitted and misbranded colors, color extraction and stabilization techniques	Summarizing, Quiz, Whiteboard, Expert Lecture	7
4	Emulsifiers: Introduction, types, selection of emulsifiers, emulsion stability, and mechanism of action. Thickeners and hydrocolloids: Introduction and types	Lecture method, group discussion, industrial visit	8
5	E-codes, CAS system. Uses and function of food additives in food formulations (different products). Regulation concerning food additives and other categories of ingredients approval and usage in European Union.	Group discussion, lecture, ppt	10

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	To detect different gums and thickeners in food samples	Experiments	BL4-Analyze	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	0	40	20	60	0

Part E

Books	Food Additives by Branen AL, Davidson PM & Salminen S
Articles	https://www.researchgate.net/publication/221925228_Food_Additive
References Books	Encyclopedia of Food and Color Additives by Gerorge AB Food Antioxidants: Technological, Toxicological and Health Perspective by Madhavi DL, Deshpande SS & Salunkhe DK. Food Flavours. Part A by Morton ID & Macleod AJ Food Proteins:Processing Applications by Shuryo Nakai Food Polysaccharides and Their Applications by Stephen AM
MOOC Courses	https://nptel.ac.in/courses/126105027
Videos	https://youtu.be/Dm3yP7FF4nI?si=55vFo027nUaRB6jy

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	1	-	-	-	-	-	-	3	1	1
CO2	3	3	2	2	3	2	-	-	-	-	-	-	3	1	1
CO3	3	3	2	3	3	2	-	-	-	-	-	-	3	1	1
CO4	3	2	2	3	3	3	1	-	-	-	1	-	3	3	3
CO5	3	3	3	2	2	2	1	-	-	-	1	2	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Processing of Fruits and Vegetables[T]
Course Code	BSFT-0203 [T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Student must have studies Post-Harvest technology and food preservation in previous semesters			**Co-Requisite/s**	Study of nutritional composition of fruits and vegetables and preparation of value added products			
Course Outcomes & Bloom's Level	**CO1-** To remember the specific processing technologies used for vegetable, fruits and products derived from these materials **(BL1-Remember)** **CO2-** To understand the application of scientific principles in the processing technologies, product specification and regulations **(BL2-Understand)** **CO3-** To provide students an experimental basis and a specialized knowledge and understanding in the changes in the composition of the raw material with respect to the type of processing technology used **(BL3-Apply)** **CO4-** To apply the subject knowledge in future perspectives i.e. such as in fruits/vegetables processing and new product development from them **(BL4-Analyze)** **CO5-** To evaluate the real life knowledge gained in fruits and vegetables composition and properties and implement the same to create processed and value added food products. **(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG2(Zero hunger) SDG3(Good health and well-being) SDG6(Clean water and sanitation)				

Part B

Modules	Contents	Pedagogy	Hours
1	Technology of Fruits and Vegetables: Structural, Compositional, and nutritional aspects of fruits and vegetables. Indian and global scenario on production and processing of fruits and vegetable; primary processing: grading, sorting, cleaning, washing, peeling, slicing, and blanching; minimal processing	Lecture method, quiz, group discussion	9
2	Canning and bottling of fruits and vegetables: process of canning, factors affecting the process- time and temperature, containers of packing, lacquering, syrups and brines for canning, spoilage in canned foods. Dehydration of fruits and vegetables: using various drying technologies like sun drying, solar drying (natural and forced convection), osmotic, tunnel drying, fluidized fed drying, freeze drying, convectional and adiabatic drying; intermediate moisture fruits and vegetables. Fruit powders using spray drying.	Lecture method, Quiz, Illustrate with analogies	9
3	Fruits beverages: Introduction, Processing of fruit juices (selection, juice extraction, deaeration, straining, filtration and clarification), preservation of fruit juices (pasteurization, chemically preserved with sugars, freezing, drying, tetra-packing, carbonation), processing of squashes, cordials, nectars, concentrates and powder.	Lecture method, industrial visit, Expert Lecture	9
4	Jams, jellies, and marmalades: Introduction, Jam: Constituents, selection of fruits, processing and technology, Jelly: Essential constituents (Role of pectin, ratio), Theory of jelly formation, Processing and technology, defects in jelly, Marmalade: Types, processing and technology, defects. Technology of preserved, crystallized, and glazed fruits	Lecture method, group discussion, audio-video clips, quiz	9
5	Tomato products: Selection of tomatoes, pulping and processing of tomato juice, tomato puree, paste, ketchup, sauce, and soup. Pickles, chutneys, and sauces: Processing, Principle and methods of pickling, types of pickles, nature, and control of spoilage in pickles.	Lecture method, Audio/Video clips, group discussion, quiz	9

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Preparation of jam/ jelly/ marmalade from selected fruit	Experiments	BL3-Apply	2
2	Preparation of RTS beverage	Experiments	BL3-Apply	2
3	Preparation of squash	Experiments	BL3-Apply	2
4	Preparation of grape raisins	Experiments	BL3-Apply	2
5	Preparation of dried fig / banana fig	Experiments	BL3-Apply	2
6	Preparation of fruit candy	Experiments	BL3-Apply	2
7	Osmotic dehydration of fruit slices	Experiments	BL4-Analyze	2
8	Preparation of fruit leather	Experiments	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	0	60	18	40	0

Part E

Books	Lal, G., Siddappa, G. S., & Tandon, G. L. (1986, January 1). Preservation of Fruits and Vegetables.
Articles	
References Books	Manay, N. S., & Shadaksharaswamy, M. (2008, January 1). Food: Facts and Principles. New Age International. Ranganna, S. (1986, January 1). Handbook of Analysis and Quality Control for Fruit and Vegetable Products. Tata McGraw-Hill Education Vere Cruess, W. (1938, January 1). Commercial Fruit and Vegetable Products.
MOOC Courses	https://nptel.ac.in/courses/126105015
Videos	https://www.youtube.com/watch?v=k1a2PSEXahM&t=1s

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	1	-	1	-	1	-	-	3	1	1
CO2	2	1	1	-	1	1	1	1	-	-	1	-	3	1	2
CO3	2	2	2	1	1	1	1	1	1	1	1	-	3	2	2
CO4	2	2	2	2	2	1	1	1	-	-	1	-	3	2	3
CO5	2	2	2	1	1	1	-	-	1	-	1	-	3	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Processing of cereals, millets and pulses [T]
Course Code	BSFT-0301 [T]

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Students must have studied introduction to food technology and food chemistry in previous semester			**Co-Requisite/s**	Students should have basic knowledge of plat parts and morphology, various preservation and processing techniques.			
Course Outcomes & Bloom's Level	**CO1-** To remember the cereals composition and milling process and technological methods used to increase cereal grains, pulses and oil-seeds quality**(BL1-Remember)** **CO2-** To understand the core principles, and properties of interaction of various flour components and their role in end use quality**(BL2-Understand)** **CO3-** To provide the students an experimental basis and specialized knowledge and understanding in the field of cereals processing**(BL3-Apply)** **CO4-** To apply the subject knowledge in future perspectives i.e. such as interaction,and interpretation of cereals, pulses and oil-seeds utilization.**(BL4-Analyze)** **CO5-** To evaluate the practical knowledge on cereals and oilseeds and implement the same to create processed and value added food products.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕			**SDG (Goals)**	SDG1(No poverty) SDG2(Zero hunger) SDG3(Good health and well-being) SDG12(Responsible consuption and production)			

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to cereal technology- Basic introduction of major cereals- wheat, rice, corn and barley. Wheat: Introduction, types, milling, flour grade, flour treatments (bleaching, maturing), products and byproducts	Lecture, discussion and PPT	11
2	Rice: Introduction, types, physicochemical properties, milling (mechanical & solvent extraction), parboiling, ageing of rice, different products, utilization of by products.	Lecture, discussion and PPT, Interactive videos	11
3	Corn: Introduction, types, milling (wet & dry), corn flour, different products Introduction to barley, oats and sorghum –Processing and products	Lecture, discussion and PPT	10
4	Millets:Introduction, types, composition, milling and value addition Pseudo-cereals: (amaranth, quinoa, buckwheat), composition and nutritional value, health benefits and current applications for the development of gluten-free foods.	Audio/Video clips, group discussion, lecture with ppt, quiz	08
5	Pulses: Introduction, types, dry milling, wet milling, improved milling method Oilseeds: Introduction, types, extraction of oil and refining	Audio/Video clips, group discussion, lecture with ppt, quiz	10

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	To determine 1000 kernel weight, bulk density, particle density and angle of repose of given cereals, millets and pulses	Experiments	BL4-Analyze	2
2	To determine the gluten content of wheat flour	Experiments	BL4-Analyze	2
3	Determination sedimentation value of flour	Experiments	BL5-Evaluate	2
4	To extract the oil from oilseeds	Experiments	BL3-Apply	2
5	To estimate the water absorption power (atta, and maida)	Experiments	BL4-Analyze	2
6	To prepare the bread from different flours	Experiments	BL6-Create	2
7	To prepare cookies from composite flour	Experiments	BL6-Create	2
8	To prepare Millet Based Deep Fried Snacks	Experiments	BL6-Create	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	0

Part E

Books	The technology of food preservation by Kent, N.L.
Articles	
References Books	Technology of Cereal by KA Rosentrater Post-harvest Technology of Cereals, Pulses and Oilseeds by Chakraverty Rice Science and Technology by Marshall Food Facts and Priniciples by Shakuntala Manay
MOOC Courses	https://nptel.ac.in/courses/126103017
Videos	https://www.youtube.com/watch?v=F8jhoaV-nsE&t=1s

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	2	-	-	-	-	-	-	3	1	1
CO2	3	3	2	3	3	3	1	-	-	-	1	-	3	1	1
CO3	3	2	3	3	2	2	1	-	-	-	1	2	3	1	1
CO4	3	2	2	3	3	3	-	-	-	-	-	-	3	3	3
CO5	3	3	3	2	2	2	-	-	-	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Processing of spices and plantation crops [T]
Course Code	BSFT-0303 [T]

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	candidates must have passed class 12 or equivalent from a recognised board with Physics, Chemistry, and Biology/Home Science as compulsory subjects and an overall grade of at least 50%			**Co-Requisite/s**	Student should have basic knowledge about plants, their morphology and anatomy.			
Course Outcomes & Bloom's Level	**CO1-** To provide an overview on post-harvest losses and its impact on the Indian economy **(BL1-Remember)** **CO2-** To comprehend about fruit and vegetable physiology, metabolic processes and various nutritional changes in fruits and vegetables along with post-harvest handling techniques.**(BL2-Understand)** **CO3-** To generate knowledge on different pre-processing operations involved before processing of fruits and vegetables**(BL3-Apply)** **CO4-** : To interpret various post-harvest disorders and diseases of fruits, minimizing the losses by suitable packaging and minimal processing operations. **(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕			**SDG (Goals)**	SDG1(No poverty) SDG2(Zero hunger) SDG3(Good health and well-being) SDG4(Quality education) SDG5(Gender equality) SDG10(Reduced inequalities) SDG12(Responsible consuption and production) SDG13(Climate action)			

Part B

Modules	Contents	Pedagogy	Hours
1	Post-harvest aspects of crops – objectives – post harvest systems and losses in agricultural commodities structure, optimum stage of harvest, importance of loss reduction. Post harvest handling (harvesting, precooling, sorting, grading and packaging) of perishables i.e. fruits and vegetables.Post harvest treatment for quality retention of horticultural crops; spoilage of fruits & vegetables, methods to reduce decay	Lecture methods, Audio/Video clips, group discussion, quiz	8
2	Coffee: Production, composition, classification, and processing of coffee; types: decaffeinated coffee, coffee brew concentrate, standards, and specifications of coffee products; chicory: technology of chicory powder and use in coffee products. Tea: Production, composition, classification, and manufacturing; types of tea; tea products such as soluble tea, tea concentrate, instant tea, decaffeinated and flavoured tea; quality evaluation and grading of tea.	Lecture methods,Audio/Video clips, group discussion, Review Analysis	12
3	Cocoa: Production, processing, and chemical composition of cocoa beans. Cocoa Processes: Cleaning, roasting, alkalization, cracking and fanning, Nib grinding for cocoa liquor, cocoa butter, and cocoa powder Manufacturing process for chocolate: Ingredients, Mixing, Refining, conching, Tempering, moulding etc. to obtain chocolate slabs, chocolate bars. Enrobed and other confectionary products.	Lecture methods, Audio/Video clips, group discussion,classroom presentations	10
4	Spices, condiments, seasonings and culinary herbs; classification and beneficial properties of spices; processing and manufacturing of major Indian spice: pepper, cardamom, ginger, chili and turmeric, clove, garlic, Cumin, coriander, cinnamon, mint and vanilla.	Lecture methods, Audio/Video clips, group discussion, quiz	8
5	Oleoresins and essential oils: method of manufacture; chemistry of the volatiles; enzymatic synthesis of flavor identical; adulteration problem in spices, packaging of spices.	Lecture methods, Audio/Video clips, group discussion, quiz	7

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	To estimate 1000 kernel weight, bulk density, true density and porosity of given sample of grains	Experiments	BL2-Understand	2
2	To determine coefficient of friction and angle of repose of given grain samples	Experiments	BL4-Analyze	2
3	To determine the caffeine content in given samples of tea and coffee	Experiments	BL5-Evaluate	2
4	To prepare decaffeinated tea	Experiments	BL6-Create	2
5	To determine the adulteration of spices	Experiments	BL4-Analyze	2
6	To prepare the essential oil from spices	Experiments	BL6-Create	2
7	To prepare masala pre-mix for culinary uses	Experiments	BL6-Create	2
8	To perform grading of different kind of tea	Experiments	BL5-Evaluate	2
9	To prepare chocolate based food product	Experiments	BL6-Create	2
10	To visit a related industry	Industrial Visit	BL4-Analyze	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Spices, condiments and seasonings-Kenneth T. Farrell
Articles	https://www.researchgate.net/profile/Gangaiah-Bandla/publication/349075652_AN_OVERVIEW_OF_INTEGRATED_FARMING_SYSTEMS_OF_COASTAL_INDIA/links/6020d8a7299bf1cc26ae8793/AN-OVERVIEW-OF-INTEGRATED-FARMING-SYSTEMS-OF-COASTAL-INDIA.pdf#page=25
References Books	Tea Production and Processing-Banerjee B. Spice Science and Technology -Kenji Hirasa and MitsnoTakemasa Chocolate, Cocoa and Confectionery Technology. -Minifie BW Handbook on Spices. National Institute of Industrial Research Board, -NIIR Coffee Processing Technology-Sivetz M & Foote HE
MOOC Courses	https://onlinecourses.nptel.ac.in/noc22_ag13/preview
Videos	https://www.youtube.com/watch?v=-NyDCWuAGfk&embeds_referring_euri=https%3A%2F%2Fonlinecourses.nptel.ac.in%2F&source_ve_path=Mjg2NjY&feature=emb_logo

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	3	3	1	1	-	-	-	1	1	3	1	1
CO2	3	3	3	2	2	2	-	-	-	-	-	2	3	1	1
CO3	3	2	3	3	3	1	-	-	-	-	-	1	3	1	1
CO4	2	2	2	2	3	3	-	-	-	-	-	3	3	3	3
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Beverage Technology [T]
Course Code	BSFT-0401 [T]

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Student must have studies food microbiology and introduction to food technology in previous semester			**Co-Requisite/s**	knowledge of food fermentation and preservation			
Course Outcomes & Bloom's Level	**CO1-** To remember the basics of Beverage technology, including the origin, principles and applications**(BL1-Remember)** **CO2-** To understand the core principles, techniques and mechanism of nonalcoholic and alcoholic fermentation**(BL2-Understand)** **CO3-** To provide the students a specialized knowledge and understanding regarding manufacturing of various alcoholic beverages as well as nonalcoholic beverages**(BL3-Apply)** **CO4-** To study the concept of additives being used in beverages**(BL4-Analyze)** **CO5-** To evaluate the quality standards comprising of Chemical, Microbial & Sensory Evaluation **(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG2(Zero hunger) SDG3(Good health and well-being) SDG6(Clean water and sanitation)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to beverage technology & History of Growth of Beverages. Importance and Market Scenario. Classification of beverages	Lecture method, quiz, group discussion	5
2	Carbonated beverages – Introduction, process technology, and carbonation; Non-carbonated beverages- Bottled Water, Stimulating beverages-Tea, Coffee, Cocoa, Fruit-based beverages	Lecture method, Quiz, Illustrate with analogies	12
3	Alcoholic beverages- Role of yeast in fermentation, Production technology of fermented (beer, wine) and distilled beverages (Brandy, Rum, Whiskey, Gin, Vodhka, Sake, etc)	Lecture method, Expert Lecture	12
4	Additives for Beverages: Colors, Acids, Emulsifiers Preservatives, Sweeteners, Flavors, Flavor Enhancers. Health drinks, energy drinks, diet drinks	Audio/Video clips, group discussion, lecture with ppt, quiz	10
5	Quality Control and Standards for beverages and bottled water, Chemical, Microbial & Sensory Evaluation, defects in beverages.	Lecture method, Audio/Video clips, group discussion, lecture with ppt, quiz	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Determination of Quality parameters of bottled water	Experiments	BL2-Understand	3
2	Brewing perfect French press coffee from roasted coffee beans	Experiments	BL2-Understand	2
3	Preparation of fruit smoothies	Experiments	BL3-Apply	2
4	Preparation of nectar and cordials	Experiments	BL3-Apply	2
5	Determination of TSS, pH and titratable acidity of different beverages	Experiments	BL3-Apply	2
6	Determination of the caffeine level in stimulating beverages	Experiments	BL3-Apply	2
7	Preparation of Alcoholic beverages	Experiments	BL3-Apply	3
8	Preparation of coconut water energy drink	Experiments	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	0

Part E

Books	Manay, N.S. and Shadaksharaswamy, M. (2008) Foods: Facts and principles. New Delhi: New Age International Ltd.
Articles	
References Books	Mudgil, D. and Barak, S. (2018) Beverages: Processing and technology. Jodhpur, India: Scientific Publishers. Varnam, A.H. and Sutherland, J.R. (2009) Beverages: Technology, Chemistry and Microbiology. Londos €tc.: Chapman and Hall.
MOOC Courses	https://nptel.ac.in/courses/126105020
Videos	https://www.youtube.com/watch?v=h5NpTku5BGc

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	-	1	-	1	1	1	-	-	3	1	1
CO2	3	2	1	1	1	1	1	-	1	-	-	-	3	1	1
CO3	3	2	2	2	1	1	1	1	1	1	-	-	3	1	1
CO4	3	2	2	1	1	1	1	-	1	1	-	-	3	2	2
CO5	3	2	2	2	1	1	1	1	1	1	-	-	3	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Livestock product technology [T]
Course Code	BSFT-0403 [T]

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Students must have studied food processing and preservation, food nutrition and related subjects in previous semester			**Co-Requisite/s**	Students should have prior basic knowledge of preservation, processing etc.			
Course Outcomes & Bloom's Level	**CO1-** To remember the raw material characteristics, handling, processing, and preservation**(BL1-Remember)** **CO2-** To understand the scientific principles in the processing technologies, by-product utilization of meat, poultry, fish and egg products**(BL2-Understand)** **CO3-** To provide students an experimental basis and a specialized knowledge and understanding in the development and quality control of meat, poultry and fish products and maintaining hygiene, sanitation and mechanized practices of meat, fish, poultry and egg industry**(BL3-Apply)** **CO4-** To apply the subject knowledge in future perspectives i.e. such as in research and development in meat, poultry and fish products**(BL4-Analyze)** **CO5-** To evaluate the real life knowledge gained and properties and implement the same to create new flesh products. **(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG2(Zero hunger) SDG3(Good health and well-being)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction: Terminologies related to meat, fish and poultry processing; Indian meat industry: Livestock, poultry, egg and fish population and their processing and export; Structure of muscle tissues; Effects of feed, breed and environment on production of meat animals, poultry and fish	Lecture method, quiz, group discussion	7
2	Slaughter process: Ante-mortem examination of meat animals, Slaughter techniques, Dressing of carcasses, Post-mortem examination of meat, Grading, Meat Quality- color, texture, water-holding capacity (WHC), emulsification capacity	Lecture method, Quiz, Illustrate with analogies, industrial visit	10
3	Preservation of meat: Refrigeration and freezing, thermal processing, dehydration, and irradiation. Meat products: RTE meat products, Sausages processing - Types and defects. By-products: Importance, classification and uses, Manufacture of Natural casings.	Lecture method, Expert Lecture, quiz	10
4	Egg: Structure of egg, composition and nutritive value of egg; Preservation of eggs: Refrigeration and freezing, thermal processing, dehydration & coating. Egg processing-dried and frozen eggs, Factors affecting egg quality and measures of egg quality.	Audio/Video clips, group discussion, lecture with ppt, quiz	9
5	Fish and seafoods: Structure, Composition and nutritive value of fish, Fish dressing, Preservation of fish: Fish Curing, Smoking and Canning;Fishery by-products Other Seafoods: Introduction and processing.	Group discussion, lecture with ppt, quiz	9

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	To study the structure of an egg	Experiments	BL2-Understand	2
2	To determine the specific gravity of eggs	Experiments	BL5-Evaluate	2
3	To study the process of osmosis by the removal of egg shell	Experiments	BL4-Analyze	2
4	To determine the exterior and interior quality (breakout method) of table eggs.	Experiments	BL4-Analyze	2
5	To determine egg quality using candling	Experiments	BL4-Analyze	2
6	Preparation of an egg/chicken pickle and its sensory evaluation	Experiments	BL6-Create	2
7	Determination of water holding capacity of meat	Experiments	BL5-Evaluate	2
8	Determination of extract release volume (ERV) of meat	Experiments	BL4-Analyze	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Outlines of meat science and technology by B.D Sharma
Articles	
References Books	Poultry Meat and Egg Production by Parkhurst and Mountney
MOOC Courses	https://nptel.ac.in/courses/127106236
Videos	https://www.youtube.com/watch?v=i5VwdkggtWU

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	2	1	-	-	-	-	-	-	3	1	1
CO2	3	3	2	1	2	1	-	-	1	-	-	1	3	1	1
CO3	2	3	3	2	2	2	1	-	1	-	1	2	3	1	1
CO4	1	2	3	2	2	3	1	-	1	-	1	1	3	3	3
CO5	1	3	2	-	2	1	-	-	1	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Dairy Technology [T]
Course Code	BSFT-0501 [T]

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	candidates must have passed class 12 or equivalent from a recognised board with Physics, Chemistry, and Biology/Home Science as compulsory subjects and an overall grade of at least 50%			**Co-Requisite/s**	The student should have a basic knowledge of milk.			
Course Outcomes & Bloom's Level	**CO1-** To remember the milk characteristics, handling, processes related to storage, processing and distribution of milk and milk Products **(BL1-Remember)** **CO2-** To understand thescientific principles in the thermal processing technologies, and production of different dairy products**(BL2-Understand)** **CO3-** To provide students an experimental basis and a specialized knowledge and understanding in the development and quality control of milk and dairy products**(BL3-Apply)** **CO4-** Toapply the subject knowledge in future perspectives i.e. such as in research and development in dairy products**(BL4-Analyze)** **CO5-** Toevaluate the real life knowledge gained and properties and implement the same to create new dairy products. **(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG2(Zero hunger) SDG3(Good health and well-being) SDG12(Responsible consuption and production)				

Part B

Modules	Contents	Pedagogy	Hours
1	General: Dairy development in India – Dairy Cooperatives – NDRI, NDDB, TCMPF - Operation Flood – Milk and Milk Products Order '92 – Nutritive value of milk ICMR recommendation of nutrients – Milk production in India with reference to Global milk production – Per capita availability of milk in India – Role of milk and milk products in human nutrition.	Lecture methods, ppt.	8
2	Dairy Chemistry: Milk Composition – Physico Chemical properties of milk – Animal, Feed and Environmental factors influencing the composition of milk – Milk lipids, Proteins, Sugar and their biosynthesis, classes and significance – Minerals and Vitamins in Milk – Thermal stability of Milk – Freezing Point depression of Milk.	quiz, lecture, ppt	8
3	Dairy Processing and Technology: Dairy processing – Milk collection, transportation & Grading of milk –Standardization – Pasteurization – Homogenization of milk .Manufacture of dairy products cream– butter – ghee – Ice cream – concentrated and dried milk products cheese and other fermented products – manufacture of Dahi – Yoghurt –Shrikand	Summarizing, Quiz, Tutorials sessions, Expert Lecture	8
4	Dairy Microbiology: Milk and microbes – Common micro organisms in milk – spoilage of milk –Fermentation of milk - Desirable and undesirable fermentation – milk borne Diseases –Milk and Public Health – common starter cultures in dairy industry-their classification.	Lecture methods,Audio/Video clips, group discussion, quiz	8
5	Standards For Milk And Milk Products: Definition of Milk and Milk Products under the PFA Rules, 1955/Food Safety Act 2006 .BIS, PFA standards – Maximum Permissible limits of Aflatoxin, Pesticides, Antibiotic residues and Heavy metals in Milk and Milk Products . Labeling of Milk and Milk Products	Lecture methods, Group discussion, quiz	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	To perform platform tests in milk.	Experiments	BL2-Understand	2
2	To estimate milk protein by Folin method.	Experiments	BL4-Analyze	2
3	To estimate milk fat by Gerber method.	Experiments	BL5-Evaluate	2
4	Preparation of flavored milk.	Experiments	BL6-Create	2
5	Pasteurization of milk	Experiments	BL3-Apply	2
6	To prepare casein and calculate its yield	Experiments	BL6-Create	2
7	Learning objective To prepare yoghurt from different sources of milk and conduct its sensory evaluation. Learning This project will help students to learn the preparation of yoghurt and also the principle of sensory evaluation	PBL	BL6-Create	2
8	Significance of lactose in industry	Seminar	BL4-Analyze	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	18	40	0

Part E

Books	
Articles	https://www.frontiersin.org/articles/10.3389/fanim.2021.760310/full
References Books	De Sukumar Outlines of Dairy Technology, Oxford University Press, Oxford. 2007. Webb and Johnson, Fundamentals of Dairy Chemistry
MOOC Courses	https://onlinecourses.nptel.ac.in/noc24_ag15/preview
Videos	https://www.youtube.com/watch?v=8MCm0-ncgos&t=4s

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	1	-	1	-	1	-	3	1	1
CO2	1	1	2	1	-	-	1	1	-	1	-	-	3	1	1
CO3	2	1	1	1	-	1	-	-	1	-	1	-	3	1	1
CO4	3	2	1	1	1	-	1	1	-	1	-	-	3	3	3
CO5	3	2	2	2	2	2	1	1	1	-	2	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Sensory Evaluation [T]
Course Code	BSFT-0502 [T]

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Students should have studied food additives and food chemistry			**Co-Requisite/s**	Students should have basic knowledge of characterstics/ attributes of different food products			
Course Outcomes & Bloom's Level	**CO1-** CO1: Illustrate the ability to identify solutions to problems related to the sensory analysis of food and to apply and expand upon the theoretical concepts presented in lectures. **(BL1-Remember)** **CO2-** CO2: Compiles, familiarity and competence with the practical skills and techniques used to analysesthe sensory properties of food. This will include experimental planning, the preparation of suitable samples and the use of instruments e.g., viscometers and color meters, as well as the collection of experimental data and its presentation, statistical analysis and interpretation.**(BL2-Understand)** **CO3-** CO3: State terminology, appropriate to the field of sensory analysis, correctly and contextually.**(BL3-Apply)** **CO4-** CO4: Ability to explain the benefits and limitations of the sensory evaluation of food and be able to recommend, justify and critique commonly used methods of sensory analysis.**(BL4-Analyze)** **CO5-** CO5: To modify foods to meet specified sensory requirements and which are intended to contribute to reducing community health concerns.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG3(Good health and well-being) SDG6(Clean water and sanitation)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to sensory analysis, importance of sensory evaluation in food industries, general testing conditions of sensory evaluation and laboratories.	Lecture method, audio/video clips, group discussion, quiz	8
2	Selection of sensory panelist, factors affecting sensory evaluation, sensory quality parameters- size and shape, texture, flavor, aroma, color& gloss.	Lecture method, audio/video clips, group discussion, quiz	8
3	Methods of evaluation: Subjective evaluation- preference tests, acceptance tests, hedonic scale, discrimination tests, descriptive tests. Objective evaluation-physical methods & chemical methods, threshold, dilution.	Lecture method, audio/video clips, group discussion, quiz	8
4	Effect of sensory analysis on food quality & new product development, risk of consumer satisfaction & consumption.	Audio/Video clips, group discussion, lecture with ppt, quiz	8
5	Nutrional Quality of foods: Food proteins (Digestibility, Boilogical Value, (NPU, PER)	Audio/Video clips, group discussion, lecture with ppt, quiz	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Use nine-point hedonic scale for sensory evaluation	Experiments	BL2-Understand	2
3	Preparation of dilution sample for sensory evaluation	Experiments	BL3-Apply	2
4	Threshold test in different food products	Experiments	BL3-Apply	2
5	Estimation of crude fibre in the food sample	Experiments	BL4-Analyze	2
6	Estimation of color properties in food sample	Experiments	BL4-Analyze	2
7	Determination of textural changes by different unit operations	Experiments	BL4-Analyze	2
8	Extraction of pomace from fruits	Experiments	BL3-Apply	2
9	Extraction of pigments from fruits and vegetables	Experiments	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	0

Part E

Books	Potter, N. N., & Hotchkiss, J. H. (2012, December 6). Food Science. Springer Science & Business Media.
Articles	
References Books	Lal, G., Siddappa, G. S., & Tandon, G. L. (1986, January 1). Preservation of Fruits and Vegetables. Sanjeev, S. R. P. K., & Kumar, S. (2002, November 30). Fruit and Vegetable Preservation.
MOOC Courses	https://nptel.ac.in/courses/126103017
Videos	https://www.youtube.com/watch?v=F8jhoaV-nsE&t=1s

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	-	1	-	1	-	1	-	-	3	1	1
CO2	3	1	1	-	-	1	-	-	-	-	1	-	3	1	1
CO3	3	2	1	1	-	1	1	-	-	-	-	-	3	1	2
CO4	3	1	3	-	-	1	-	1	-	1	-	-	3	1	2
CO5	3	2	3	-	-	1	-	-	-	-	1	-	3	2	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Food product/processing waste management [T]
Course Code	BSFT-0601 [T]

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Student should have studied subjects- processing of cereals and pulses, fruits and vegetables, technology of flesh foods, dairy technology in the previous semesters			**Co-Requisite/s**	Student should have basic knowledge of waste generation and managemnet from different sectors of food industry			
Course Outcomes & Bloom's Level	**CO1-** CO1: Identify various wastes and by-products from food industries and understand their characteristics **(BL1-Remember)** **CO2-** CO2: To describe the various methods of waste treatment and disposal as well as utilization of by-products in food and non-food sectors**(BL2-Understand)** **CO3-** CO3: To analyze the importance of recycling, disposing methods and valorization of food industry waste **(BL3-Apply)** **CO4-** CO4: To apply the legal aspects related to food and packaging waste disposal.**(BL4-Analyze)** **CO5-** CO5: To design and develop a functional ETP or waste utilization approaches to suit requirement of food and environment. **(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG1(No poverty) SDG2(Zero hunger) SDG3(Good health and well-being) SDG6(Clean water and sanitation)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction: Classification and characterization of food industrial wastes from fruit and vegetable processing industry, beverage industry, fish, meat and poultry industry, sugar industry and dairy industry.	Lecture method, Quiz, group discussion	8
2	Waste disposal methods –physical, chemical and biological; Economical aspects of waste treatment and disposal.	lecture method, Quiz	8
3	Treatment methods for liquid wastes from food process industries; Design of activated sludge process, Rotating biological contactors, Trickling filters, UASB, Biogas plant.	Lecture ethod, expert lecture, Quiz	8
4	Treatment methods of solid wastes: Biological composting, drying and incineration; Design of solid waste management system: Landfill digester, Vermicomposting pit.	Audio-video clips, lecture method quiz	8
5	Bio filters and bio clarifiers, Ion exchange treatment of waste water, Drinking-water treatment, Recovery of useful materials from effluents by different methods.	Lecture method, audio-video clips, industrial visit	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Production of Banana fiber from banana pseudo-stem	Experiments	BL3-Apply	2
2	Production of ethyl alcohol from molasses	Experiments	BL4-Analyze	2
3	Extraction of polyphenols from fruit and vegetable peels	Experiments	BL4-Analyze	2
4	Isolation of starch from mango kernels	Experiments	BL4-Analyze	2
5	Extraction of pectin from fruit waste	Experiments	BL4-Analyze	2
6	Extraction of oil from citrus peel	Experiments	BL4-Analyze	2
7	Preparation of candied orange peel	Experiments	BL3-Apply	2
8	Preparation of fiber rich cookies	PBL	BL3-Apply	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	18	40	0

Part E

Books	Wang, L. K., Hung, Y. T., Lo, H. H., & Yapijakis, C. (2005, September 29). Waste Treatment in the Food Processing Industry.
Articles	
References Books	Green, J. H., & Kramer, A. (1979, January 1). Food Processing Waste Management. A V I Publishing Company.
MOOC Courses	https://nptel.ac.in/courses/105105350
Videos	https://www.youtube.com/watch?v=Ee8RqLKgGUg&t=1s

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	-	1	1	2	1	1	1	-	3	1	1
CO2	2	1	1	1	1	-	1	-	1	-	-	-	3	1	2
CO3	3	1	1	-	-	1	-	2	1	1	-	-	3	1	2
CO4	3	2	1	1	1	2	1	-	-	-	2	-	3	2	3
CO5	3	2	1	1	1	2	-	1	-	1	1	-	3	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Food Packaging [T]
Course Code	BSFT-0603 [T]

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	Student must have studied about different food products, and their physiochemical properties			**Co-Requisite/s**	Student should have basic knowledge of food and its types.			
Course Outcomes & Bloom's Level	**CO1-** CO1: comprehend advance knowledge on the properties and production of various packaging materials and effect of various indicators used in supply chain management to indicate the food quality**(BL1-Remember)** **CO2-** CO2: Generalize various types of scavengers and emitters for improving the food shelf life.**(BL2-Understand)** **CO3-** CO3: Demonstrate new packaging systems and safety and legislative requirements**(BL3-Apply)** **CO4-** CO4: Acquaint about food-package interaction between package-flavour, gas storage systems for food storage, recycling and use of green plastics for reducing the pollution and their effect on food quality.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG2(Zero hunger) SDG3(Good health and well-being)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction of food packaging. Different packaging materials- paper, glass, plastics and metal. Cans and canning process.	Lecture method, audio/video clips, group discussion, quiz	8
2	Rotatable plastic packaging. Modified atmospheric packaging- reasons, requirement, application for different food, limitation. Control atmospheric packaging. Vacuum packaging.	Lecture method, audio/video clips, group discussion, quiz	8
3	Packaging of different foods: requirement and application; Red meat, fish, poultry, eggs, milk and milk products, cereal product, bakery and confectionary products, fruits and vegetables: fresh and processed, oils and fats.	Lecture method, audio/video clips, group discussion, quiz	8
4	Edible packaging, Microwavable packaging, Intelligent packaging, Active packaging, Aseptic packaging: principles and requirements.	Audio/Video clips, group discussion, lecture with ppt, quiz	8
5	Testing of packaging material, Designing of Food Packages. Barcode labeling. Informant printing on the package. Packaging laws and regulation.	Audio/Video clips, group discussion, lecture with ppt, quiz	8

M

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Identification of different types of packaging and packaging materials	Experiments	BL3-Apply	2
2	To perform different destructive tests for glass containers	Experiments	BL4-Analyze	2
3	Measurement of thickness of packaging materials	Experiments	BL4-Analyze	2
4	Determination of water-vapour transmission rate	Experiments	BL4-Analyze	2
5	Testing of chemical resistance of packaging materials	Experiments	BL4-Analyze	2
6	To perform sterilization of different packaging materials	Experiments	BL4-Analyze	2
7	To determine leakage of plastic pouches	Experiments	BL4-Analyze	2
8	To determine the basis weight, density and grammage of paper and paper board	Experiments	BL4-Analyze	2
9	To determine the wax content in given sample of wax paper	Experiments	BL4-Analyze	2
10	Visit to relevant industries	Industrial Visit	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	30	40	

Part E

Books	Paine, F. A., & Paine, H. Y. (2012, December 6). A Handbook of Food Packaging. Springer Science & Business Media.
Articles	
References Books	Sacharow, S., & Griffin, R. C. (1980, January 1). Principles of Food Packaging. Avi Publishing Company.
MOOC Courses	https://nptel.ac.in/courses/127106237
Videos	https://www.youtube.com/watch?v=0b3As1QHvk8

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	-	1	-	1	-	1	-	3	1	1
CO2	3	1	1	1	1	-	1	-	-	1	-	-	3	1	1
CO3	3	1	1	-	-	-	2	1	-	2	2	-	3	1	2
CO4	3	2	1	1	1	-	2	-	1	-	-	-	3	1	2
CO5	3	2	1	-	-	1	2	1	2	1	2	-	3	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Product Development and Formulation [T]
Course Code	BSFT-0701 [T]

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	students to pass 10+2 with a minimum aggregate of 50% from the science stream with mandatory subjects like PCMB (Physics, Chemistry, Maths, Biology).			**Co-Requisite/s**	Students should have basic knowledge of food processing and preservation methods. Shelf life study, storage and transportation of food products.			
Course Outcomes & Bloom's Level	**CO1-** To understand the latest consumer demand for novel food products.**(BL2-Understand)** **CO2-** To learn and develop novel technology to develop new products.**(BL2-Understand)** **CO3-** To understand the Cost analysis and feasibility of new product development.**(BL3-Apply)** **CO4-** Thorough knowledge of sensory and shelf-life evaluations foods.**(BL4-Analyze)** **CO5-** Toapply the subject knowledge in future perspectives i.e., such as in research and development in new products**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG2(Zero hunger) SDG3(Good health and well-being) SDG12(Responsible consuption and production)				

Part B

Modules	Contents	Pedagogy	Hours
1	Food needs and consumer preferences, Need for new products, Innovations in product development, need, classification, characterization, Needs and types of foods consumption trends. Factors to be considered new product development – social concerns, health concerns, impact of technology, market influence, market sector perspective and market research. Consumer research and the market. Trends in social change and its role in diet pattern.	Lecture, PPT and discussion	12
2	Phases of food product development- introductory phase, growth phase, maturity phase and decline phase. Developing standard products, Process control parameter, Types of products and logistics. Processing- primary and secondary, various food ingredients used, use of food additives. Standardization and scale up, Safety and regulatory aspects, sanitation and waste disposal.	Quiz, Illustrate with analogiesInteractive videos	10
3	Chemical and physical properties of foods, Shelf-life studies and shelf-life prediction. Planning for the food product to be developed. Drawing up a working plan and time schedule.	Summarizing, Quiz, Tutorials sessions, Expert Lecture	7
4	Packaging - Development of suitable packaging material, management. Design and package graphics. Labelling, and testing. Storage and transportation-Types and mode of transportation, optimization of transport taking into account the type of product, distance, storage facilities.	Lecture methods,Audio/Video clips, group discussion, quiz	9
5	Product costing, Advertising and marketing, Entrepreneurship, plant location, Investment and financing of project	Lecture with ppt, quiz	7

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Preparation of high fibre bread.	Experiments	BL6-Create	2
2	Preparation of high fibre biscuits	Experiments	BL6-Create	2
3	Preparation of high fibre cake	Experiments	BL6-Create	2
4	Preparation of nutritious beverages	Experiments	BL6-Create	2
5	Preparation of functional foods for obese person.	Experiments	BL6-Create	2
6	Preparation of functional foods for aged persons	Experiments	BL6-Create	2
7	Preparation of hypocholesterolmic foods	Experiments	BL6-Create	2
8	Preparation of low sodium foods	Experiments	BL6-Create	2
9	Preparation of foods for underweight persons	Experiments	BL6-Create	2
10	Preparation of fortified atta	PBL	BL6-Create	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	12
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	20

Part E

Books	New food product development: From concept to market place.-Gordon W. Fuller
Articles	https://www.sciencedirect.com/science/article/abs/pii/0924224494900175
References Books	Basic Food Preparation-A complete Manual-Raina et.al. Foods: Facts and Principles-Manay, S. and Shadaksharaswami, M. Breakfast Cereals and How They are Made?-R.B. Fast and E.F.Caldwell
MOOC Courses	https://nptel.ac.in/courses/126105015
Videos	https://www.youtube.com/watch?v=k1a2PSEXahM

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	3	2	2	1	-	1	-	-	1	1	3	1
CO2	3	3	2	3	3	3	-	-	1	-	-	-	2	3	1
CO3	3	2	2	3	3	2	-	-	1	-	-	-	2	3	1
CO4	2	2	3	3	3	3	2	-	1	-	2	3	3	3	3
CO5	2	3	3	2	2	2	2	-	1	-	2	3	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Fermentation technology [T]
Course Code	BSFT-0702 [T]

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Minor							
Pre-Requisite/s	Student must have studied food microbiology and dairy technology in previous semester.			**Co-Requisite/s**	Study of production of various fermented foods.			
Course Outcomes & Bloom's Level	**CO1-** To understand the principles of food fermentations**(BL1-Remember)** **CO2-** To study the production of various fermented foods**(BL2-Understand)** **CO3-** To gain knowledge about different downstream methods**(BL3-Apply)** **CO4-** To apply the subject knowledge in future perspectives i.e. such as in research and development in fermentation technolo**(BL4-Analyze)** **CO5-** To evaluate the real-life knowledge gained and properties and implement the same to create fermented products**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG6(Clean water and sanitation) SDG9(Industry Innovation and Infrastructure)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to Industrial Fermentations: Types of fermentation processes (submerged/ solid state and semi-solid) and Range of products, Fermenter, Fermentation media, carbon and nitrogen sources.	Lecture method, discussion	08
2	Screening, isolation and maintenance of industrially important microorganisms, Microbial growth, metabolism, death, membrane transport, fermentation kinetics and fermentation modelling.	Lecture method, discussion	08
3	Different types of fermenters, scaling up of fermentation, sterilization, agitation; pH, Eh, temperature measurement and control, Up-Stream & downstream processing and product recovery, immobilization in fermentation	Lecture method, Summarizing, Quiz, Tutorials sessions, Expert Lecture	11
4	Food fermentations: Fermented milk foods: Cheese and Butter. Fermented vegetable foods- Sauerkraut, fermented pickles and soya sauce and Tofu. Single cell protein-Production of Baker's yeast and Commercial Production of bread	Audio/Video clips, lecture with ppt, quiz	10
5	Industrial production of microbial cell biomass, organic acids, enzymes, antibiotics, micro-nutrients, amino acids, vitamins, ethanol, SCP and alcoholic beverages	Group discussion, lecture with ppt, quiz	08

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Preparation of Yoghurt	Experiments	BL4-Analyze	2
2	Preparation of whey based fermented beverage	Experiments	BL4-Analyze	2
3	Preparation of pickles	Experiments	BL4-Analyze	2
4	Preparation and maintenance of starter cultures	Experiments	BL4-Analyze	2
5	Preparation of Sauerkraut	Experiments	BL4-Analyze	2
6	Preparation of Bread	Experiments	BL4-Analyze	2
7	Preparation of wine	PBL	BL5-Evaluate	3
8	Preparation of Cheese	PBL	BL5-Evaluate	3
9	Preparation of tofu	Experiments	BL4-Analyze	2
10	Preparation of vinegar	Experiments	BL4-Analyze	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	30	40	

Part E

Books	Industrial Microbiology by A. H. Patel
Articles	https://www.sciencegate.app/document/10.1016/b978-0-12-821292-9.00026-1
References Books	Microbial Biotechnology: Fundamentals of Applied Microbiology - A. N. Glazer and H. Nikaido Principles of Fermentation Technology by PF Stanbury Dr Whitaker
MOOC Courses	https://nptel.ac.in/courses/102105087
Videos	https://youtu.be/m27ouF6xfZg?si=ywlB2EfJDtUFuCek

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	-	1	-	1	-	-	-	2	1	1
CO2	2	2	1	1	1	-	1	-	-	-	-	-	2	2	2
CO3	2	2	2	2	1	1	-	1	-	1	1	-	3	2	3
CO4	3	3	2	2	1	-	1	-	-	-	-	-	3	2	3
CO5	3	3	2	2	1	-	1	-	1	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Research methodology [T]
Course Code	BSFT-0704 [T]

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Interdisciplinary Major							
Pre-Requisite/s	The student must have completed 3 years BSc in Food Technology			**Co-Requisite/s**	Student should have basic knowledge of mean, median mode,sampling methods and probability			
Course Outcomes & Bloom's Level	**CO1-** To understand the basic concepts of Research Methodology, its applications in experimental design and data collect as well as analysis.**(BL1-Remember)** **CO2-** To describe the basic concepts of each and every division of the subject along with its technical writing aspects**(BL2-Understand)** **CO3-** To provide experimental basis, and to enable students to acquire a specialized knowledge and understanding of data and its applications in experimental verification.**(BL3-Apply)** **CO4-** To provide basis of analyzing the applications of Research Methodology in various fields of research and industries.**(BL4-Analyze)** **CO5-** To apply the understanding of statistical tools in evaluation in various samples.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✓ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Research: Definition and types, components and steps; Research Question, Research Problem identification, guidelines for selecting meaningful problem; Research Objective: Definition, broad and specific objectives, Hypothesis: Meaning and sources of research hypothesis Technology transfer: Introduction and procedure.	Lecture methods,Audio/Video clips,group discussion,quiz	05
2	Research Method: Principle, Scientific methods, steps in experimental research, types and problems in experimentation; Importance of survey method, Comparison of survey method with other methods Sampling – steps, size, types, merits and demerits, Data Collection: Sources and types of Data: Ways of data organization and summarization. Standard operating procedure (S.O.P): Introduction and procedure	Lecture methods,Audio/Video-clips	08
3	Data analysis - Estimation of population parameters, mean value, standard error, and variance analysis; Probability Theories; Hypothesis Tests, One Sample Test - Two Sample Tests / Chi-Square Test, t-test, Completely Randomized Design, Randomized Complete Block Design, Latin Square Design.	Lecture methods, Audio/Video-clips,group discussion	08
4	Computer application: Use of MS-Office and Excel, Library documentation and Scientific literature searching, Appropriate Statistical and other relevant packages. Research proposal and thesis writing: Purpose of research proposal, Academic/ Project/ Case study proposals, Steps for the preparing proposal and Common mistakes	Lecture methods,Audio/Video-clips,group discussion,quiz	09
5	Methods selecting relevant literature, Features of thesis, Structure of Thesis, Steps in thesis writing, Citation and Referencing: Different ways of work citation, Publication in Research journals: Introduction and its importance, Arrangement of the article; Difference between general and research article.	Lecture methods,Audio/Video-clips,group discussion,quiz	05

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	Kothari, C. R. (2004, January 1). Research Methodology. New Age International.
Articles	
References Books	Panneerselvam, R. (2014, April 4). RESEARCH METHODOLOGY. PHI Learning Pvt. Ltd. Wilkinson, T. S., & Bhandarkar, P. L. (2003, January 1). Methodology and Techniques of Social Research. Young, P. V. (1956, January 1). Scientific Social Surveys and Research. Englewood Cliffs, N.J. : Prentice-Hall.
MOOC Courses	https://nptel.ac.in/courses/110105091
Videos	https://youtu.be/oXnjR0OtfBI

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	2	-	-	-	-	-	1	3	1	1
CO2	2	2	3	2	1	1	-	-	-	1	-	-	3	1	1
CO3	2	2	2	1	2	2	-	-	-	-	-	-	3	1	1
CO4	1	1	2	2	1	2	-	-	-	-	-	1	3	3	3
CO5	1	3	3	2	3	2	1	-	-	-	1	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Functional Foods and Nutraceuticals [T]
Course Code	BSFT-0801 [T]

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	students to pass 10+2 with a minimum aggregate of 50% from the science stream with mandatory subjects like PCMB (Physics, Chemistry, Maths, Biology).			**Co-Requisite/s**	Students should have basic knowledge of bio-active compounds prsent in various plants and animal products , processing methods.			
Course Outcomes & Bloom's Level	**CO1-** Recognize the importance and link between nutrition and diseases**(BL1-Remember)** **CO2-** Identify major types of health foods and nutraceutical products in the market**(BL2-Understand)** **CO3-** To understand the molecular basis of using micronutrients and phytochemicals in prevention of chronic diseases**(BL2-Understand)** **CO4-** Design and develop foods having health promoting properties**(BL6-Create)** **CO5-** Critically evaluate the safety and efficacy of using health foods and nutraceutical products. **(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✕ Professional Ethics ✓ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG9(Industry Innovation and Infrastructure) SDG12(Responsible consuption and production)				

Part B

Modules	Contents	Pedagogy	Hours
1	Nutraceuticals and Functional Food: An Introduction, Definition; the link between nutrition and medicine; classical nutrients; phytochemicals and other dietary health factors for disease prevention. Applied aspects of the Nutraceutical Science	Lecture methods, ppt	6
2	Nutraceuticals: Types of nutraceutical compounds – Phytochemicals, phytosterols and other bioactive compounds, peptides and proteins, dietary fibers, oligosaccharides and resistant starch, prebiotics, probiotics and synbiotics, Conjugated Linoleic Acid, omega-3 fatty acids, fat replacers; their sources and role in promoting human health	Lecture methods, Quiz, Illustrate with analogies	10
3	Functional Foods: Types of functional foods- Cereal and cereal products, Milk and milk products, egg, oils, meat and products, sea foods, nuts and oilseeds, functional fruits and vegetables, herbs and spices, beverages (tea, wine etc), Fermented foods – their health benefits and role in promoting health.	Lecture methods, PPT, Expert Lecture	11
4	Future prospects:Research development and trends in processing of functional foods. Formulation and fabrication of functional foods. Legal Aspects: Stability of nutraceuticals. Safety, Consumer acceptance and assessment of health claims, labeling, marketing, and regulatory issues related to nutraceuticals and functional foods.	Lecture methods, Audio/Video clips, group discussion, quiz	10
5	Anti-nutritional Factors present in Foods: Types of inhibitors present in various foods and how they can be inactivated. General idea about role of Probiotics and Prebiotics as nutraceuticals. Recent advances in techniques & feeding of substrates. Assessment of nutritional status and Recommended Daily allowances	Lecture methods, Group discussion, quiz	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Estimation of ascorbic acid from lemon & amla juice by titration method	Experiments	BL4-Analyze	2
2	To determine the antioxidant potential of functional foods	Experiments	BL5-Evaluate	2
3	TLC separation of Plant pigments – Curcumin and carotene	Experiments	BL3-Apply	2
4	Estimation of crude fiber/pectic substances from plant material	Experiments	BL4-Analyze	2
5	Estimation of total phenols and chlorogenic acid (Phenolic compound) in plant materials and animal foods	Experiments	BL4-Analyze	2
6	To estimate cholesterol content in given sample by Lievermann-Burchard method	Experiments	BL4-Analyze	2
7	Qualitative test for tannins, phenolics and alkaloids using TLC	Experiments	BL5-Evaluate	2
8	To prepare functional foods from plant foods	PBL	BL6-Create	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	12
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	20

Part E

Books	
Articles	https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=f9c23dd60eea111659bd43b58ff763a70ff78824
References Books	Handbook of Nutraceutical and Functional Foods-Wildman REC Innovations in Healthy and Functional Foods-Ghosh D Handbook of nutraceuticals Volume 2-Pathak YV
MOOC Courses	https://onlinecourses.swayam2.ac.in/ugc19_hs33/preview#:~:text=The%20online%20course%20on%20Functional,implications%20and%20mechanisms%20of%20action.
Videos	https://www.youtube.com/watch?v=R7BonXAiOE4&t=1s

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	3	3	3	2	-	-	-	2	1	3	1	1
CO2	2	3	2	3	3	3	-	-	-	-	-	1	3	1	1
CO3	1	3	1	2	2	1	-	-	-	-	-	2	3	1	1
CO4	1	2	1	3	2	3	3	2	-	-	3	3	3	3	3
CO5	2	1	1	3	3	3	-	3	-	-	-	3	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Legumes and oilseeds Technology [T]
Course Code	BSFT-0803a [T]

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	Students must have studied processing of cereals, pulses and oilseeds in previous semester.			**Co-Requisite/s**	Knowledge of composition, and processing technologies used for legumes and oil seeds			
Course Outcomes & Bloom's Level	**CO1-** To understand and identify the composition, and specific processing technologies used for legumes and oil seeds **(BL1-Remember)** **CO2-** To learn the processing methods for value addition of legumes and oilseeds and their by-products.**(BL2-Understand)** **CO3-** To provide the students a specialized knowledge about application of scientific principles in the processing soybean and peanut **(BL3-Apply)** **CO4-** To apply the subject knowledge in future perspectives i.e. such as applications in food processing using fermentation, extraction, milling, etc.**(BL4-Analyze)** **CO5-** To evaluate the theoretical knowledge in different commercialized legumes and oilseed products and implement the same to create innovative food products.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG12(Responsible consuption and production)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to legumes and pulses and production trends in India and abroad. Morphology, pre and post harvest factors, Processing of legumes: Home scale, Cottage Scale and commercial methods of dehulling. Modern techniques in Dal mills. Processing of Red gram, Bengal gram, Green gram, Black gram. Dal milling – Principle, methods, equipments and effect on quality. Principle products, Dry and Wet milling of pulses, Anti-nutritional compounds and their removal.	Lecture method, discussion	12
2	Cooking quality of dhal – methods, factors affecting quality of dhal and cooking of dhal. Quick cooking dhal, Instant dhal. Fermented Products of legumes. Soaking – Principles, Methods of soaking -Sprouting, Puffing, Roasting and Parboiling of Legumes, Physical and Bio-chemical changes during these processes.	Lecture method, discussion	10
3	Introduction to oilseeds and production trends in India and abroad, Morphology, pre and post harvest factors, types of oilseeds and their nutritional value, Anti-nutritional compounds and their removal; Processing of oil seeds for direct use and consumption, Oil extraction methods-mechanical (Ghani and Expellers) and chemical methods (solvent extraction); factors affecting extraction process; Refining, hydrogenation and interesterification of extracted oil - their principles and process controls	Lecture method, discussion, quiz, Illustrate with analogies	10
4	Utilization of oilseed cake of different food uses, Processing of deoiled cake into protein concentrates and isolates, extraction of bioactive compounds, Texturized vegetable protein, Margarine and Spread, mustard sauce	Lecture method, discussion, quiz, Illustrate with analogies	9
5	Soya and peanut as a source of protein and oil; their processing– soya/peanut milk, soy/peanut protein Isolate, paneer, soya sauce; peanut butter, extrusion based food products from soya and peanut	Audio/Video clips, group discussion, lecture with ppt, quiz	9

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	To determine the physical properties of legumes and oil seeds.	Experiments	BL4-Analyze	2
2	To determine the nutritional quality of selected pulses and oilseeds.	Experiments	BL4-Analyze	2
3	To study the preconditioning of pulses and oilseeds before milling	Experiments	BL4-Analyze	2
4	To study the removal of anti-nutritional compounds from selected pulses and oilseeds	Experiments	BL4-Analyze	2
5	To study the cooking quality of dhal	Experiments	BL5-Evaluate	2
6	To develop a composite legume mix and prepare a value added product.	Experiments	BL5-Evaluate	2
7	To prepare soya milk and groundnut milk	PBL	BL6-Create	3
8	To prepare soya sauce	PBL	BL6-Create	3
9	To prepare value added food products from deoiled cake	PBL	BL6-Create	3
10	To extract oil using solvent extraction method from oilseeds	Experiments	BL5-Evaluate	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	30	40	

Part E

Books	Chakraverty A., Post harvest technology of cereals: pulses and oilseeds
Articles	
References Books	Kay DE, Food Legumes
MOOC Courses	https://nptel.ac.in/courses/103105460
Videos	https://youtu.be/eJBjEjnH4eo?si=vuiZ7dqrs1UU0Mc7

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	1	-	1	1	-	-	1	1	-	3	2	1
CO2	2	2	1	1	1	-	1	1	-	-	-	-	3	2	1
CO3	2	2	1	1	1	1	1	1	-	1	-	-	3	3	2
CO4	3	3	2	1	1	-	1	-	1	-	-	-	3	3	3
CO5	3	3	2	1	-	1	1	1	1	1	1	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Food Chemistry [T]
Course Code	BSFT0103[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Student must have the basic knowledge of Physical ,Inorganic and Organic chemistry			**Co-Requisite/s**	Students should know the chemistry and functions of Biomolecules			
Course Outcomes & Bloom's Level	**CO1-** To remember the basics of modern biochemistry and molecular biophysics, including the principles of biological phenomena, and structural, functional and dynamic aspects of biological components**(BL1-Remember)** **CO2-** To understand the core principles and topics of chemistry, structural and chemical biology including nucleic acid structure and interactions, signaling proteins and membrane proteins, enzyme kinetics and drug discovery and protein design**(BL2-Understand)** **CO3-** To provide the students a specialized knowledge and understanding in the field of food biochemistry**(BL3-Apply)** **CO4-** To apply the subject knowledge in future perspectives i.e. such as in food constituents' interactions and their isolation, utilization and metabolism**(BL4-Analyze)** **CO5-** To evaluate the application of principles of biochemistry in practice to ensure healthy body metabolism.**(BL5-Evaluate)**						
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to Food Chemistry- Definition, Composition of food Water: Definition of water in food. Structure of water and ice, Types of water, Interaction of water with solutes, Sorption phenomenon, Water activity and packaging, Water activity and spoilage	Lecture, ppt, Tutorials sessions	6
2	Lipids: Classification of lipids, Characteristics, Physical properties-melting point, softening point, specific gravity, refractive index, smoke, flash and fire point, turbidity point. Chemical properties-reichert meissel value, polenske value, iodine value, peroxide value, saponification value. Effect of frying on fats, Changes in fats and oils- rancidity, lipolysis, flavor reversion, Auto-oxidation and its prevention, Technology of edible fats and oils- Refining, Hydrogenation and Interesterification.	Quiz, lecture, Interactive videos	10
3	Proteins: Protein classification and structure, Nature of food proteins (plant and animal proteins), Properties of proteins (electrophoresis, sedimentation, amphoterism and Denaturation), Functional properties of proteins eg. Organoleptic, solubility, viscosity, binding gelation / texturization, emulsification, foaming. Enzymes Introduction, classification. General characteristics. Enzymes in food processing. Industrial Uses of Enzymes. Immobilized enzymes.	Summarizing, Quiz, Tutorials sessions, Expert Lecture	10
4	Carbohydrates: Classification (mono, oligo and poly saccharides), Structure of important polysaccharides (starch, glycogen, cellulose, pectin, hemicellulose, gums), Chemical reactions of carbohydrates, Modified celluloses and starches.	Lecture methods,Audio/Video clips, group discussion, quiz	9
5	Vitamins: Structure, Importance and Stability, Water soluble vitamins, Fat soluble vitamins. Minerals: Sources and functions of micro and macro minerals in food. Energy content of foods. Body composition, Physiological fuel value, Measurement of Energy Expenditure: BMR, RMR, RDA, Food groups, Balanced diet, Exchange list.	Lecture methods,Audio/Video clips, group discussion, quiz	10

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	To get familiarize with Food Technology Laboratory glasswares, instruments and general laboratory guidelines	PBL	BL2-Understand	3
2	To prepare and standardize the chemical solutions	Experiments	BL2-Understand	2
3	To determine moisture content in given food sample	Experiments	BL3-Apply	2
4	To determine ash content in given food sample	Experiments	BL3-Apply	2
5	To determine crude fat content in given food sample	Experiments	BL3-Apply	2
6	To determine crude protein content in given food sample	Experiments	BL3-Apply	2
7	To determine crude fibre content in given food sample	Experiments	BL3-Apply	2
8	To determine the titratable acidity and pH in given food sample	Experiments	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	18	40	0

Part E

Books	Osgood, M., Ocorr, K.A. and Lehninger, A.L. (2000a) The absolute, ultimate guide to lehninger's principles of Biochemistry, third edition: Study guide and solutions manual. New York: Worth Publishers.
Articles	https://network.bepress.com/life-sciences/food-science/food-chemistry/
References Books	Harpers Illustrated Biochemistry (2015a). Erscheinungsort nicht ermittelbar: McGraw-Hill Professional. Stryer, L., Tymoczko, J.L. and Berg, J.M. (2002) Biochemistry. New York: W.H. Freeman.
MOOC Courses	https://nptel.ac.in/courses/126105027
Videos	https://www.youtube.com/watch?v=Dm3yP7FF4nI&t=1s

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	1	-	1	1	-	1	-	-	1	1	1
CO2	2	1	1	1	-	1	-	1	1	1	-	-	1	1	1
CO3	2	2	2	1	1	1	1	1	1	1	-	-	1	1	2
CO4	3	2	2	2	1	2	1	1	2	1	-	-	1	2	2
CO5	3	2	2	2	1	1	2	1	1	1	-	-	1	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Extrusion Technology [T]
Course Code	DSE I- BSFT-0504a

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	Knowledge of food processing technologies			**Co-Requisite/s**	Processing of different extruded products and selection of food extrusion equipment.			
Course Outcomes & Bloom's Level	**CO1-** To remember the fundamentals, design considerations, processing of different extruded products and selection of food extrusion equipment.**(BL1-Remember)** **CO2-** To understand the suitability of raw materials, preconditioning, process variables and extruder types for extrusion and its impact on extrusion process, rheological behaviour and product quality**(BL2-Understand)** **CO3-** To analyse the chemical and nutritional changes occurring in extrusion process and packaging requirement of extruded products**(BL3-Apply)** **CO4-** To apply the subject knowledge in future perspectives i.e. such as value added healthy extruded products**(BL4-Analyze)** **CO5-** To apply the subject knowledge in future perspectives i.e. such as value added healthy extruded products**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG3(Good health and well-being) SDG9(Industry Innovation and Infrastructure) SDG12(Responsible consuption and production)				

Part B

Modules	Contents	Pedagogy	Hours
1	Food Extrusion: Definition, introduction to extruders, principles and types, Uses of extruders in the food industry, Pre-conditioning of raw materials used in extrusion process, structural changes during process, Extruder Selection, Design, and Operation for industrial food applications	Lecture method, quiz, seminar	10
2	Single screw extruder: Principle of working, Net Flow, Operations, manufacturing of pasta and vermicelli. Twin screw extruder: Counter rotating and co-rotating twin screw extruder, Process characteristics of the twin screw extruder, Rheological Properties of Materials During the Extrusion Process, Advantages of Twin Screw Extruder.	Lecture method, group discussion,	10
3	Breakfast cereals by extrusion technology: Classification of Breakfast cereals: Raw materials, process and quality testing for Ready to eat breakfast cereals, defects Texturized vegetable protein: Definition, Manufacturing process and quality parameters of TVP, defects	Lecture method,Illustrate with analogies	10
4	Effect of extrusion on food products: Chemical and nutritional changes in food during extrusion, factors affecting extrusion, Packaging materials for extruded product	Audio/videos, Quiz, Illustrate with analogies, expert lecture	06
5	Recent Advances in extrusion technology: Carbon dioxide or Nitrogen assisted extrusion technology, Extrusion in confectionary technology, Non-thermal Extrusion of Protein Products	Audio/videos, Quiz, Illustrate with analogies, expert lecture	09

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Introduction of food extruders components and their functions	Experiments	BL3-Apply	2
2	Determination of starch content in cereal flour	Experiments	BL4-Analyze	2
3	Determination of degree of gelatinization in cereal extrudates	Experiments	BL4-Analyze	2
4	Determination of quality parameters for available commercial extruded snack product	Experiments	BL4-Analyze	2
5	Effect of feed moisture content on extrudate food product characteristic	Experiments	BL4-Analyze	2
6	Effect of extruder screw speed and barrel temperature on extrudate food product characteristics	Experiments	BL4-Analyze	2
7	Effect of fiber rich ingredient on extrudate food product characteristics	Experiments	BL4-Analyze	2
8	Effect of fat addition on extrudate product characteristics	Experiments	BL4-Analyze	2
9	Texture profile analysis of extruded product	Experiments	BL4-Analyze	2
10	Studies on development of weaning food by extrusion technology	PBL	BL4-Analyze	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	30	40	

Part E

Books	N.D. Frame; Technology of Extrusion Cooking
Articles	
References Books	Maskan and Altan; Advances in Food Extrusion Technology
MOOC Courses	https://nptel.ac.in/courses/126105015
Videos	https://youtu.be/k1a2PSEXahM

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	-	1	1	1	-	-	-	3	2	1
CO2	2	2	1	2	-	1	1	1	-	1	-	-	3	2	2
CO3	3	2	1	2	1	1	2	1	-	1	-	-	3	3	3
CO4	3	2	2	2	-	1	2	2	-	1	-	-	3	3	3
CO5	3	2	2	3	1	-	2	2	1	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Processing of fish and Marine Products [T]
Course Code	DSE I- BSFT-0504b

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	Knowledge of livestock product technology			**Co-Requisite/s**	To understand handling of fresh fish and principles of fish preservation and processing			
Course Outcomes & Bloom's Level	**CO1-** To recognize the handling of fresh fish and principles of fish preservation and processing**(BL1-Remember)** **CO2-** To describe the quality control standards, packaging requirements and safety guidelines followed in marine products' processing industry. **(BL2-Understand)** **CO3-** To analyse the chemical and nutritional changes occurring in marine foods processing and utilization of by-products**(BL3-Apply)** **CO4-** To illustrate the subject knowledge in future perspectives i.e. such as skills for the preparation of various fish value added and by-products**(BL4-Analyze)** **CO5-** To appraise the practical knowledge gained and implement the same to create sea foods based novel products for healthier lifestyle.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG6(Clean water and sanitation) SDG9(Industry Innovation and Infrastructure) SDG12(Responsible consuption and production)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction: Fish, crustaceans, molluscs, algae and others: their composition and types; Fish muscle structure, myofibriller protein and their role in elasticity formation, handling, sanitation and post mortem changes; status of marine food products industry in India and world, and MPEDA, Major fisheries industries.	Lecture Method	08
2	Fish and shellfish: - Cleaning, chilling, freezing, canning, drying, curing, use of fish preservatives, exposure to gamma rays, marinating, canning, fermentation, Hurdle technology in fish preservation and processing	Lecture Method, Quiz, Illustrate with analogies	09
3	By-products Fish meal –production methods, packaging and storage. Fish oil – body oil and liver oil: extraction, purification and preservation, Fish protein concentrate, Fish hydrolysate, partially hydrolyzed and deodorized fish meat, functional fish protein concentrate and their incorporation to various products. Introduction to Inland Fish Studies: Importance of inland fisheries, Overview of freshwater ecosystems, Fisheries management and conservation	Lecture Method, Quiz, Illustrate with analogies	10
4	Value added products Diversified fish products: Fish and prawn pickles, fish sauce, fillets, fish ham, etc., Battered and braided products like fish finger, fish cutlet, fish wafer, and fish soup powder etc. and imitation products. Packing and labeling of marine products, their cold storages and export of products	Lecture Method, Quiz, Illustrate with analogies	09
5	Safety HACCP in safe marine products production, Determining the quality assurance of marine products, Microbiological and biological hazards associated with fish and fishery products- marine toxins-shellfish toxins, scombroid toxins, ciguatera toxins and puffer fish toxins; mycotoxins, parasites and viruses	Lecture Method, Quiz, Illustrate with analogies	09

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Estimation of moisture and ash (including acid soluble) content in fish sample	Experiments	BL4-Analyze	2
2	Estimation of crude protein in fish sample	Experiments	BL4-Analyze	2
3	Estimation of fat content and determination of energy value of fish.	Experiments	BL4-Analyze	2
4	Estimation of salt content in canned fish	Experiments	BL4-Analyze	2
5	Estimation of freshness quality indices of fish	Experiments	BL4-Analyze	2
6	Determination of in-vitro digestibility of fish	Experiments	BL4-Analyze	2
7	Preparation of dried and smoked fish	PBL	BL6-Create	2
8	Preparation of fermented fish sauce	PBL	BL6-Create	2
9	Preparation of surimi and surimi based products	PBL	BL6-Create	2
10	Extraction of fish body oil	Experiments	BL5-Evaluate	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	
Articles	
References Books	Gopakumar K.- Text Book of Fish Processing Technology. ICAR Chandran, K.K; Post Harvest Technology of Fish and Fishery Products
MOOC Courses	https://nptel.ac.in/courses/110105139
Videos	https://youtu.be/i5VwdkggtWU?si=cj7YxKM2pdpsbU2R

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	-	1	-	-	1	-	2	2	1
CO2	2	2	2	2	1	1	-	-	1	1	-	-	2	2	1
CO3	2	2	2	2	1	1	1	-	1	-	-	-	3	2	2
CO4	3	3	2	2	2	1	1	-	-	-	-	-	3	3	2
CO5	3	3	3	2	2	1	-	1	-	-	1	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Flavor Technology [T]
Course Code	DSE II- BSFT-0604a

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	Knowledge of food chemistry and food additives			**Co-Requisite/s**	Study of flavour compounds present in different food products			
Course Outcomes & Bloom's Level	**CO1-** To understand the flavour compounds involved in development of flavor**(BL1-Remember)** **CO2-** To learn the applications of the analytical techniques involved in flavor analysis**(BL2-Understand)** **CO3-** To provide the students a specialized knowledge about synthesis and formulation of flavours from natural sources and chemical reactions**(BL3-Apply)** **CO4-** To apply the subject knowledge in future perspectives i.e. such as in food processing and sensorial evaluation of flavors.**(BL4-Analyze)** **CO5-** To evaluate the theoretical knowledge in different commercialized products and implement the same to create processed and value added food products.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕			**SDG (Goals)**	SDG3(Good health and well-being)			

Part B

Modules	Contents	Pedagogy	Hours
1	Flavour: Introduction, Sources of flavours (natural, processed and added), Flavour composites (natural, semi-synthetic and synthetic), chemical compounds responsible for flavor in food	Lecture method, Quiz, Illustrate with analogies	05
2	Chemical compound classes and their flavour responses; flavour development during biogenesis, flavour development during food processing from carbohydrates, proteins and lipids (Maillard reaction and oxidation); use of biotechnology to develop flavours.	Lecture method, Quiz, Illustrate with analogies	08
3	Spices and spice-based products as flavours, Plantation crops as flavours, tea, coffee, cocoa and vanilla. Formulations of flavours, Flavour emulsions, Flavours production in fermented foods, bakery products and fruits and vegetables, Off-flavours in foods.	Lecture method, Expert Lecture	11
4	Microcapsule system and Encapsulation techniques for flavours; Analysis of flavours, GC, E-nose, E-tongue; Instrumental analysis; sample handling and artifacts; data handling, packaging and flavor compounds interactions	Audio/Video clips, group discussion, lecture with ppt, quiz	11
5	Sensory evaluation of flavours, selection of flavourist, Gustation and Olfaction, gustatory receptors, Types of taste and their perception, perception of odour in mouth and nose	Audio/Video clips, group discussion, lecture with ppt, quiz	05

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	To extract the flavor from different spices and condiments	Experiments	BL3-Apply	
2	To perform different sensory evaluation tests to examine the extracted flavors	Experiments	BL4-Analyze	
3	To study the biochemical composition of flavor extract using FTIR.	Experiments	BL4-Analyze	
4	To formulate the flavor and use in value added food product.	Experiments	BL4-Analyze	
5	To encapsulate the flavor compounds using gums or protein concentrates.	Experiments	BL4-Analyze	
6	To study the off-flavours in fruits,vegetables and meats.	Field work	BL4-Analyze	
7	To prepare oleoresins and essential oil from food sources.	PBL	BL6-Create	
8	To determine the antioxidant properties of essential oil and oleoresins.	Experiments	BL5-Evaluate	
9	To visit a commercial perfumery/food flavors production plant.	Industrial Visit	BL3-Apply	

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	

Part E

Books	Burdock GA.,Fenaroli's Handbook of Flavor Ingredients.. CRC Press.
Articles	
References Books	Deibler D & Delwiche J., Handbook of Flavor, Characterization: Sensory Analysis, Chemistry and Physiology by Marcel Dekker Taylor A., Food Flavour Technology by Sheffield Academic Press.
MOOC Courses	https://nptel.ac.in/courses/126105027
Videos	https://youtu.be/Dm3yP7FF4nI?si=r8-_Sr9sCIf8HpkQ

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	1	1	1	1	-	-	1	1	1
CO2	1	2	1	1	2	1	1	1	-	1	1	-	2	2	1
CO3	2	2	2	2	2	1	2	1	1	1	-	-	2	2	1
CO4	2	3	2	2	1	2	1	1	-	1	2	-	3	3	2
CO5	3	3	3	2	1	2	1	1	1	1	2	-	3	3	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Vegetable & dairy fat rich product [T]
Course Code	DSE II- BSFT-0604b

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	Knowledge of fat rich food products			**Co-Requisite/s**	To understrand production, classification, and packaging parameters of fat based food products			
Course Outcomes & Bloom's Level	**CO1-** To remember various fat-rich dairy products in India and abroad**(BL1-Remember)** **CO2-** To study the lipid profile of dairy products **(BL2-Understand)** **CO3-** Understanding the production, classification, and packaging parameters of cream-based products**(BL3-Apply)** **CO4-** Recall the butter making process and understanding the compositional difference among butter, fat spread and margarine **(BL4-Analyze)** **CO5-** To evaluate the quality of fat rich dairy products based on lipid profile**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG2(Zero hunger) SDG3(Good health and well-being) SDG6(Clean water and sanitation) SDG9(Industry Innovation and Infrastructure) SDG12(Responsible consuption and production)				

Part B

Modules	Contents	Pedagogy	Hours
1	Status and types of vegetable and dairy fat rich products in India and abroad: Cream, Butter, Fat spreads, Cream and butter powder, Ghee, Butteroil, Vegetable Oils, Margarine, Shortening, Vegan Butter, Vegetable Cream, Vegetable-based Spreads. Status of lipids in milk- General Composition of Milk Fat, Fatty acid profile of milk fat, Cholesterol, Phospholipids, physico-chemical properties of buffalo and cow milk fat	Lecture method	06
2	Traditional Indian Dairy Products- Khoa and khoa based sweets, Chhana and Chhana based sweets, Dahi/Misti Dahi, Chakka/Maska and Shrikhand, Kheer and Payasam, basundi, Product description methods of manufacture, and packaging processes	Lecture method, Quiz, Illustrate with analogies	10
3	Vegetables fat Products- Vegetable Oils: Olive oil, Canola oil, Sunflower oil, Soybean oil, Corn oil, Coconut oil, Palm oil. Margarine, Shortening, Vegan Butter, Vegetable Cream, Vegetable-based Spreads Product description methods of manufacture, and packaging processes.	Lecture method, Quiz, Illustrate with analogies	08
4	Butter- Composition and Classification of butter, Processing, Packaging, Storage and Distribution. Butter related products- Whipped Butter, Whey Butter, Flavoured Butter, processing, packaging and storage. Fat spreads- Classification, manufacturing process, applications. Margarine- Definition, manufacturing process and uses.	Audio/Video clips, group discussion, Lecture method	08
5	Ghee- Definition, standards and composition, Methods of Preparation, packaging, and storage. Butter oil- Definition, Methods of Preparation, Packaging and Storage Adulteration in fat-rich vegetable & dairy products	Audio/Video clips, group discussion, Lecture method	08

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	To study the working principle of cream separator	Experiments	BL4-Analyze	2
2	Production of table cream	Experiments	BL4-Analyze	2
3	Analysis of cream	Experiments	BL6-Create	2
4	Neutralization of sour cream for butter-making	Experiments	BL5-Evaluate	2
5	Preparation of Khoa	Experiments	BL6-Create	2
6	Preparation of kulfi	PBL	BL6-Create	2
7	Preparation of ghee from cream	PBL	BL6-Create	2
8	Chemical analysis of ghee	Experiments	BL4-Analyze	2
9	Detection of adulteration in dairy products	PBL	BL6-Create	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	30	40	

Part E

Books	Thompkinson, D.K.- Fat Rich Dairy Products
Articles	
References Books	Adriano Gomes Da Cruz, Chaminda Senaka Ranadheera, Filomena Nazzaro, Amir Mortazavian; Dairy Foods: Processing, Quality, and Analytical Techniques
MOOC Courses	https://nptel.ac.in/courses/126105027
Videos	https://youtu.be/Dm3yP7FF4nI?si=WdEESMsiMAV1iGpP

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	-	1	-	1	-	-	-	2	2	2
CO2	2	2	1	2	1	1	-	-	-	1	-	-	2	3	2
CO3	3	2	2	2	1	1	1	1	-	-	1	-	3	3	2
CO4	3	3	2	2	1	-	1	-	-	1	-	-	3	3	3
CO5	3	3	3	2	1	1	1	-	1	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Tools and techniques for food [T]
Course Code	GE-II [T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Generic Elective							
Pre-Requisite/s	Should be acquainted with the basics knowledge of instruments and their uses.			**Co-Requisite/s**	Knowledge of food analysis and food adulteration			
Course Outcomes & Bloom's Level	**CO1-** Demonstrate an understanding of physics and engineering in biosensor, electrodes**(BL1-Remember)** **CO2-** Demonstrate an understanding of the biomedical instrumentation principles in aspects of device design and applications**(BL2-Understand)** **CO3-** Apply these principles in the context of bioinstrumentation interactions with tissues, organs and human body to explain the measurement results and to develop the instrumentation**(BL3-Apply)** **CO4-** Students will demonstrate these abilities and hone the appropriate information gathering, computational and data-handling skills in homework and lab exercises.**(BL4-Analyze)** **CO5-** They will demonstrate their proficiency formally in examinations**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**					

Part B

Modules	Contents	Pedagogy	Hours
1	Microscopy: History, principle, types and applications (Bright field, dark field and fluorescent microscopy). Electron microscope: principle and applications of scanning electron , transmission electron microscope.	Lecture method, audio/video clips, group discussion, quiz	8
2	Centrifugation: Basic principle, types (analytical and ultracentrifugation) and applications.	Lecture method, audio/video clips, group discussion, review analysis	8
3	Chromatography: Principle, working and applications of Paper chromatography, thin layer chromatography, gel filtration chromatography, ion exchange chromatography and affinity chromatography,.	Lecture method, audio/video clips, group discussion, classroom presentation	8
4	Electrophoresis: principles, types and applications of paper, agarose gel & PAGE electrophoresis. Radioactivity: principle of radioactive decay, half life. Radioisotopes: applications in biological sciences, Scintillation counters: basic principle and application.	Audio/Video clips, group discussion, lecture with ppt, quiz	8
5	Spectrum and their Types, wave length range of electromagnetic radiation. Spectroscopy: basic principle and applications of colorimetry and U.V, Visible and Infrared spectroscopy. Microtomy: Basic principle and applications	Audio/Video clips, group discussion, lecture with ppt, quiz	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Estimation of Fat content	Experiments	BL4-Analyze	3
2	Estimation of Crude Fibre	Experiments	BL4-Analyze	3
3	Estimation of Beta-Carotene	Experiments	BL4-Analyze	3
4	Estimation of Water Absorption Index	Experiments	BL4-Analyze	3
5	Estimation of Phenols	Experiments	BL4-Analyze	3
6	To separate plant pigments using TLC	Experiments	BL4-Analyze	3
7	Estimation of Protein by Follin's Lowry method 8. Estimation of Sugars	Experiments	BL4-Analyze	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2008, February 1). Lehninger Principles of Biochemistry. Macmillan.
Articles	
References Books	Work, T. S., & Work, E. (1983, January 1). Laboratory Techniques in Biochemistry and Molecular Biology Williams, B. L., & Wilson, K. (1975, January 1). A Biologist's Guide to Principles and Techniques of Practical Biochemistry.
MOOC Courses	https://nptel.ac.in/courses/126105020
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	-	1	-	1	-	1	-	-	1	1	1
CO2	2	1	1	1	1	-	-	1	-	1	-	-	1	1	1
CO3	2	2	2	2	1	1	1	1	1	1	-	-	2	1	1
CO4	3	2	2	1	1	-	1	-	1	-	1	-	2	1	1
CO5	3	2	2	1	1	1	1	1	1	-	1	-	2	1	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Basics of food biochemistry [T]
Course Code	GE-II [T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Generic Elective							
Pre-Requisite/s	Student must have studied food chemistry in previous semester			**Co-Requisite/s**	knowledge of metabolic pathway of biomolecules present in food			
Course Outcomes & Bloom's Level	**CO1-** To remember the basics of modern biochemistry and molecular biophysics, including the principles of biological phenomena, and structural, functional and dynamic aspects of biological components.**(BL1-Remember)** **CO2-** To understand the core principles and topics of chemistry, structural and chemical biology including nucleic acid structure and interactions, signaling proteins and membrane proteins, enzyme kinetics and drug discovery and protein design**(BL2-Understand)** **CO3-** To provide the students a specialized knowledge and understanding in the field of food biochemistry.**(BL3-Apply)** **CO4-** To apply the subject knowledge in future perspectives i.e. such as in food constituents' interactions and their isolation, utilization and metabolism**(BL4-Analyze)** **CO5-** To evaluate the application of principles of biochemistry in practice to ensure healthy body metabolism.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG2(Zero hunger) SDG3(Good health and well-being)				

Part B

Modules	Contents	Pedagogy	Hours
1	Carbohydrates metabolism: Glycolysis, alcoholic and lactic acid fermentation, gluconeogenesis, TCA cycle, glycogenolysis & glycogen synthesis. Functions of carbohydrates.	Lecture method, group discussion, quiz, seminar	10
2	Lipids- Fatty acids, triacyl glycerols; glycerophospholipids, sphingolipids, sterols. Nucleic acids- Nucleotides, Nitrogenous Bases- Purines and Pyrimidines; nucleotides as regulating molecules, different types of DNA and RNA. Functions of lipids and nucleic acids.	Lecture method, group discussion, quiz, seminar	10
3	Metabolism of amino acids: Assimilation of Ammonia: its incorporation in glutamate, glutamine and alanine as nitrogen carrier, regulation of glutamate dehydrogenase and glutamine synthetase, transamination, nitrogen excretion and urea cycle. Functions of amino acids.	QuiLecture method, Expert Lecture	10
4	Electron-transport chain (ETC) and oxidative phosphorylation: Constituents of ETC & their sequence (Complex I-IV) & location, inhibitors of ETC, chemiosmotic theory, ATP synthase complex- structure and function, dicarboxylic acid shuttle, glycerol phosphate shuttle.	Audio/Video clips, group discussion, lecture with ppt, quiz	10
5	Biochemistry of digestion, role of hormones and enzymes. Basics of function of nerve system. Biochemistry of blood clotting.	Lecture with ppt, quiz	5

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Qualitative examination of carbohydrates in given food samples	Experiments	BL2-Understand	2
2	Quantitative examination of carbohydrates (PSA method) in given food samples	Experiments	BL2-Understand	2
3	To perform amino acids and protein qualitative tests	Experiments	BL3-Apply	2
4	Quantitative determination of proteins by biuret reagent	Experiments	BL3-Apply	2
5	Qualitative and Quantitative tests	Experiments	BL3-Apply	2
6	To extract the lipid content from food samples	Experiments	BL3-Apply	2
7	To determine the in-vitro protein digestibility from legumes	Experiments	BL3-Apply	2
8	To perform the electrophoresis	Experiments	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	18	40	0

Part E

Books	Osgood, M., Ocorr, K.A. and Lehninger, A.L. (2000) The absolute, ultimate guide to lehninger's principles of Biochemistry, third edition: Study guide and solutions manual. New York: Worth Publishers.
Articles	
References Books	Harpers Illustrated Biochemistry (2015). Erscheinungsort nicht ermittelbar: McGraw-Hill Professional. Campbell, M.K. and Farrell, S.O. (2012) Biochemistry. Pacific Grove, CA: Brooks/Cole.
MOOC Courses	https://nptel.ac.in/courses/102106087
Videos	https://youtu.be/82yp3h2IzlQ?si=Z-aPUfssHzemE-EO

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	-	-	1	-	-	3	1	1
CO2	2	1	1	1	1	1	-	-	-	1	-	-	3	1	1
CO3	2	1	1	1	1	1	1	1	1	1	-	-	3	1	2
CO4	3	2	2	2	1	1	-	1	-	1	-	-	3	1	2
CO5	3	2	2	2	1	1	1	1	1	1	-	-	3	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Basics of Computer & Information Technology [T]
Course Code	GE-III

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Generic Elective							
Pre-Requisite/s	Student must have studied computer science in 10+2			**Co-Requisite/s**	Knowledge of MS Word, Powerpoint and Excel			
Course Outcomes & Bloom's Level	**CO1-** The course prepares the student to understand the basic concepts of Computer Applications, its applications and future prospects.**(BL1-Remember)** **CO2-** The subject Computer Applications is designed for under graduate students of biotechnology for understanding of basic concepts of each and every division of the subject along with its applications in other fields.**(BL2-Understand)** **CO3-** The course aims to provide experimental basis, and to enable students to acquire a specialized knowledge and understanding.**(BL3-Apply)** **CO4-** The course aims to provide basis of analyzing the applications of Fundamentals of Biostatistics and Computer Applications in various fields of research and industries.**(BL4-Analyze)** **CO5-** The course aims to provide basis of experimental design, computer applications and use of statistical tools in research and industries.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕			**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG12(Responsible consuption and production)			

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to Computer Systems – Basics of Computer Systems, various Hardware Components – Data Storage and various Memory Units – Central Processing Unit, Introduction to Software and its life cycle.	Quiz	6
2	DOS, MS-Offices and its application, Operating System: types of operating system, application, process and its characteristics. WWW, web browser, Email.	Quiz	6
3	Introduction to Computer Networking- Introduction, Goals, Networking Topologies & Technologies – LAN, WAN, MAN,PAN, Wireless LAN.	Networking	8
4	Introduction to Biostatistics, common terms, notions and Applications, Statistical population and Sampling Methods, Classification and tabulation of Data, Diagrammatic and graphical presentation, Frequency Distribution, Measures of central value, Measures of variability; Standard deviation, standard Error, Range, Mean Deviation, Coefficient of Variation, Analysis of variance	Networking	8
5	Basis tests, Test of significance; t-test, chi-square test. Regression; Basis of regression, regression analysis, Estimation, testing, Prediction, Checking and residual analysis. Multivariate Analysis. Design of Experiments, randomization, replication, local control, complimentary Randomized randomized block design.	Activity based learning can be given to implement application aspect	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Various Components of Computer	Virtual Labs	BL2-Understand	2
2	MS-DOS:Internal & External DOS Commands	Virtual Labs	BL2-Understand	2
3	Windows Operating System	Virtual Labs	BL2-Understand	2
4	MS-WORD	Virtual Labs	BL3-Apply	2
5	MS Excel	Virtual Labs	BL3-Apply	2
6	MS-POWER POINT	Virtual Labs	BL3-Apply	2
7	Web browser & E-Mail	Virtual Labs	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	18	40	0

Part E

Books	T. (2001, April 1). Pc Software For Windows 98 Made Simple.
Articles	
References Books	Sinha, P. K., & Sinha, P. (2004, November 1). Computer Fundamentals. Gupta, S. (2021, January 15). Statistical Methods. Sultan Chand & Sons.
MOOC Courses	https://nptel.ac.in/courses/106105080
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	-	1	-	1	-	1	-	2	1	1
CO2	2	1	1	1	1	-	1	-	-	-	-	-	2	1	1
CO3	2	1	1	2	1	-	1	1	1	-	1	-	2	1	1
CO4	2	1	1	2	1	-	-	-	-	1	-	-	2	1	2
CO5	3	2	2	2	1	1	-	1	-	1	1	-	2	1	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Industrial training
Course Code	IAPC I

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					0	0	4	4
Course Type	Project							
Course Category	Projects and Internship							
Pre-Requisite/s	Deep knowledge of all disciple core subject of Food Technolgy program			**Co-Requisite/s**	Presentation of research project/ internship			
Course Outcomes & Bloom's Level	**CO1-** Understand themselves in relation to their community and develop among themselves since of social and civic and responsibility**(BL1-Remember)** **CO2-** Identify the needs and problem of the community and involve them in problem solving.**(BL2-Understand)** **CO3-** Utilize their knowledge in finding practical solution to individual and community problem**(BL3-Apply)** **CO4-** Develop the confidence require for group living and sharing of responsibilities of acquire leader ship qualities and democratic attitudes. **(BL4-Analyze)** **CO5-** Develop the capacity to meet emergencies and natural disasters and practice national integration and social harmony**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**					

Part B

Modules	Contents	Pedagogy	Hours

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
300	0	300	0	0	0

Part E

Books	
Articles	
References Books	
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	3	2	2
CO2	-	-	-	-	-	-	-	-	-	-	-	-	3	2	3
CO3	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3
CO4	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3
CO5	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Industrial training
Course Code	IAPC II

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					0	0	4	4
Course Type	Project							
Course Category	Projects and Internship							
Pre-Requisite/s	Deep knowledge of all disciple core subject of Food Technolgy program			**Co-Requisite/s**	Presentation of research project/ internship			
Course Outcomes & Bloom's Level	**CO1-** Understand themselves in relation to their community and develop among themselves since of social and civic and responsibility**(BL1-Remember)** **CO2-** Identify the needs and problem of the community and involve them in problem solving.**(BL2-Understand)** **CO3-** Utilize their knowledge in finding practical solution to individual and community problem**(BL3-Apply)** **CO4-** Develop the confidence require for group living and sharing of responsibilities of acquire leader ship qualities and democratic attitudes. **(BL4-Analyze)** **CO5-** Develop the capacity to meet emergencies and natural disasters and practice national integration and social harmony**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**					

Part B

Modules	Contents	Pedagogy	Hours

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
300	0	300	0	0	0

Part E

Books	
Articles	
References Books	
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	-	-	1	-	-	-	-	3	2	2
CO2	1	2	1	1	-	1	-	-	-1	-	-	-	3	2	3
CO3	1	2	1	1	1	-	-	-	-	-	-	-	3	3	3
CO4	2	2	1	1	-	-	1	-	-	-	-	-	3	3	3
CO5	2	2	1	1	1	-	-	1	1	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	IAPC III [P]
Course Code	IAPC III [P]

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					0	0	8	8
Course Type	Project							
Course Category	Projects and Internship							
Pre-Requisite/s	Deep knowledge of all disciple core subject of Food Technolgy program			**Co-Requisite/s**	Presentation of research project/ internship			
Course Outcomes & Bloom's Level	**CO1-** Understand themselves in relation to their community and develop among themselves since of social and civic and responsibility**(BL1-Remember)** **CO2-** Identify the needs and problem of the community and involve them in problem solving.**(BL2-Understand)** **CO3-** Utilize their knowledge in finding practical solution to individual and community problem**(BL3-Apply)** **CO4-** Develop the confidence require for group living and sharing of responsibilities of acquire leader ship qualities and democratic attitudes. **(BL4-Analyze)** **CO5-** Develop the capacity to meet emergencies and natural disasters and practice national integration and social harmony**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**					

Part B

Modules	Contents	Pedagogy	Hours

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
400					

Part E

Books	
Articles	
References Books	
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	-	-	1	-	-	-	-	3	2	2
CO2	1	2	1	1	-	1	-	-	-1	-	-	-	3	2	3
CO3	1	2	1	1	1	-	-	-	-	-	-	-	3	3	3
CO4	2	2	1	1	-	-	1	-	-	-	-	-	3	3	3
CO5	2	2	1	1	1	-	-	1	1	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	IAPC IV [P]
Course Code	IAPC IV [P]

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					0	0	10	10
Course Type	Project							
Course Category	Internships							
Pre-Requisite/s	Deep knowledge of all disciple core subject of Food Technolgy program			**Co-Requisite/s**	Presentation of research project/ internship			
Course Outcomes & Bloom's Level	**CO1-** Understand themselves in relation to their community and develop among themselves since of social and civic and responsibility**(BL1-Remember)** **CO2-** Identify the needs and problem of the community and involve them in problem solving.**(BL2-Understand)** **CO3-** Utilize their knowledge in finding practical solution to individual and community problem**(BL3-Apply)** **CO4-** Develop the confidence require for group living and sharing of responsibilities of acquire leader ship qualities and democratic attitudes. **(BL4-Analyze)** **CO5-** Develop the capacity to meet emergencies and natural disasters and practice national integration and social harmony**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**					

Part B

Modules	Contents	Pedagogy	Hours

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
500					

Part E

Books	
Articles	
References Books	
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	-	-	1	-	-	-	-	3	2	2
CO2	1	2	1	1	-	1	-	-	-1	-	-	-	3	2	3
CO3	1	2	1	1	1	-	-	-	-	-	-	-	3	3	3
CO4	2	2	1	1	-	-	1	-	-	-	-	-	3	3	3
CO5	2	2	1	1	1	-	-	1	1	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	NCC-2
Course Code	NCC-2

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					2	0	2	4
Course Type	Theory only							
Course Category	Generic Elective							
Pre-Requisite/s	Should be acquainted with the basics knowledge of General Awareness about Leadership Quality, Personality Development, Defense system etc			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Develop the qualities of social skills.**()** **CO2-** Imbibe leadership qualities. **()** **CO3-** Be motivated to serve the nation by joining Armed forces. **()** **CO4-** Contribute in environmental awareness and conservation activities**()** **CO5-** Keep abreast of current affairs & general awareness.**()** **CO6-** Effectively contribute in managing disaster relief tasks**()**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG6(Clean water and sanitation) SDG13(Climate action) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours
Unit 1. Personality Development	Group Discussions – Social Skills & Time management.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 2. Leadership Development	Case Studies – Case Studies – Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965 war.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 3. Disaster management	(i) Initiative Trg, Organising Skills. (ii) Dos and Don'ts. (iii) Natural Disasters. (iv) Man Made Disasters. (v) Fire Services and Fire Fighting.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit-4.Environmental Awareness	Adventure Environmental Awareness and Conservation, Local and global approaches to conserve nature.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 5. General Awareness & Armed Forces	General Awareness, Army, Navy, Air Force and Central Armed Police Forces.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	R Gupta ; NCC National Cadet Corps A, B & C Certificate Examination Book; Ramesh Publishing House, 2018.
Articles	https://indiancc.mygov.in/
References Books	Singh, Neeraj; A Hand Book of NCC; Kanti Prakashan Publisher Cadet training hand book specialised subjects (2017)
MOOC Courses	
Videos	https://www.youtube.com/watch?v=eBA5t4iepAA

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	NCC-I
Course Code	NCC-I

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					2	0	2	4
Course Type	Theory only							
Course Category	Generic Elective							
Pre-Requisite/s	Should be acquainted with the basics knowledge of General Awareness about Leadership Quality, Personality Development, Defense system etc			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Develop the qualities of social skills.**()** **CO2-** Imbibe leadership qualities. **()** **CO3-** Be motivated to serve the nation by joining Armed forces. **()** **CO4-** Contribute in environmental awareness and conservation activities**()** **CO5-** Keep abreast of current affairs & general awareness.**()** **CO6-** Effectively contribute in managing disaster relief tasks**()**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG6(Clean water and sanitation) SDG13(Climate action) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours
Unit 1. Personality Development	Group Discussions – Social Skills & Time management.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 2. Leadership Development	Case Studies – Case Studies – Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965 war.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 3. Disaster management	(i) Initiative Trg, Organising Skills. (ii) Dos and Don'ts. (iii) Natural Disasters. (iv) Man Made Disasters. (v) Fire Services and Fire Fighting.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit-4.Environmental Awareness	Adventure Environmental Awareness and Conservation, Local and global approaches to conserve nature.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 5. General Awareness & Armed Forces	General Awareness, Army, Navy, Air Force and Central Armed Police Forces.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	R Gupta ; NCC National Cadet Corps A, B & C Certificate Examination Book; Ramesh Publishing House, 2018.
Articles	https://indiancc.mygov.in/
References Books	Singh, Neeraj; A Hand Book of NCC; Kanti Prakashan Publisher Cadet training hand book specialised subjects (2017)
MOOC Courses	
Videos	https://www.youtube.com/watch?v=eBA5t4iepAA

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Biostatistics & Computer applications [T]
Course Code	SEC III [T]

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					1	0	1	2
Course Type	Embedded theory and lab							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	Student must have studied computer science in 10+2			**Co-Requisite/s**	Knowledge of MS Word, Powerpoint and Excel			
Course Outcomes & Bloom's Level	**CO1-** The course prepares the student to understand the basic concepts of Computer Applications, its applications and future prospects.**(BL1-Remember)** **CO2-** The subject Computer Applications is designed for under graduate students of biotechnology for understanding of basic concepts of each and every division of the subject along with its applications in other fields.**(BL2-Understand)** **CO3-** The course aims to provide experimental basis, and to enable students to acquire a specialized knowledge and understanding.**(BL3-Apply)** **CO4-** The course aims to provide basis of analyzing the applications of Fundamentals of Biostatistics and Computer Applications in various fields of research and industries.**(BL4-Analyze)** **CO5-** The course aims to provide basis of experimental design, computer applications and use of statistical tools in research and industries.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**					

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to Computer Systems – Basics of Computer Systems, various Hardware Components – Data Storage and various Memory Units – Central Processing Unit, Introduction to Software and its life cycle.	Quiz	6
2	DOS, MS-Offices and its application, Operating System: types of operating system, application, process and its characteristics. WWW, web browser, E- mail.	Quiz	6
3	DOS, MS-Offices and its application, Operating System: types of operating, Topologies & Technologies – LAN, WAN, MAN,PAN, Wireless LAN.	Networking	8
4	Introduction to Biostatistics ,common terms ,notions and Applications, Statistical population and Sampling Methods,Classification and tabulation of Data, Diagrammatic and graphical presentation,Frequency Distribution, Measures of central value,Measures of variability; Standard deviation, standard Error, Range, Mean Deviation, Coefficient Variation, Analysis of variance.	Networking	8
5	Basic tests, tests of significance, t-test, chi-square test, Regression , Basis of regression, regression analysis, Estimation, testing, Prediction, Checking residual analysis. Multivariate Analysis. Design of Experiments, randomization, replication, local control, complementary randomized, randomized block design.	Activity based learning can be given to implement application aspect	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Various Components of Computer	Virtual Labs	BL2-Understand	2
2	MS-DOS:Internal & External DOS Commands	Virtual Labs	BL2-Understand	2
3	Windows Operating System	Virtual Labs	BL2-Understand	2
4	MS-WORD	Virtual Labs	BL3-Apply	2
5	MS Excel	Virtual Labs	BL3-Apply	2
6	MS-POWER POINT	Virtual Labs	BL3-Apply	2
7	Web browser & E-Mail	Virtual Labs	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	0

Part E

Books	T. (2001, April 1). Pc Software For Windows 98 Made Simple.
Articles	
References Books	Sinha, P. K., & Sinha, P. (2004, November 1). Computer Fundamentals. Gupta, S. (2021, January 15). Statistical Methods. Sultan Chand & Sons.
MOOC Courses	https://nptel.ac.in/courses/106105080
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	-	1	-	1	-	1	-	2	1	1
CO2	2	1	1	1	1	-	1	-	-	-	-	-	2	1	1
CO3	2	1	1	2	1	-	1	1	1	-	1	-	2	1	1
CO4	2	1	1	2	1	-	-	-	-	1	-	-	2	1	2
CO5	3	2	2	2	1	1	-	1	-	1	1	-	2	1	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Cooperation Marketing & Finance
Course Code	SEC V

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Specialization Elective Courses							
Pre-Requisite/s	Student Should acquainted with the basic knowledge of entrepreneurship and supply chain			**Co-Requisite/s**	Student Should acquainted with the basic knowledge of business and startups			
Course Outcomes & Bloom's Level	**CO1-** CO1: Communicate with required clarity ensuring that the information communicated is clear and accurate**(BL1-Remember)** **CO2-** CO2: Comprehend and apply basic computer working, basic operating system and uses internet services to get accustomed & take benefit of IT developments in the industry.**(BL2-Understand)** **CO3-** CO3: To demonstrate knowledge of entrepreneurship and identify establishment for supporting the development of businesses/entrepreneurship.**(BL3-Apply)** **CO4-** CO4: To illustrate procedures to achieve a safe working environment in line with occupational health, safety, environment regulations.**(BL4-Analyze)** **CO5-** CO5: Comply time management technique in day-to-day work**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Concept of Entrepreneurship Definition of Entrepreneurship given by various economists the ideal definition –The conceptual model of Entrepreneurship given by John Kao. Views given by Schumpeter Walker & Drucker on Entrepreneurship - Entrepreneur and Manager -Enterprise and Entrepreneur. Managing Creativity Issues to be addressed in working the definition of creativity –Definition -Attributes of a creative person - Creative Thinking and Motivation - Managing Creativity - Organizational Actions that enhance and hinder Creativity -Organizational priorities and Creativity -Managerial responsibilities in a creative organization	Lecture method, audio/Video clips, group discussion, quiz	8
2	Definition of Small Business - Composition of Small Business- Economic Contribution of Small Business. Strategic Planning for Small Business -Steps in Strategic Planning - Develop a clear Mission Statement -Assess Organization Strengths - Conduct a thorough Market Segment Analysis -Analyze Competitors - Create Company Goals - Formulate Strategic Options and Select appropriate Strategies (Focus, Cost leadership & Differentiation) - Translate Strategic Plans into Action Plans-Establish accurate Controls. Why Strategic Planning fails in Small Business. Forms of Ownership: Sole Proprietorship, Partnership& Corporation form of Organization -Advantages and Disadvantages, Franchising- What is Franchising - Advantages and Disadvantages to Franchising - Franchise Evaluation Checklist –Franchise contracts - Types of Franchise arrangements.	lecture method, audio/video clips, group discussion, quiz	8
3	Introduction: Project - definition, features, types, infrastructure creation-a special type of projects, significance of infrastructure in economic development, bottlenecks in the infrastructure creation, Project Identification: Idea generation, Project screening, Feasibility study. The advantages and disadvantages of starting your business –The advantages and disadvantages of buying all existing business – Critical areas to be examined while buying all existing business - Determining the value of a business – Financial Record Keeping – Profit Planning & Cost Control, Project costing: Breakdown structure of the project, cost estimation of the project, factor affecting the cost of the project, Costing with alternative configurations/specifications. Project Appraisal: technical appraisal, marketing appraisal, legal and environment appraisal, financial appraisal- cost estimation of the project and evaluating project using pay back and NPV, Detailed project report – introduction, Introduction to SCBA.	Audio/Video clips, group discussion, lecture with ppt, quiz	8
4	Arrangement of funds: Traditional sources of financing – Equity shares, preference shares, Debentures/bonds, loan from financial institutionsLoan syndication and consortium finance; Alternative sources of financing- Foreign Issue, FDI & FII, ECB, Private equity, Securitization, BOT projects, PPP, Venture capital / Incubation fund, Franchising etc;	Audio/Video clips, group discussion, lecture with ppt, quiz	8
5	Role played by various Financial Institutions like IDBI, ICICI and IFCI: Special Role played by SIDBI and Commercial Banks – Approval of term loan applications by Commercial Banks – How to decide about a suitable agency for assistance Role played by SFCR and NSIC; Project Implementation: Project contracts – Principles, practical aspects of contacts, legal aspects of project management, global tender, Negotiation for projects, Project insurance, Human resource management, network analysis	Audio/Video clips, group discussion, lecture with ppt, quiz	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	Scarborough, N. M., Wilson, D. L., & Zimmerer, T. (2009, January 1). Effective Small Business Management.
Articles	
References Books	Desai, V. (2001, January 1). Dynamics of Entrepreneurial Development and Management.
MOOC Courses	https://nptel.ac.in/courses/110106141
Videos	https://www.youtube.com/watch?v=N3-FZn_iQFU&t=3s

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	2	-	1	1	-	1	-	3	1	1
CO2	3	1	1	-	1	2	1	1	-	1	-	-	3	1	2
CO3	3	1	1	2	-	1	-	1	-	1	2	-	3	1	2
CO4	3	2	1	-	-	-	1	2	1	-	-	-	3	1	3
CO5	3	2	2	2	1	1	1	2	1	2	2	-	3	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Introduction to CAD and CAM
Course Code	SEC VI

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	Studied computer application in previous semester			**Co-Requisite/s**	To study computer graphics and its tools in a generic framework			
Course Outcomes & Bloom's Level	**CO1-** To understand fundamental concepts of computer graphics and its tools in a generic framework.**(BL1-Remember)** **CO2-** To impart the parametric fundamentals to create and manipulate geometric models using curves, surfaces and solids.**(BL2-Understand)** **CO3-** To impart the parametric fundamentals to create and manipulate geometric models using NURBS and solids**(BL3-Apply)** **CO4-** To provide clear understanding of CAD systems for 3D modeling and viewing.**(BL4-Analyze)** **CO5-** To create strong skills of assembly modeling and prepare the student to be an effective user of a standards in CAD system.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Boothroyd, G, “Assembly Automation and Product Design” Marcel Dekker, New York, 1997
Articles	
References Books	Chitale A.K and Gupta R.C “ Product design and manufacturing “ PHI learning private limited, 6th Edition, 2015. David Rogers, James Alan Adams “Mathematical Elements for Computer Graphics” 2 nd Edition, Tata McGraw-Hill edition.2003
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	-	1	-	-	1	1	-	-	1	1	1
CO2	1	1	1	-	1	-	-	-	-	1	1	-	2	1	1
CO3	1	1	1	1	-	1	1	-	1	1	-	-	2	1	2
CO4	2	1	1	-	1	-	-	-	-	1	-	-	2	2	2
CO5	2	2	1	1	-	1	-	-	-	1	1	-	2	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Introduction to Good Laboratory practices [T]
Course Code	SEC VI [T]

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	Knowledge of food laboratory euipments and testing protocols			**Co-Requisite/s**	To study guidelines on good laboratory practices and SOPs and calibration procedure of different instruments.			
Course Outcomes & Bloom's Level	**CO1-** to learn the regulations and various guidelines on good laboratory practices and SOPs and calibration procedure of different instruments.**(BL1-Remember)** **CO2-** to gain the knowledge of the various hazards and safety procedures to be followed in laboratory. **(BL2-Understand)** **CO3-** To provide the students a specialized knowledge about implementation of laboratory standard practices, their records and analyze laboratory data with accuracy.**(BL3-Apply)** **CO4-** To apply the subject knowledge in minimization of errors related with handling of laboratory accessories and equipment's**(BL4-Analyze)** **CO5-** To evaluate the theoretical knowledge of good laboratory practices and its implementation in food industry laboratories to ensure the quality and safety of the foods**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG2(Zero hunger) SDG3(Good health and well-being) SDG6(Clean water and sanitation) SDG12(Responsible consuption and production)				

Part B

Modules	Contents	Pedagogy	Hours
1	Concept and evolution and scopes of Quality Control and Quality Assurance; Good laboratory practices (GLP) -Introduction, history, definition, principles and WHO guidelines on GLP. Levels of Laboratories,	Lecture method, group discussion, seminar	06
2	General Rules/Protocols for Lab Safety measures, Precaution and Safety in handling of chemicals, laboratory tools, glasswares, food ingredients/raw materials, and instruments; Biosafety in laboratory - Laboratory associated infections and other hazards, assessment of biological Hazards and levels of biosafety, fire prevention methods	Lecture method, group discussion, seminar, Quiz, Illustrate with analogies	07
3	Food laboratory sanitation, Control of rats, rodents, birds, insects and microbes. Cleaning and Disinfection: Physical and Microbiological Approach, cleaning of glasswares and utensils, Basic SOPs for instrument handling and maintenance and raw material/ingredients storage	Quiz, Illustrate with analogies	07
4	Internal and External Audit, Log Book Maintenance, Keeping data records, its analysis by using statistical and mathematical tools. Result analysis and its interpretation; Arrangement of chemicals, reagents, glasswares, etc in laboratory.	Audio/Video clips, group discussion, lecture with ppt, Review Analysis	05
5	Calibration of common food technology instruments: pH meter, spectrophotometer, water bath, moisture analyzer, hot air oven, pipettes, scales and balances, centrifuge, etc.; Quality management in industry and laboratory, Laboratory Design & Layout of food technology laboratory	Audio/Video clips, group discussion, lecture with ppt, Review Analysis	05

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	World health organization (WHO); Handbook Good Laboratory Practices
Articles	
References Books	Indian council of medical research, New Delhi; Guidelines for good laboratory practices B.W.Wenclawiak, M.Koch E. Hadjicostas; Quality Assurance in Analytical Chemistry.
MOOC Courses	https://nptel.ac.in/courses/126105020
Videos	https://youtu.be/h5NpTku5BGc?si=U-GL_p3nLe4_7pZM

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	1	-	1	1	1	-	1	1	1
CO2	2	2	1	1	1	1	1	1	-	1	-	-	2	1	1
CO3	2	2	1	2	1	2	-	-	1	1	-	-	2	1	2
CO4	2	3	2	2	1	2	1	1	-	1	1	-	3	2	2
CO5	3	3	2	2	1	2	-	1	1	1	1	-	3	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Mathematical aptitude and Reasoning [T]
Course Code	SEC- II

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	Basic Knowledge of mathematical operations.			**Co-Requisite/s**	Basic knowledge of logics, diagrams and interpenetration of data.			
Course Outcomes & Bloom's Level	**CO1-** CO1: To read between the lines and understand various language structures and understand the basic mathematics tools **(BL1-Remember)** **CO2-** CO2: To demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions **(BL2-Understand)** **CO3-** CO3: To provide experimental basis and increase students' aptitude using mathematics to analyze real-life situations **(BL3-Apply)** **CO4-** CO4: To develop and evaluate abstract, logical and critical thinking. **(BL4-Analyze)** **CO5-** CO5: To apply the understanding of mathematical aptitude and reasoning to reflect critically upon their work and the work of others**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG2(Zero hunger) SDG3(Good health and well-being) SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
Unit 1	Problems on Trains, Height and Distance, Calendar, Average, Numbers, Problems on H.C.F and L.C.M, Simplification.	Audio/Video clips, group discussion, lecture with PPTs, quiz	4
Unit 2	Surds and Indices, Chain Rule, Boats and Streams, Odd Man Out and Series, Time and Distance, Time and Work, Problems on Ages.	Audio/Video clips, group discussion, lecture with PPTs, quiz	4
Unit 3	Permutation and Combination, Problems on Numbers, Decimal Fraction, Square Root and Cube Root, Ratio and Proportion. Data Interpretation: Table Charts, Pie Charts, Bar Charts, Line Charts.	Audio/Video clips, group discussion, lecture with PPTs, classroom presentations, Analysis	4
Unit 4	Verbal Reasoning: Logical Sequence of Words, Syllogism, Cause and Effect, Venn Diagrams, Analogy, Character Puzzles, Classification, Arithmetic Reasoning, Blood Relation Test, Series Completion, Dice, Cube and Cuboids, Seating Arrangement, Direction Sense Test, Data Sufficiency, Verification of Truth	Audio/Video clips, group discussion, lecture with PPTs, Quiz	4
Unit 5	Puzzles: Sudoku, Number puzzles, Missing letters puzzles, Logical puzzles, Clock puzzles.	Audio/Video clips, group discussion, lecture with PPTs, Quiz	4

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	1. Dr. R. S. Aggarwal, Quantitative Aptitude, S. Chand Publication. 2. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, McGraw Hill Publications.
Articles	
References Books	Experts, D. (2018). Crack IAS Prelims General Studies Paper 2 with 5 Mock Tests 7th Edition. Disha Publications. http://books.google.ie/books
MOOC Courses	https://nptel.ac.in/courses/111106162
Videos	https://youtu.be/IdKQ8p0fvmA?si=XvQsNFDcmpfuzMTs

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	2	-	1	-	-	-	-	1	-	-
CO2	3	3	1	3	3	2	-	-	-	-	-	-	1	-	-
CO3	3	2	-	1	3	-	-	-	-	-	-	-	1	-	-
CO4	3	2	-	2	-	-	-	-	-	-	-	-	1	1	1
CO5	2	2	-	1	-	-	-	-	-	-	-	-	1	1	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Basic Soft Skills
Course Code	SEC-I

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	Communication skills, Body language and Etiquette, Group discussion skills, Interview skills, Presentation skills, and Emotional Intelligence, Time Management Skills, Preparation of CV and Life skills			**Co-Requisite/s**	Communication skills, Body language and Etiquette, Group discussion skills, Interview skills, Presentation skills, and Emotional Intelligence, Time Management Skills, Preparation of CV and Life skills			
Course Outcomes & Bloom's Level	**CO1-** Aims to increase learner's computer knowledge and unique soft skills so as to develop attributes that enhance an individual's interactions, earning power and job performance. **(BL2-Understand)** **CO2-** The objective of the course is to inculcate potential skills in the learners to prepare them to deal with the external world in a collaborative manner, communicate effectively, take initiative, solve problems, and demonstrate a positive work ethic so as to hold a good impression and positive impact.**(BL3-Apply)** **CO3-** is able to train learners' thinking, to improve their perseverance and patience. is able to enrich learners by fostering the building of self-esteem and self-confidence.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**					

Part B

Modules	Contents	Pedagogy	Hours

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Soft Skills And Personality Development- The Institute of Chartered Accountants of India (Set up by an Act of Parliament) Southern India Regional Council Chennai
Articles	
References Books	
MOOC Courses	https://nptel.ac.in/courses/109104107
Videos	https://youtu.be/y-IPi4KMArQ?si=BWWXa95KQ6dC0dwE

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	-	1	1	-	-	-	2	1	1
CO2	1	2	1	2	2	1	1	-	-	1	1	-	3	1	2
CO3	2	2	3	2	3	-	-	1	-	1	-	-	3	1	2
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Bionstrumentation [T]
Course Code	SEC-I [T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	Should be acquainted with the basics knowledge of instruments and their uses.			**Co-Requisite/s**	Knowledge of food analysis and food adulteration			
Course Outcomes & Bloom's Level	**CO1-** Demonstrate an understanding of physics and engineering in biosensor, electrodes**(BL1-Remember)** **CO2-** Demonstrate an understanding of the biomedical instrumentation principles in aspects of device design and applications**(BL2-Understand)** **CO3-** Apply these principles in the context of bioinstrumentation interactions with tissues, organs and human body to explain the measurement results and to develop the instrumentation**(BL3-Apply)** **CO4-** Students will demonstrate these abilities and hone the appropriate information gathering, computational and data-handling skills in homework and lab exercises.**(BL4-Analyze)** **CO5-** They will demonstrate their proficiency formally in examinations**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**					

Part B

Modules	Contents	Pedagogy	Hours
1	Microscopy: History, principle, types and applications (Bright field, dark field and fluorescent microscopy). Electron microscope: principle and applications of scanning electron , transmission electron microscope.	Audio/Video clips, group discussion, lecture with ppt, quiz	8
2	Centrifugation: Basic principle, types (analytical and ultracentrifugation) and applications.	Audio/Video clips, group discussion, lecture with ppt, Review Analysis	8
3	Chromatography: Principle, working and applications of Paper chromatography, thin layer chromatography, gel filtration chromatography, ion exchange chromatography and affinity chromatography,.	Audio/Video clips, group discussion, lecture with ppt, classroom presentation	8
4	Electrophoresis: principles, types and applications of paper, agarose gel & PAGE electrophoresis. Radioactivity: principle of radioactive decay, half life. Radioisotopes: applications in biological sciences, Scintillation counters: basic principle and application.	Audio/Video clips, group discussion, lecture with ppt, quiz	8
5	Spectrum and their Types, wave length range of electromagnetic radiation. Spectroscopy: basic principle and applications of colorimetry and U.V, Visible and Infrared spectroscopy. Microtomy: Basic principle and applications	Audio/Video clips, group discussion, lecture with ppt, quiz	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2008, February 1). Lehninger Principles of Biochemistry. Macmillan.
Articles	
References Books	Work, T. S., & Work, E. (1983, January 1). Laboratory Techniques in Biochemistry and Molecular Biology Williams, B. L., & Wilson, K. (1975, January 1). A Biologist's Guide to Principles and Techniques of Practical Biochemistry.
MOOC Courses	https://nptel.ac.in/courses/126105020
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	-	1	-	1	-	1	-	-	1	1	1
CO2	2	1	1	1	1	-	-	1	-	1	-	-	1	1	1
CO3	2	2	2	2	1	1	1	1	1	1	-	-	2	1	1
CO4	3	2	2	1	1	-	1	-	1	-	1	-	2	1	1
CO5	3	2	2	1	1	1	1	1	1	-	1	-	2	1	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	One-week Hands on training of Food Processing [T]
Course Code	SEC-III [T]

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					1	0	1	2
Course Type	Embedded theory and lab							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	Knowledge of food analysis and instrumentation			**Co-Requisite/s**	Hands on experience of developing value-added food products.			
Course Outcomes & Bloom's Level	**CO1-** To learn the useful processing of different segments of food and their nutritive value and their value addition.**(BL1-Remember)** **CO2-** To understand the effect of various processing techniques on quality of products. **(BL2-Understand)** **CO3-** To demonstrate the hands on experience of developing value-added food products.**(BL3-Apply)** **CO4-** To illustrate procedures to identify opportunities in research, innovation and protection of their work**(BL4-Analyze)** **CO5-** To apply the knowledge of food processing prospects to build startups in country.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG9(Industry Innovation and Infrastructure) SDG12(Responsible consuption and production)				

Part B

Modules	Contents	Pedagogy	Hours
1	Processing of cereals, pulses and oilseeds: Milling and preparation of dalia, pasta, macroni, noodles, popped products, beer, etc., oil extraction from oilseeds, and oilseed cake	Lecture method, laboratory practiacls	6
2	Processing of bakery and confectionery: Preparation of bread, biscuit, cookies, rusks, muffins, pastry, patties, toffees, and candies	Lecture method, laboratory practiacls, workshop	6
3	Processing of milk: Preparation of flavoured milk, paneer, curd, butter, ghee, whey, ice-cream, khoa, and gulab jamun.	Hans on training	6
4	Processing of fruits and vegetables: Preparation of juice, squash, syrup, jam, jelly, marmalade, pickle, sauces, and wine	Hans on training	6
5	Processing of meat, fish and poultry: Meat emulsion, sausages, meat balls, coagulated egg products, poached egg, fish paste and sauce	Hans on training	6

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Milling and preparation of dalia, pasta, macroni, noodles, popped products, beer, etc., oil extraction from oilseeds, and oilseed cake	Experiments	BL6-Create	3
2	Preparation of bread, biscuit, cookies, rusks, muffins, pastry, patties, toffees, and candies	Experiments	BL6-Create	3
3	Preparation of flavoured milk, paneer, curd, butter, ghee, whey, ice-cream, khoa, and gulab jamun.	PBL	BL6-Create	3
4	Preparation of juice, squash, syrup, jam, jelly, marmalade, pickle, sauces, and wine	PBL	BL6-Create	3
5	Meat emulsion, sausages, meat balls, coagulated egg products, poached egg, fish paste and sauce	PBL	BL5-Evaluate	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	30	40	

Part E

Books	S. Ranganna; Handbook of analysis and quality control for fruit and vegetable products
Articles	
References Books	Chakraverty,A; Post Harvest Technology Of Cereals, Pulses And Oilseeds. Oxford & IBH Publishing & Co. Pvt. Ltd., New Delhi.
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	-	1	1	2	-	-	1	1	2
CO2	2	2	2	1	2	-	1	-	-	-	2	-	2	2	2
CO3	3	2	3	2	2	-	-	1	1	1	-	-	3	3	3
CO4	3	3	3	2	1	1	2	-	-	-	-	2	3	3	3
CO5	3	3	3	2	1	-	`1	-	1	1	-	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Introduction to food analysis [P]
Course Code	SEC-IV [P]

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					0	0	2	2
Course Type	Lab only							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	Knowledge of proximate and chemical analysis of food products			**Co-Requisite/s**	knowledge of instruments used in food analysis			
Course Outcomes & Bloom's Level	**CO1-** To understand the working principle and instrumentation of various instruments used in food analysis.**(BL1-Remember)** **CO2-** The students will know the importance of various methods to identify any malfunction aspect of food.**(BL2-Understand)** **CO3-** To provide students an experimental basis and a specialized knowledge and understanding in the analysis of food.**(BL3-Apply)** **CO4-** To apply the subject knowledge in future perspectives i.e. such as in research and development in food products**(BL4-Analyze)** **CO5-** To evaluate the real life knowledge gained and properties and implement the same to create new food products.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG2(Zero hunger) SDG3(Good health and well-being) SDG6(Clean water and sanitation)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction – Sampling methods – Sample preparation and preservation- Extraction methods and Separation process of food components;– Official Methods of Food Analysis.	Lecture method	
2	Nature and Concept of Food analysis, Basic instrumentation: Principle for pH meter, filtration, Reverse osmosis. Centrifugation: Principle, Theory (RCF, Sedimentation coefficient) and types of Rotors, Ultracentrifugation,.	Quiz, Illustrate with analogies,, Interactive videos, disussion	
3	Chromatography: Theory & Principle, chromatographic parameter (partition coefficient, capacity factor, retention & dead time, Resolution& their calculation), components of chromatography & types.	Quiz, Tutorials sessions, Expert Lecture	
4	Advance chromatography: GC, HPLC, (principle, instrumentation &application). Separation technique & analysis: Electrophoresis.	Quiz, Tutorials sessions, Expert Lecture	
5	Introduction to quality attributes of food Appearance, flavour, textural factors; Gustation importance, taste perception, Taste measurement-Electronic Tongue; Olfaction definition and importance of odour and flavour, Odour measurement technique- e- nose; Perception of colour & Colour Measurement.	Audio/Video clips, group discussion, lecture with ppt, quiz	

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Determination of moisture content from a given food sample by lab oven method	Experiments	BL3-Apply	2
2	Determination of total ash content in the given food sample.	Experiments	BL4-Analyze	2
3	Determination of acid insoluble ash from a given food sample.	Experiments	BL4-Analyze	2
4	Determination of crude fat in a given food sample.	Experiments	BL4-Analyze	2
5	Determination of amount of crude fiber in a given food sample.	Experiments	BL4-Analyze	2
6	Determination of Titratable Acidity in Foods using a Potentiometric Titration	Experiments	BL4-Analyze	2
7	Determination of pH in a given food sample	Experiments	BL4-Analyze	2
8	Determination of extent of liking in a given food sample by hedonic scale rating.	Experiments	BL4-Analyze	2
9	To perform Thin Layer Chromatography (TLC) of Food Colours	Experiments	BL4-Analyze	2
10	High Performance Liquid Chromatography (HPLC) of Sugars	Experiments	BL4-Analyze	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Yeshajahn Pomeranz et.al, Food Analysis, Theory and Practice
Articles	
References Books	Joslyn, M.A., Methods in Food Analysis
MOOC Courses	https://nptel.ac.in/courses/126105015
Videos	https://youtu.be/k1a2PSEXahM?si=funi1jTWOchWfrnR

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	2	1	1	1	1	1	-	1	-	1	2	1
CO2	1	2	2	3	1	1	1	1	-	1	-	-	1	2	2
CO3	2	2	3	3	1	2	2	2	1	-	1	-	2	3	3
CO4	2	2	3	3	2	2	2	1	1	-	-	-	2	3	3
CO5	2	2	3	3	2	2	1	1	-	1	1	-	2	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Technical writing [P]
Course Code	SEC-IV [P]

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					0	0	2	2
Course Type	Lab only							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	Knowledge of English communication			**Co-Requisite/s**	this course will teach processes for analyzing writing contexts and producing effective, clean, and reader-centered documents in an efficient manner.			
Course Outcomes & Bloom's Level	**CO1-** Demonstrate rhetorical knowledge to create effective technical writing documents for endusers.**(BL1-Remember)** **CO2-** Apply and adapt flexible writing process strategies to produce clear, high-quality deliverables in a multitude of technical writing genres**(BL2-Understand)** **CO3-** Use professional technical writing conventions of clean and clear design, style, and layout of written materials**(BL3-Apply)** **CO4-** Gather and apply researched information that is appropriate to your field, as demonstrated by reading and analyzing documents, and citing sources correctly**(BL4-Analyze)** **CO5-** Write clearly, correctly, and concisely**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕	**SDG (Goals)**						

Part B

Modules	Contents	Pedagogy	Hours

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Internal Communication: Writing Memos and Emails	Seminar	BL3-Apply	2
2	External Communication: Formal Letters	Seminar	BL3-Apply	2
3	Using Visuals to Convey Information	Experiments	BL3-Apply	2
4	Process Documentation	Experiments	BL3-Apply	2
5	Writing Proposals	Simulation	BL4-Analyze	2
6	Communicating on the Internet	PBL	BL6-Create	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Technical Writing Process by Kieran Morgan
Articles	
References Books	The Insider's Guide to Technical Writing by Krista Van Laan Managing Your Documentation Projects by JoAnn T. Hackos
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	-	-	2	-	1	-	1	-	1	1	1
CO2	1	2	2	1	1	-	1	-	-	-	-	-	1	1	1
CO3	1	2	2	1	-	-	-	1	1	1	-	-	2	2	1
CO4	2	2	2	1	1	1	-	-	-	-	1	-	2	2	1
CO5	2	2	1	-	-	-	1	-	1	-	-	-	2	1	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Disaster Management
Course Code	VAC III (T)

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					2	1	0	3
Course Type	Theory only							
Course Category	Foundation core							
Pre-Requisite/s	To be familiar with the basics of natural disasters as well as anthropogenic factors and various approaches for disaster managements.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To learn types of disasters and its profile in India**(BL1-Remember)** **CO2-** To understand the causes and impacts of disasters on environment and related case studies of Global and National disasters.**(BL2-Understand)** **CO3-** To learn about risk reduction approaches of disasters with safety issues in mitigating industrial disasters.**(BL3-Apply)** **CO4-** To understand the concept of Disaster Management Cycle and its Risk Reduction Measures**(BL4-Analyze)** **CO5-** To apply the National Acts and policies for mitigating disasters, Role of Army, Police, Community, Corporate, Media etc. for post Disaster Management.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG1(No poverty) SDG3(Good health and well-being) SDG4(Quality education) SDG6(Clean water and sanitation) SDG7(Affordable and clean energy) SDG8(Decent work and economic growth) SDG10(Reduced inequalities) SDG11(Sustainable cities and economies) SDG13(Climate action) SDG15(Life on land) SDG17(Partnerships for the goals)				

Part B

Modules	Contents	Pedagogy	Hours
1	Concepts and definitions (Disaster, Hazard, Vulnerability, Resilience, Risks, Capacity buildings) Factors of disasters, Global trends in disaster: urban disasters, pandemics, complex emergencies, Climate change	Audio/Video clips, group discussion, lecture with ppt, quiz	8
2	Classification of disaster: geophysical, hydrological, climatological, meteorological, biological and technological or man-made hazards. Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc. Differential impacts- in terms of caste, class, gender, age, location, disability.	Audio/Video clips, group discussion, lecture with ppt, Review Analysis	8
3	Disaster management cycle – Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA).	Audio/Video clips, group discussion, lecture with ppt, classroom presentations	8
4	Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc. Climate Change Adaptation. Relevance of indigenous knowledge, appropriate technology and local resources	Audio/Video clips, group discussion, lecture with ppt, quiz	8
5	Disaster Management Indian scenario, India's vulnerability profile, Disaster Management Act 2005 and Policy guidelines, Environmental Legislation for Disaster Risk Management in India. Role of information technology in protecting environment and health. Role of NGOs Cases Studies: Bhopal Gas Disaster, Gujarat Earth Quake, Orissa Super-cyclone, South India Tsunami, Bihar floods, Plague Surat, COVID-19 pandemic	Audio/Video clips, group discussion, lecture with ppt, Case Based Assignments, Quiz, Application Based Activity	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	• Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423 • Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361] • Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011 • Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010. • Kapur, Anu & others, 2005: Disasters in India Studies of grim reality, Rawat Publishers, Jaipur
Articles	
References Books	• Coppola P Damon, 2007. Introduction to International Disaster Management, Carter, Nick 1991. Disaster Management: A Disaster Manager's Handbook. • Cuny, F. 1983. Development and Disasters, Oxford University Press. Document on World Summit on Sustainable Development 2002. • Govt. of India: Disaster Management Act 2005, Government of India, New Delhi. Government of India, 2009. National Disaster Management Policy. • Disaster Management Guidelines. GOI-UNDP Disaster Risk Reduction Programme (2009-2012. • Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003 • National Institute of Disaster Management • National Disaster Management Authority • http://nidm.gov.in, http://cwc.gov.in , http://ekdrm.net , http://www.emdat.be , http://www.nws.noaa.gov , http://pubs.usgs.gov , http://nidm.gov.ini http://www.imd.gov.ini
MOOC Courses	https://nptel.ac.in/courses/130106113
Videos	https://youtu.be/tPm85HpraQg?si=7-MaACyah6FWLUXn

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	-	1	2	-	-	-	-	1	-	-
CO2	1	2	-	-	-	-	1	2	-	-	-	-	1	-	-
CO3	1	2	-	-	-	-	1	2	-	-	-	-	-	-	-
CO4	1	2	-	-	-	-	1	2	-	-	-	-	-	2	-
CO5	1	2	-	-	-	-	1	2	-	-	-	-	-	-	3
CO6	1	2	-	-	-	-	1	2	-	-	-	-	-	-	3

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	English
Course Code	AEC I [T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Foundation core							
Pre-Requisite/s	Student should know the interpersonal skills and be an effective goal-oriented team player.			**Co-Requisite/s**	Communicative skills, workshop, Leadership development etc.			
Course Outcomes & Bloom's Level	**CO1-** Determine interpersonal skills and be an effective goal-oriented team player.**(BL1-Remember)** **CO2-** Elaborate creativity and lateral thinking.**(BL2-Understand)** **CO3-** to evaluate themselves by giving oral presentations and will receive feedback on their performances.**(BL3-Apply)** **CO4-** Paraphrase text(s) and use appropriate referencing styles**(BL4-Analyze)** **CO5-** Design and present/publish technical documents**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education) SDG5(Gender equality)				

Part B

Modules	Contents	Pedagogy	Hours
Module 1	Introduction to Communication Definition, Process, Principles and Types • Forms & Grapevine Barriers & Noise	Classroom Lecture, Story telling, role play, group discussions	4
Module 2	Language Know-how Common Errors Learning through examples Functional Grammar & Contemporary usage	Classroom Lecture, Story telling, role play, group discussions	6
Module 3	Paragraph Development Techniques Principles & Methods Instruments for Cohesive Writing Creating Mind Maps/Infographic	Classroom Lecture, Story telling, role play, group discussions	8
Module 4	Writing skills Introduction to writing skills. Tone, Orientation, Attitude, Formal vs Informal, general writing, technical writing Letter/ Application/e-mail, Format, and content Indian isms in Email Writing Writing for the Web: Do's & Don'ts of Email Writing, Netiquette	Classroom Lecture, Story telling, role play, group discussions	6
Module 5	Resume Writing - Concept, types, and Application Curriculum Vitae: difference between Resume and CV Interview Skills Group Discussion and Debate	Classroom Lecture, Story telling, role play, group discussions	6

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	Prasad, V., "Advanced Communication Skills", Atma Ram Publications, New Delhi
Articles	https://www.jetir.org/papers/JETIR2108373.pdf https://open.lib.umn.edu/communication/chapter/1-2-the-communication-process/ https://www.iosrjournals.org/iosr-jbm/papers/Vol22-issue8/Series-2/E2208024254.pdf
References Books	Madhukar, R., K, "Business Communication", Vikas Publishing House Pvt. Ltd.
MOOC Courses	https://nptel.ac.in/courses/109103020
Videos	https://nptel.ac.in/courses/109103020

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	2	-	-	-	2	-	-	1	-	1
CO2	2	2	1	2	2	2	-	-	-	2	-	-	1	-	3
CO3	2	1	1	-	1	-	-	-	-	2	-	-	3	2	3
CO4	3	2	-	2	1	-	-	-	-	2	-	-	2	3	3
CO5	3	2	-	2	1	-	-	-	-	2	-	-	2	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Bioinformatics
Course Code	BSBT 501 (T)

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Should be familiar with the basics of bioinformatics, its databases and search tools, types of sequence alignment, homology modeling and evolutionary prediction of sequences.			**Co-Requisite/s**	The subject bioinformatics is designed to under graduate students of biotechnology for understanding of basic concepts of computational tools, their designing, applications, and their uses in industry and research.			
Course Outcomes & Bloom's Level	**CO1-** The course prepares the student to understand the basic concepts of Bioinformatics, its applications and future prospects.**(BL1-Remember)** **CO2-** The course aims to provide experimental basis, and to enable students to acquire a specialized knowledge and understanding**(BL2-Understand)** **CO3-** The course aims to provide basis of analyzing the applications of Bioinformatics in various fields of research and industries.**(BL3-Apply)** **CO4-** To evaluate the analytical efficiency of each algorithm**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
Unit-I	Overview of Bioinformatics, divisions, scope, tasks and future prospects of bioinformatics, bioinformatics as multidisciplinary domain,	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
Unit-2	Databases and search tools: Types of Databases and their applications, National Centre for Biotechnology Information (NCBI), European Bioinformatics Institute (EBI), DNA Databank of Japan (DDBJ), PDB and SWISSPROT.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
Unit-3	Sequence alignment: Types of sequence alignment, Pairwise sequence alignment and its softwares, BLAST , Types and versions of BLAST, FASTA: Types and versions of FASTA	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
Unit-4	Matrices and algorithms: Dot matrix, BLOSUM, PAM, BLAST algorithm, Needlemann Wunsch algorithm, Smith Watermann algorithm, Fitch Margoliash algorithm.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
Unit-5	Multiple sequence alignment methods and its softwares, Phylogenetic prediction , Maximum parsimony method, Distance method, Maximum likelihood method	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Retrieval of DNA/ sequences from NCBI.	Experiments	BL2-Understand	2
2	cessing protein sequence from NCBIAc	Experiments	BL3-Apply	3
3.	Pairwise alignment and analysis of protein sequences using BLASTp software	Experiments	BL3-Apply	2
4.	Pairwise alignment and analysis of protein sequences using FASTA software	Experiments	BL3-Apply	2
5.	Alignment of protein sequences using dot matrix	Experiments	BL3-Apply	2
6.	Multiple sequence alignment and analysis of protein sequences using CLUSTALW software	Experiments	BL4-Analyze	5
7	Phylogenetic prediction of given set of sequences	Experiments	BL2-Understand	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	Introduction to bioinformatics by Cynthia Gibas
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1122955/
References Books	Developing bioinformatics Skills: Hoomann H Rashidi
MOOC Courses	https://nptel.ac.in/courses/102106065 https://nptel.ac.in/courses/102106065
Videos	https://nptel.ac.in/courses/102106065 https://nptel.ac.in/courses/102106065

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	-	-	-	1	1	-	-	1	2	-
CO2	1	2	-	-	-	-	-	-	1	2	-	-	1	2	-
CO3	1	2	-	-	-	-	-	-	1	2	-	-	2	1	-
CO4	1	2	-	-	-	-	3	-	1	2	-	-	1	2	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Cellular Metabolism
Course Code	BSBT 502 (T)

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Disciplinary Major							
Pre-Requisite/s	Knowledge about basics of biomolecules			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To impart knowledge on structural, functional and dynamic aspects of biological components. **(BL1-Remember)** **CO2-** To comprehend the understanding of the metabolic pathways involving the four major metabolic compounds:**(BL2-Understand)** **CO3-** To estimate the relation of biological material to living matter and elaborate the structure and functions of different biomolecules.**(BL3-Apply)** **CO4-** To analyze the various biomolecules in biological samples**(BL4-Analyze)** **CO5-** To evaluate the applications of biomolecules in various fields **(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Basic Concepts of Intermediary metabolism, Carbohydrate metabolism: Glycolysis, Kreb's Cycle, glycogenolysis, glycogenesis, pentose phosphate pathway, gluconeogenesis, glyoxolate pathway, Cori cycle. Metabolic disorders	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	7
2	Biosynthesis and degradation of fatty acids, Biosynthesis of lipids, Degradation of lipids, Regulation of lipid metabolism. Formation of ketone bodies Ketosis. Metabolic disorders	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	7
3	Transamination, Oxidative deamination, decarboxylation, Biosynthesis of amino acids, Degradation of amino acids, Regulation of amino acids metabolism. Nitrogen Metabolism - Assimilation of inorganic Nitrogen sources; Urea cycle	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	7
4	Biosynthesis and degradation of purine nucleotides, Biosynthesis and Degradation of Pyrimidine nucleotide, regulation of purine and pyrimidine metabolism.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lectures	10
5	Photosynthetic microorganisms, photosynthetic pigments, and generation of reducing power by cyclic and non-cyclic photophosphorylation, Electron transport chain in photosynthetic bacteria. Carbon dioxide fixation pathways. Respiration : Components of electron transport chain, free energy changes and electron transport, oxidative phosphorylation, ATP synthase and theories of ATP formation.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Estimation of Blood Glucose by Coupled Enzyme Assay	Experiments	BL4-Analyze	3
II	Sugar Fermentation by Microorganisms	PBL	BL3-Apply	3 DAYS
III	Demonstration of Starch Digestion by Salivary Amylase	Simulation	BL2-Understand	3
IV	Isolation and Fractionation of Egg Lipids by TLC and their Estimation	PBL	BL5-Evaluate	6

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	David L. Nelson, Michael M. Cox, W. H. Freeman;Lehninger Principles of Biochemistry, Fifth Edition, , 2008, th Edition
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7545035/
References Books	G.Zubay Biochemistry 3 rd Edition Stryer Biochemistry 9 th Edition DVoet and JG. Voet , J Wiley and Sons. Biochemistry 5 th Edition David Plummer Practical Biochemistry Volume 3 Company.S;Philadelphia, Stipanuk.PA. (4th edition) (2019) Biochemical, physiological, and molecular aspects of human nutrition. Second Edition, Murray, R., Mayes, P., Rodwell, V., Granner, D (2006) Harper's illustrated biochemistry. 26th edition, McGraw-Hill Companies, Columbus, OH.
MOOC Courses	https://nptel.ac.in/courses/104105139
Videos	https://nptel.ac.in/courses/104105139

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	2	-	-	-	2	-	-	1	-	1
CO2	2	3	2	2	2	1	-	-	-	2	-	-	1	-	3
CO3	3	1	1	2	1	-	-	-	-	-	-	-	3	2	3
CO4	3	2	1	1	1	-	-	-	-	2	-	-	2	3	2
CO5	2	1	1	2	1	-	-	-	-	2	-	-	2	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Genomics & Proteomics
Course Code	BSBT 503 (T)

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Should be acquainted with basic knowledge of genes, genomes and proteins.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To understand the fundamentals of genes, chromosomes and DNA along with their organization in the cell.**(BL1-Remember)** **CO2-** To utilize the knowledge about major genome databases, Genome analysis, Comparative genomics & Functional genomics for the preparation of genomic libraries.**(BL2-Understand)** **CO3-** To analyze the various genes isolated from different samples for their specific characteristics using various techniques.**(BL3-Apply)** **CO4-** To amplify and detect the various genes in different samples for research and development.**(BL4-Analyze)** **CO5-** To develop a genome database or purify the protein in order to develop a specific product at the commercial level**(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕	**SDG (Goals)**	SDG4(Quality education)					

Part B

Modules	Contents	Pedagogy	Hours
I	Genome evolution and structure: Forward genetics and Reverse genetics. Genomics history, Types of genomes. Chromosomal models, Chromosome structure and organization of genome. Genome sequencing methods, Tools of genomics.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
II	Comparative Genomics: Orthologous and Paralogous genes, Speciation: Types and advantages, Genomic and c-DNA libraries, Selection and screening of gene library	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
III	Microarrays tools and analysis: Process and Application of Microarrays, DNA and RNA microarray and its differences, PCR and its variants, Real Time PCR: Probes and application, Genome annotation	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	10
IV	Genomics techniques and applications: Genetic and physical mapping: Introduction to molecular markers- Single nucleotide polymorphisms, RFLP, RAPD, AFLP, FISH for genome analysis, Human Genome Project, Pharmacogenomics: An introduction. DNA barcoding for rapid assessment of genetic diversity	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
V	Fundamentals of Proteomics: Proteomics Basics and 2D Gel Electrophoresis, Protein Identification and Analysis: Protein preparation and Separation, HRT, HART, MALDI-TOF: Instrumentation and applications	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	To understand the genome organization	Internships	BL2-Understand	2
XI	Molecualr characterization of a plant using RAPD Markers	Experiments	BL4-Analyze	1 month
VI	To isolate plasmid DNA using alkaline lysis method and Quick method and its visualization by agarose gel electrophoresis	Experiments	BL5-Evaluate	5
VII	To perform restriction digestion using kit and its visualization using agarose gel electrophoresis	Experiments	BL3-Apply	5
VIII	To perform Native -PAGE.	Experiments	BL3-Apply	6
IX	To perform SDS-PAGE	PBL	BL3-Apply	6
X	Comparitive analysis of genomes of various plants and preparation of phylogentic tree	PBL	BL4-Analyze	2 months

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Gupta.P.K. :Biotechnology and Genomics ;3rd Edition Mir.R.A. Shafi.S.M and Zargar.S.M.Principles of Genomics and Proteomics;.Elsevier;2023
Articles	https://www.frontiersin.org/articles/10.3389/fmed.2021.747333/full https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2952408/ https://www.tandfonline.com/doi/full/10.1080/13102818.2017.1400401
References Books	Twyman.R.M.;Principles of Proteomics;2nd Edition Ahmed;N;Microbial Genomics And Proteomics; 2016
MOOC Courses	https://nptel.ac.in/courses/102101072
Videos	https://nptel.ac.in/courses/102101072

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	1	2	2	2	-	-	-	-	-	-	2	-	1
CO2	3	1	1	2	2	2	-	-	-	-	-	-	1	1	2
CO3	2	1	1	2	1	-	2	-	-	-	-	-	3	2	1
CO4	3	1	2	1	1	-	1	-	-	-	-	-	1	3	2
CO5	1	-	-	-	1	-	1	-	-	-	-	-	2	2	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Animal Diversity
Course Code	BSBT GE I [T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Electives							
Pre-Requisite/s	Based on Animal Diversity classication taxonomy so create basic knowladge of animal identification and classification.			**Co-Requisite/s**	Create basic platform to all other animal based subject/course.			
Course Outcomes & Bloom's Level	**CO1-** To describe general taxonomic rules on animal classification**(BL1-Remember)** **CO2-** To understand the taxonomy of invertebrates and vertebrates animals, their affinities and their association with evolution and phylogeny.**(BL1-Remember)** **CO3-** To understand the importance of kingdom Animalia and its applications**(BL3-Apply)** **CO4-** To provide experimental basis, and to enable students to basic concept of classification and animal identification**(BL4-Analyze)** **CO5-** To evaluate the applications of taxonomy in various fields such as research and development.**(BL5-Evaluate)** **CO6-** To apply the understanding of animal diversity in identification of animals and their phylogeny in organic evolution**(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours
1	Principle and Concepts of Taxonomy. Characteristics & classification of non-chordates phylums up to sub-classes according to Parker and Haswell. Chordata: Classification of Phylum up to order according to Parker and Haswell	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Phylum –Protozoa, porifera, and Coelentarata Type study of paramecium and plasmodium Protozoa and human diseases type study of Sycon and type study of Obelia.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Phylum platyhelminthes and Nemetahelminthes Annelida- Type study of Taenia, Ascaris and Nereis Phylum Arthropoda: Type study of Prawn Economic importance of insects social insects & their life cycle.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	Phylum Mollusca and Echinodermata Type study of Pila External Features of star fish different larva of Echinodermata	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Hemichordate- External features and affinities of Balanoglossous. Urochordata- Type study of Herdmania (excluding Development). Cephalochordate- Type study of Amphioxus. Affinities of Amphioxus.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Identification of & taxonomy of animals	Field work	BL2-Understand	8
VII	To collect the local vertebrate fauna and study them.: This project will help in understanding the vertebrates and their varieties	PBL	BL4-Analyze	8
3	Identification of Helminthes and annelids	Experiments	BL4-Analyze	4
4	Identification of Molluscan and arthropods	Experiments	BL4-Analyze	4
5	Identification of echonoderms and vertebrates	Experiments	BL5-Evaluate	8
VI	To collect the local Invertebrate fauna and study them.: This project will help in understanding the invertebrates and their varieties.	PBL	BL4-Analyze	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	0

Part E

Books	Text Book of Zoology by: S. Chand
Articles	https://www.nature.com/articles/ncomms12718
References Books	Unified Zoology by: V.K. Tiwari Invertebrate and Vertebrate zoology by: Veerbala Rastogi
MOOC Courses	https://nptel.ac.in/courses/102104042
Videos	https://nptel.ac.in/courses/102104042

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	1	2	2	-	-	-	-	-	-	-	1	2	3
CO2	2	3	1	2	2	-	-	-	-	-	-	-	2	2	3
CO3	1	2	2	1	1	-	-	-	-	-	-	-	2	1	3
CO4	1	2	2	3	1	-	-	-	-	-	-	-	1	1	2
CO5	1	2	3	1	3	-	-	-	-	-	-	-	1	1	2
CO6	1	2	-	-	2	-	-	-	-	-	-	-	-	2	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Organic Chemistry
Course Code	BSBT GE III (T)

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Minor							
Pre-Requisite/s	Students should know the basic principles of chemistry			**Co-Requisite/s**	Students must know the basic chemical reactions of organic compounds			
Course Outcomes & Bloom's Level	**CO1-** To remember the Stereochemistry and reaction mechanism of organic compounds**(BL1-Remember)** **CO2-** To understand the basic principles of Chemistry**(BL2-Understand)** **CO3-** To apply the basic chemical test on natural organic compounds**(BL3-Apply)** **CO4-** To analyze the presence of functional groups in an organic compounds**(BL4-Analyze)** **CO5-** To evaluate the applications of organic reactions mechanisms in preparation of various industrial products like pharmaceutical agents, Paints , Synthetic dyes etc**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
Unit -I	Effects and Stereochemistry: Electronic effects (resonance, inductive, hyperconjugation) and steric effects and its applications (acid/base property); optical isomerism in compounds with and without any stereocenters (allenes, biphenyls); conformation of acyclic systems (substituted ethane/n-propane/n-butane) and cyclic systems (mono- and di-substituted cyclohexanes).	lecture method, collaborative learning, Field visits, ABL	8
Unit -II	Chemistry of Intermediate and Synthetic Applications-I: Chemistry of reactive intermediates (carbocations, carbanions, free radicals, carbenes, nitrenes, benzynes etc ...); Hofmann-Curtius-Lossen rearrangement, Wolff rearrangement, Simmons-Smith reaction, Reimer-Tiemann reaction, Michael reaction, Darzens reaction, Wittig reaction and McMurry reaction	lecture method, collaborative learning, Field visits, ABL	8
Unit -III	Chemistry of Intermediate and Synthetic Applications-II: Pinacol-pinacolone, Favorskii, benzilic acid rearrangement, dienone-phenol rearrangement, Baeyer-Villiger reaction; oxidation and reduction reactions in organic chemistry; organometallic reagents in organic synthesis (Grignard, organolithium and organocopper); Diels-Alder, electrocyclic and Sigmatropic reactions; functional group inter-conversions and structural problems using chemical reactions	lecture method, collaborative learning, Field visits, ABL	8
Unit -IV	Natural Products Chemistry: Chemistry of alkaloids, steroids, terpenes, carbohydrates, amino acids, peptides and nucleic acids.	lecture method, collaborative learning, Field visits, ABL	8
Unit -V	a)Aromatic and Heterocyclic Chemistry: Monocyclic, bicyclic and tricyclic aromatic hydrocarbons, and monocyclic compounds with one hetero atom: synthesis, reactivity and properties. b) Applications of Artificial Intelligence in Organic Chemistry Introduction of AI, AI in Organic Industry, Knowledge-based Expert System in an organic chemistry Industry, Fuzzy Logic Technique in Industry, ANN Technique in the FoIndustry, Machine Learning Techniques	lecture method, collaborative learning, Field visits, ABL	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
Unit - I	To check the presence of Carbohydrates in various organic products	Experiments	BL3-Apply	2
Unit -II	To check the presence of Proteins in various food products	PBL	BL3-Apply	2
Unit -III	To check the presence of Lipids/Fats in various food products	Experiments	BL3-Apply	2
Unit -IV	To separate Casein protein from milk sample	PBL	BL4-Analyze	4
Unit -V	To separate Nicotine from dry tea leaves	PBL	BL4-Analyze	4

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Reaction mechanism in organic Chemistry;O.P. Agarwal
Articles	Laboratory Techniques in Organic Chemistry ;A.I.Vogel
References Books	Advanced Organic Chemistry; Jerry March
MOOC Courses	https://nptel.ac.in/courses/104103111
Videos	https://nptel.ac.in/courses/104101115

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	3	3	-	-	-	-	-	-	-	1	2	2
CO2	2	2	1	3	2	-	-	-	-	-	-	-	1	1	1
CO3	1	2	3	2	2	-	-	-	-	-	-	-	1	2	2
CO4	2	2	2	3	3	-	-	-	-	-	-	-	1	2	3
CO5	2	1	3	3	2	-	-	-	-	-	-	-	1	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Immunology
Course Code	BSMB 202(T)

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	This course will introduce to the applied aspects of immunology in disease detection and diagnosis			**Co-Requisite/s**	The students should be well versed with different types of immune responses which show different types of changes.			
Course Outcomes & Bloom's Level	**CO1-** To remember the structure of various Immunological Barriers of the body**(BL1-Remember)** **CO2-** To understand the Different cells & proteins involved in Immune system**(BL2-Understand)** **CO3-** To understand the connection of immune system failure & disorders.**(BL2-Understand)** **CO4-** To apply the use of Proteins & receptors in antibody formation**(BL3-Apply)** **CO5-** To evaluate the applications of Antigens & Antibodies in Diagnostic & Medical Research**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to the immune system, Cells and organs of the immune system, Hematopoietic development and mediators of the process. Sign and symptoms and mechanism involved in inflammatory response.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Innate and Adaptive immune responses: Anatomical and Physiological barriers of the innate immunity. Receptors of Innate Immune system. Connection between innate and adaptive immune response and its mechanism.Antigens& Immunogens and its properties, Epitopes and CDRS	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Structure, classification and functions of Antibody, Antigen-antibody reactions :Precipitation and agglutination reactions, Organization and expression of Immunoglobulin genes, Monoclonal antibodies: production and application	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	Major histocompatibility complex (MHC), Types of MHC and Display of antigenic peptide, Role of MHC in antigen processing and presentation. Complement system: component, activation pathway , Complement deficiency diseases	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Hypersensitivity: Allergens and its types, types of hypersensitivity and There mechanism, Introduction to Autoimmune disorders(Central and peripheral Tolerance). Immunization: active and passive immunization, types of vaccines and their production strategy.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Anatomical view of mammalian thymus and various immune organs	Experiments	BL3-Apply	2
VIII	Study about Covaxin vaccine administration in local area and effect visualized	Internships	BL4-Analyze	15 DAYS
4	To perform Radial immune diffusion	Experiments	BL3-Apply	2
5	To perform Double immuno diffusion	Experiments	BL3-Apply	2
6	Haemoglobin detection by given Blood Sample	Experiments	BL3-Apply	2
VII	Detection of Hb% of human population in locality and relate to their nutrition diet.	PBL	BL4-Analyze	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	20

Part E

Books	Immunology by Kindt, Goldsby, Osborne, 4th Edition
Articles	https://njms.rutgers.edu/sgs/olc/mci/prot/2009/Hypersensitivities09.pdf
References Books	Essentials Immunology, Ivam M Roitt, 12th Edition
MOOC Courses	https://nptel.ac.in/courses/104108055
Videos	https://nptel.ac.in/courses/104108055

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	2	2	-	1	-	-	-	-	-	1	2	2
CO2	1	2	2	3	1	3	1	-	-	-	-	-	1	2	2
CO3	1	2	1	2	1	2	2	-	-	-	-	-	1	2	2
CO4	1	2	1	2	1	2	2	-	-	-	-	-	3	3	3
CO5	1	2	2	1	2	-	2	-	-	-	-	-	3	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Analytical Chemistry
Course Code	BSMB 203 (T)

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Knowledge of Fundamentals of Analytical Chemistry			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember basic concept and principle of analytical techniques**(BL1-Remember)** **CO2-** To understand the difference between the analytical techniques**(BL2-Understand)** **CO3-** To use/apply the basic statistical treatment of the analytical data for getting a correct result and analytical methods**(BL3-Apply)** **CO4-** To Analyse Qualitative and Quantitative aspects**(BL4-Analyze)** **CO5-** To Evaluate the data obtained from the analysis**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
Module 1	General purification techniques Purification of solid organic compounds, recrystallisation, use of miscible solvents, use of drying agents and their properties, sublimation. Purification of liquids. Different types of extraction: use of immiscible solvents solvent extraction, efficiency of extraction, selectivity of extraction, liquid phase and solid phase extraction systems, methods of extraction, applications. Chemical methods of purification and test of purity	Problem solving sessions, Experienced examples, Quizzes Summarizing, Leaving Questions Hand on Experience ,Tutorials	8
Module 2	Titrimetric Methods of Analysis General Introduction General principle. Types of titrations. Requirements for titrimetric Analysis. Concentration systems: Molarity, formality, normality, wt % ppm, milliequivalents and millimoles-problems Primary and secondary standards, criteria for primary standards, preparation of standard solutions, standardization of solutions. Limitation of volumetric analysis, end point, equivalence point	Learn by doing, Simulations/ Virtual labs, Videos	8
Module 3	Chromatography, Introduction, Principle of chromatography, Classifications of chromatography, Techniques of paper and column chromatography, Thin Layer Chromatography(TLC) Partition chromatography, Ion exchange chromatography	Tutorials, Virtual labs, Demonstrations, Experiments	8
Module 4	Thermal Analysis Thermal analytical methods, principle involved in thermogravimetric analysis differential gravimetric analysis and differential scanning calorimeter, discussion of various components with block diagram, characteristics of TG and DTA, Factors affecting TG, DTA and DSC Curves	Problem solving sessions, Expeienced examples,	8
Module 5	Evaluation and procession of analytical data, Precision and accuracy, Types of errors, Normal distribution curve, Standard deviation, Confidence limit, Graphical presentation of result-method of average, Method of linear list square, Significant figures, Statistical aid to hypothesis testing: t–test & F-test, Correlation coefficient, Rejection of data	. Problem solving sessions, Expeienced examples,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Complexometric titration	Experiments	BL3-Apply	4
VIII	Qualitative Analysis using Thin Layer Chromatography	PBL	BL4-Analyze	6
IX	Purification of sample by Crystallization technique	PBL	BL6-Create	7
IV	To determine the Percentage of Copper in copper alloy solution	Experiments	BL3-Apply	2
V	To determine the percentage of Chromium in chrome alloy	Experiments	BL3-Apply	2
VI	To purify the given sample Ammonium Chloride	Experiments	BL3-Apply	
VII	Qualitative Analysis using Paper, Chromatography	PBL	BL4-Analyze	6

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	Y Anjaneyulu Textbook of Analytical Chemistry 2008
Articles	https://nptel.ac.in/courses/104105084
References Books	Skoog D.A. and West D.M. Saunders Fundamental of Analytical Chemistry Ninth Edition
MOOC Courses	https://nptel.ac.in/courses/104105084
Videos	https://nptel.ac.in/courses/104105084

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	3	2	1
CO3	3	1	-	2	-	-	-	-	-	-	-	-	1	1	2
CO4	2	3	-	-	-	-	-	-	-	-	-	-	1	1	2
CO5	2	2	-	-	-	-	-	-	-	-	-	-	2	2	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Bacteriology, mycology and Virology
Course Code	BSMB 601(T)

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	characteristics of bacterial cells, cell organelles, cell wall composition and various appendages like capsules, flagella or pili.			**Co-Requisite/s**	Differentiate a large number of common bacteria by their salient characteristics; classify bacteria into groups.			
Course Outcomes & Bloom's Level	**CO1-** Describe characteristics of bacterial cells,cell organelles,cell wall composition and various appendages like capsules, flagella or pili**(BL1-Remember)** **CO2-** Differentiate a large number of common bacteria by their salient characteristics; classify bacteria into groups.**(BL2-Understand)** **CO3-** Describe the nutritional requirements of bacteria for growth; developed knowledge and understanding that besides common bacteria there are several other microbes which grow under extreme environments**(BL2-Understand)** **CO4-** Perform basic laboratory experiments to study microorganisms ;methods to preserve bacteria in the laboratory; calculate generation time of growing bacteria**(BL4-Analyze)** **CO5-** Discuss how fungi and algae are used as biofertilizers in agriculture and as biopesticides. To illustrate creative use of modern tools and techniques for manipulation and analysis of genomic sequences.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓			**SDG (Goals)**	SDG4(Quality education)			

Part B

Modules	Contents	Pedagogy	Hours
1	Morphology And Ultra Structure of Bacteria, Size, Shape andArrangement Of Bacteria, Ultra Structure Of Bacterial Cell Wall Of Eubacteria And Archaebacteria, Relation Of Gram Staining To CellWallOfBacteria, StructureAndFunctionOfFlagella, Fimbrae, Pili,Capsule, SlimeLayer, ChemotaxisAndPhototaxis, S-LayerAndCapsule Types. Structure And Function of Mesosome, Ribosome,Nucleoid,CytoplasmicInclusionBodies. Formation And Structure of Endospore.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
2	Kinetics Of Bacterial Growth,Bacterial Culture Types-Synchronous,Continuous,Arithmetic, BatchCulture,GrowthPhase,Growth Kinetics,MeasurementofGrowth,Environmental Factor Affecting Growth-Temperature,PH,Nutrient Concentration,Osmotic Pressure.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	7
3	Historyanddevelopmentofvirology,Nomenclatureandclassificationofvirus,Morphologicalcharacteristicsofvirus:-enveloped capsid nucleic acids, Virus related particles viroid, andvirusoids,Techniqueforvisualizationandenumerationofandenumerationofviralparticles.BriefHistoryofPlantvirology,Classification and structure of plant virus. Tobacco mosaic virus,cauliflowermosaicvirus,and potato tubes pindle virus.Future Aspects of viruses	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
4	Classification And General Characterstics Of Fungi, Colonial AndMorphological Structure Of Fungi,Cell Wall Structure Of FungiFungalNutrition(Carbon,NitrogenAndOxygen)AndFungalGrowth Reproduction Of Fungi: Vegetative, Asexual And Sexual,Heterothallism,Heterokaryosis AndParasexuality In Fungi,Microbial Interactions,Secondary Metabolites,Antimicrobial	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	7
5	Role Of Fungi in Bio-Deterioration, Application of Fungi In BioRemediation, Fungi As Plant Pathogen, Phosphate Solubilizing Fungi And There Application,Mushroom Cultivation,Industrially Important Fungal Enzymes.	Audio/Video clips, group discussion, lecture with ppt,Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Mushroom Cultivation	Experiments	BL6-Create	12
2	Isolation of Bacterial Colony by Streaking Plate method	Experiments	BL2-Understand	3
3	Isolation of Bacterial Colony by Pour Plate method	Experiments	BL2-Understand	3
4	Isolation of Bacterial Colony by Serial dilution Plate method	Experiments	BL2-Understand	3
5	Endospore Staining	Experiments	BL2-Understand	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Pelczar,M.J.Chan,E.C.S. and Krieg,N.R.(1986).Microbiology, Vth Eds.,Mc .Graw Hill.
Articles	https://www.researchgate.net/publication/313745331_Plant_Pathogenic_Fungi
References Books	Modern Microbial Genetics by U.N.Streips and R.E. Yasbin, 2nd edition; Wiley Publishers;2002.
MOOC Courses	https://nptel.ac.in/courses/102105087
Videos	https://nptel.ac.in/courses/102105087

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	3	3	1	2	1	3	1	2	2	3
CO2	2	1	2	2	1	3	3	2	1	1	3	1	2	3	2
CO3	1	2	1	1	1	3	3	2	1	2	3	2	3	2	3
CO4	2	3	2	3	3	1	1	1	2	1	1	2	2	1	2
CO5	2	3	2	3	3	2	2	1	1	1	1	1	2	1	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Food and Dairy Microbiology
Course Code	BSMB 602 (T)

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Explain the interactions between microorganisms and the food environment, and factors influencing their growth and survival.			**Co-Requisite/s**	Describe the characteristics of foodborne, waterborne, and spoilage microorganisms, and methods for their isolation, detection, and identification.			
Course Outcomes & Bloom's Level	**CO1-** Explain the interactions between microorganisms and the food environment, and factors influencing their growth and survival.**(BL1-Remember)** **CO2-** Explain the significance and activities of microorganisms in food.**(BL2-Understand)** **CO3-** Describe the characteristics of foodborne, waterborne and spoilage microorganisms, and methods for their isolation, detection and identification.**(BL3-Apply)** **CO4-** Explain why microbiological quality control programmes are necessary in food production.**(BL3-Apply)** **CO5-** Explain the effects of fermentation in food production and how it influences the microbiological quality and status of the food product.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to microbiology: Microbiology in daily life, Characteristics and morphology of bacteria, fungi, virus, protozoa and algae. Control of micro-organisms- Growth curve; Influence of environmental factors on growth- PH, Water activity, O2 availability, Temperature, Pressure, and Radiation.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
2	Principles, physical methods of food preservation: temperature (low, high, canning, drying), irradiation, hydrostatic pressure, high voltage pulse, microwave processing, and aseptic packaging, chemical methods of food preservation: salt, sugar, organic acids, SO2, nitrite and nitrates, ethylene oxide, antibiotics, and bacteriocins.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
3	Contamination and spoilage of different foods: Cereals, sugar and their products, Milk and milk products, Fruits and vegetables, canned foods, Meat, fish, egg, and poultry.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visit	8
4	Foodborne illness: Food intoxication- Staphylococcal intoxication, botulism. Food infection- Salmonellosis, Clostridium perfringens, Bacillus cereus gastroenteritis, E. coli infection, Yersinia enterocolitica, Listeria monocytogenes, Campylobacter jejuni, and others. Pre-biotic and pro-biotic	utorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visit	8
5	SCP- Microorganisms used, raw materials used as substrate, condition for growth and production, nutritive value and use of SCP; Fat from microorganisms- Microorganisms used raw materials, production of fat; Production of amino acids; Production or other substances added to foods. Production of enzymes- amylases, invertase, pectolytic enzymes, proteolytic enzymes, and other enzymes	utorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visit	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Staining of microorganisms	Experiments	BL3-Apply	2
2	Composition, preparation and sterilization of media	Experiments	BL3-Apply	2
3	Demonstration of techniques for pure culture of microorganisms	Experiments	BL4-Analyze	2
4	Streak plate method	Experiments	BL3-Apply	2
5	Pour plate method.	Experiments	BL3-Apply	2
6	Serial dilution agar plate method	Experiments	BL4-Analyze	2
7	Microbiology testing of milk	PBL	BL4-Analyze	2
8	Serial dilution agar plate method	Experiments	BL4-Analyze	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Virendra Kumar Pande Textbook of Food Microbiology 1st Edition
Articles	https://academic.oup.com/jimb
References Books	John C. Ayres Microbiology of Foods 2nd Edition Frazier, W.C. Food Microbiology 4th edition Pelzar, H.J. and Rober, D. Microbiology 5th edition
MOOC Courses	https://onlinecourses.nptel.ac.in/noc24_ag03/preview https://onlinecourses.nptel.ac.in/noc23_ag02/preview https://nptel.ac.in/courses/126105015 https://onlinecourses.nptel.ac.in/noc24_ag07/preview
Videos	https://nptel.ac.in/courses/102105058

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	2	2	1	-	-	-	-	-	2	3	1	2
CO2	2	2	1	3	1	3	2	-	-	-	-	2	1	2	1
CO3	1	1	2	2	2	1	2	3	-	-	-	1	3	3	2
CO4	3	2	3	3	1	1	3	2	-	-	-	1	2	3	1
CO5	2	3	3	2	3	2	1	2	-	-	-	3	1	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Research Methodology
Course Code	BSMB 702 (T)

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	Student should have some basic knowledge of statistics			**Co-Requisite/s**	Should have understanding of the basic concepts of different types of research and their purposes			
Course Outcomes & Bloom's Level	**CO1-** The course prepares the student to understand the basic concepts of Research Methodology, its applications in experimental design and future prospects.**(BL1-Remember)** **CO2-** The subject Research Methodology is designed for post graduate students of Biotechnology for describing the basic concepts of each and every division of the subject along with its applications in other fields.**(BL2-Understand)** **CO3-** The course aims to provide experimental basis, and to enable students to acquire a specialized knowledge and understanding of data and its applications in experimental verification**(BL2-Understand)** **CO4-** The course aims to provide basis of analyzing the applications of Research Methodology in various fields of research and industries.**(BL3-Apply)** **CO5-** The course aims to provide basis of experimental design, computer applications and use of statistical tools in research and industries.**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction: Definition of Research, Qualities of Researcher, Components of Research Problem, Various Steps in Scientific Research, Types of Research; Hypotheses Research Purposes - Research Design - Survey Research, Research Reports.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Data Collection: Sources of Data: Primary Data, Secondary Data; Procedure Questionnaire - Sampling Merits and Demerits - Experiments - Kinds - Procedure; Control Observation.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Introduction to Statistics - Probability Theories - Conditional Probability, Point and Interval Estimates of Means and Proportions; Hypothesis Tests, One Sample Test - Two Sample Tests / Chi-Square Test, t-test - Standard deviation.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	Statistical Applications: Analysis of Variance, Completely Randomized Design, Randomized Complete Block Design, Latin Square Design	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Report Writing, Computer application: Use of computers for preparing and presenting Documents. Appropriate Statistical and other relevant packages, internet .Use of MS-Office	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Steps in scientific research methodology	Case Study	BL2-Understand	2
2	Sampling process	Case Study	BL2-Understand	2
3	Developing Hypothesis	Case Study	BL2-Understand	2
4	Data collection	Case Study	BL3-Apply	2
5	Analysis of Variance	Case Study	BL3-Apply	2
6	Randomized Block Design	Case Study	BL4-Analyze	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	30
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	Research methodology, C. R. Kothari, 6th Edition
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5037945/
References Books	Research methodology, Panneerselvam, R., Prentice Hall of India, New Delhi
MOOC Courses	https://nptel.ac.in/courses/121106007
Videos	https://nptel.ac.in/courses/121106007

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	-	-	-	1	2	-	-	-	-	-
CO2	1	2	-	-	-	-	-	-	1	1	-	-	-	-	-
CO3	1	2	-	-	-	-	-	-	1	2	-	-	-	-	-
CO4	1	2	-	-	-	-	-	-	1	1	-	-	-	-	-
CO5	1	2	-	-	-	-	-	-	1	1	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Microbial Quality Control in Food and Pharmaceutical Industries
Course Code	BSMB 801 (T)

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Disciplinary Major							
Pre-Requisite/s	Student must be aware with the basic laboratory rules and regulations, safety measures and bioethics.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Students will gain knowledge about the different types of microorganisms and their significance.**(BL1-Remember)** **CO2-** To understand Basic concept of microbiological quality control**(BL2-Understand)** **CO3-** To Design SOPs and related laboratory infrastructure**(BL3-Apply)** **CO4-** To Conduct microbiological quality control**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✓	**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG8(Decent work and economic growth)					

Part B

Modules	Contents	Pedagogy	Hours
I	Microbiological Laboratory and Safe Practices: Good laboratory practices, Good microbiological practices. Biosafety cabinets – Working of biosafety cabinets, using protective clothing, specification for BSL-1, BSL-2, BSL-3.Discarding biohazardous waste – Methodology of Disinfection, Autoclaving & Incineration.	Lecture method, group discussions, demonstartions, experiments, industrial visits, ABL, PBL	8
II	Determining Microbes in Food / Pharmaceutical Samples: Culture and microscopic methods - Standard plate count, Most probable numbers,Direct microscopic counts, Biochemical and immunological methods: Limulus lysate test for endotoxin, geldiffusion, sterility testing for pharmaceutical products.	Lecture method, group discussions, demonstartions, experiments, industrial visits, ABL, PBL	9
III	Pathogenic Microorganisms of importance in Food & Water:Enrichment culture technique, Detection of specific microorganisms - on XLD agar, Salmonella Shigella Agar, Manitol salt agar, EMB agar, McConkey Agar, Saboraud Agar.	Lecture method, group discussions, demonstartions, experiments, industrial visits, ABL, PBL	8
IV	Ascertaining microbial quality of milk by MBRT, Rapid detection methods of microbiological quality of milk at milk collection centres (COB, 10 min Resazurin assay).	Lecture method, group discussions, demonstartions, experiments, industrial visits, ABL, PBL	9
V	HACCP for Food Safety and Microbial Standards:Hazard analysis of critical control point (HACCP) - Principles, flow diagrams, limitations Microbial Standards for Different Foods and Water – BIS standards for common foods and drinking water.	Lecture method, group discussions, demonstartions, experiments, industrial visits, ABL, PBL	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Design of a quality control Laboratory	PBL	BL3-Apply	3
II	SOP designing and hands on Practice	PBL	BL3-Apply	7
III	Bioburden test, sterility test, environmental monitoring, detection of specific pathogens, personal hygiene Monitoring	PBL	BL4-Analyze	15 days
IV	To learn Good Laboratory Practice (GLP), Major drug and food regulatory agencies	Industrial Visit	BL2-Understand	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Harrigan WF (1998)Laboratory Methods in Food Microbiology, 3rd ed. Academic Press. Garg N, Garg KL and Mukerji KG (2010) Laboratory Manual of Food Microbiology I K International Publishing House Pvt. Ltd.
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3624724/#:~:text=Quality%20control%20(QC)%20in%20diagnostic,identification%20and%20antibacterial%20susceptibility%20testing.
References Books	Jay JM, Loessner MJ, Golden DA (2005) Modern Food Microbiology, 7th edition. Springer Baird RM, Hodges NA and Denyer SP (2005) Handbook of Microbiological Quality control in Pharmaceutical and Medical Devices, Taylor and Francis Inc.
MOOC Courses	https://nptel.ac.in/courses/112107259
Videos	https://nptel.ac.in/courses/112107259

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	-	2	2	-	-	-	-	-	1	2	2
CO2	1	2	3	2	2	1	-	-	-	-	-	-	2	2	1
CO3	1	1	1	1	2	1	1	-	-	-	-	-	-	-	1
CO4	2	-	1	1	1	1	-	-	-	-	-	-	1	1	3
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Hindi I
Course Code	BSMB AECII (T)

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Foundation core							
Pre-Requisite/s	हिंदी भाषा का मूल गया ज्ञान होना आवश्यक है			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** संपर्क भाषा के रूप में हिंदी को समझना। सांस्कृतिक, एवं राष्ट्रिय एकता बनाये रखना भाषा के माध्यम से संम्भव है। पाठ्यक्रम में व्याकरण ,एवं लेखन परम्परा का बोध करना **(BL1-Remember)** **CO2-** ज्ञान को अर्थपूर्णता देने में भाषा एक सशक्त आधार है।**(BL2-Understand)** **CO3-** छात्र , भाषा को सुन कर अर्थ ग्रहण कर सकें ,शुद्ध -स्पष्ट लिख सकें एवं वक्ता के मनोभावों को समझकर भावानुभूति कर सकें। **(BL3-Apply)** **CO4-** हिंदी भाषा एवं नैतिक मूल्यों को समझना।**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✓ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
I	स्वतंत्रता पुकारती {कविता} ---जयशंकर प्रसाद पुष्प की अभिलाषा {कविता} --- माखनलाल चतुर्वेदी वाक्य संरचना और अशुद्धियाँ {संकलित }	lecture method, group discussion, story telling,	8
II	एक थे राजा भोज { निबंध } --विश्वनाथ शुक्ल २ पर्यायवाची , विलोम , एकार्थी ,अनेकार्थी एवं शब्दयुग्म शब्द {संकलित } ३ वह तोड़ती पत्थर -सूर्यकान्त त्रिपाठी निराला ४ वर्ण -विचार {स्वर ,व्यंजन ,वर्गीकरण ,उच्चारण स्थान }	lecture method, group discussion, story telling, role play	6
III	१ भगवान् बुद्ध) { निबंध } ---स्वामी विवेकानंद २ लोकतंत्र एक धर्म है(निबंध --डॉ सर्वपल्ली राधा कृष्णन ३ पल्लवन	lecture method, group discussion, story telling, role play	6
IV	अफसर(निबंध -शरद जोशी २ संक्षेपण {संकलित } ३ नारीत्व का अभिशाप ४ विराम -चिह्न {संकलित }	lecture method, group discussion, story telling, role play	6
V	नैतिक मूल्य परिचय एवं वर्गीकरण(आलेख } --डॉ शशि राय २ अंतर्ज्ञान और नैतिक जीवन(लेख --डॉ सर्वपल्ली राधाक ३ अप्प दीपोभव {लेख } -स्वामी श्रद्धा	lecture method, group discussion, story telling, role play	6

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	हिंदी भाषा और नैतिक मूल्य : मध्य प्रदेश शासन
Articles	https://www.cvs.edu.in/upload/IMG-20200323-WA0003.pdf
References Books	
MOOC Courses	https://onlinecourses.swayam2.ac.in/cec20_lg05/preview
Videos	https://onlinecourses.swayam2.ac.in/cec20_lg05/preview

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	2	2	-	-	-	-	-	-	-	-	2	-
CO2	2	3	1	2	2	-	-	-	-	-	-	-	-	2	-
CO3	2	2	1	1	1	-	-	-	-	-	-	-	-	2	-
CO4	1	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO5	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	English II
Course Code	BSMB AECIII (T)

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Ability Enhancement Courses							
Pre-Requisite/s	1.Basic Language Proficiency 2.Educational Background 3.Motivation and Willingness to Learn Time Commitment 4.Technology Proficiency			**Co-Requisite/s**	1.Communication Skills Workshop 2.Emotional Intelligence Training 3.Conflict Resolution Seminar 4.Leadership Development Program 5.Cross-Cultural Competency Training 6.CareerDevelopment Workshops			
Course Outcomes & Bloom's Level	**CO1-** Determine interpersonal skills and be an effective goal-oriented team player.**(BL1-Remember)** **CO2-** They will be able to analyze and improve their speaking ability in English both in terms of fluency and comprehensibility.**(BL2-Understand)** **CO3-** They will be able to evaluate themselves by giving oral presentations and will receive feedback on their performances.**(BL3-Apply)** **CO4-** They will be able to develop their reading speed and comprehension of academic articles.**(BL4-Analyze)** **CO5-** They will be able to compare their reading fluency skills.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**					

Part B

Modules	Contents	Pedagogy	Hours
Module 1	Unit I: Introduction: Theory of communication, types and modes of communication, effective communication, barriers of communication, strategies to overcome the barriers.	lecture methods, collaborative learning, videos,group discussions, debates	10
Module 2	Unit II: Professional Skills: Social skills - Small talks and leading the conversation, conducting debate and discussions, public speaking, public speech, presentation skills and meeting etiquettes, business communication, group discussion and interview skills, critical conversations.	lecture methods, collaborative learning, videos,group discussions, debates	6
Module 3	Unit III: Cross Cultural Communication: Contextual conversation, do's and don'ts of cross cultural communication, verbal and non verbal communication, bias and prejudice body language.	lecture methods, collaborative learning, videos,group discussions, debates	6
Module 4	Unit IV: Internet Etiquettes: Email writing, social media articles/ blogs, notes, memos, reports & proposal writing, writing letters, formal and informal. Self profiling: Making job resume/ CV, elevator pitch (3 minutes self- introduction during interviews), Twitter/ Face book bio.	lecture methods, collaborative learning, videos,group discussions, debates	6
Module 5	Unit V: Critical Thinking: • Where the Mind is without Fear - Rabindranath Tagore. • The Portrait of a Lady - Khushwant Singh. • On the Rule of the Road - AG Gardiner. • Cherry Tree - Ruskin Bond. • Close Reading, Comprehension, analysis and interpretation, paraphrasing and summary.	lecture methods, collaborative learning, videos,group discussions, debates	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Fluency in English - Part II, 2006, Oxford University Press. • Business English, 2008, Pearson Publication.
Articles	https://www.frontiersin.org/articles/10.3389/feduc.2019.00087/full https://www.cii.co.uk/media/6158020/a-useful-guide-to-swot-analysis.pdf http://www.mmmut.ac.in/News_content/35141tpnews_10142020.pdf
References Books	• Language, Literature and Creativity, 2013, Orient Blackswan. • John E Warriner, Harcourt, Brace, Jovanovich, Warriner's English Grammar and Composition: Complete Course, 1973.
MOOC Courses	https://www.edx.org/learn/leadership/catalyst-leading-with-effective-communication-inclusive-leadership-training?hs_analytics_source=referrals&utm_source=mooc.org&utm_medium=referral&utm_campaign=mooc.org-course-list https://www.edx.org/learn/writing/university-of-california-berkeley-academic-and-business-writing?hs_analytics_source=referrals&utm_source=mooc.org&utm_medium=referral&utm_campaign=mooc.org-course-list
Videos	https://www.youtube.com/watch?v=fq98P9N9Hbg https://www.youtube.com/watch?v=uA5YeqgsjmYhttps://www.youtube.com/watch?v=eBSeCp__xhI

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	1	2	3	-	-	3	2	-	2	3	2	2	-
CO2	-	2	2	3	-	2	-	2	3	-	-	-	-	-	-
CO3	2	-	3	-	2	2	2	3	2	-	-	-	-	2	1
CO4	2	-	3	-	2	-	3	-	2	-	3	2	-	2	3
CO5	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	HINDI II
Course Code	BSMB AECIV

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Ability Enhancement Courses							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** हिंदी भाषा एवं नैतिक मूल्यों को समझना**(BL1-Remember)** **CO2-** सांस्कृतिक ,एवं राष्ट्रिय एकता बनाये रखना भाषा के माध्यम से संभव है।**(BL2-Understand)** **CO3-** छात्र जीविकोपार्जन के लक्ष्यों का सहज संधान कर सके ।**(BL3-Apply)** **CO4-** पाठ्यक्रम में व्याकरण ,सामान्य तथा पारम्परिक साहित्य ,लोक कलाएं ,स्थापत्य एवं लेखन परम्परा का बोध करना एवं समग्र व्यक्तित्व का विकास करना है।**(BL2-Understand)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG3(Good health and well-being) SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	मध्य प्रदेश की लोक -कलाएं (संकलित) इंद्रधनुष का रहस्य लोकोक्तियां एवं मुहावरे (संकलित संधि (संकलित)	lecture method, group discussion, story telling,	5
2	जनसंचार माध्यम -प्रिंट ,इलेक्ट्रॉनिक ,सोशल सपनों की उड़ान प्रमुख वैज्ञानिक आविष्कार संक्षिप्तियां (संकलित)	lecture method, collaborative learning, Field visits, ABL, PBL	4
3	पत्रकारिता के विविध आयाम (संकलित) मध्य प्रदेश का लोक साहित्य (संकलित) पत्र -लेखन ---आवेदन ,प्रारूपण ,आदेश ,परिपत्र ,ज्ञापन ,अनुस्मारक (संकलित) समास (संकलित)	lecture method, group discussion, story telling, role play	5
4	हिंदी की शब्द सम्पदा (संकलित) राज भाषा हिंदी (संकलित)- हिंदी की संवैधानिक स्थिति एवं व्यवहारिक स्थिति दूरभाष और मोबाइल (संकलित) अनुवाद -अर्थ ,प्रकार एवं अभ्यास	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	4
5	विश्व के प्रमुख धर्म एवं नैतिक विशेषताएं -हिन्दू ,जैन ,बौद्ध ,सिक्ख ,ईसाई ,इस्लाम धर्म सत्य के साथ मेरे प्रयोग -(महात्मा गाँधी की आत्मकथा का	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	भाषा एवं नैतिक मूल्यों;Madhy Pradesh hindi granth acadmi, bhopal
Articles	https://leverageedu.com/blog/hi/%E0%A4%A8%E0%A5%88%E0%A4%A4%E0%A4%BF%E0%A4%95-%E0%A4%B6%E0%A4%BF%E0%A4%95%E0%A5%8D%E0%A4%B7%E0%A4%BE-%E0%A4%AE%E0%A4%B9%E0%A4%A4%E0%A5%8D%E0%A4%B5-%E0%A4%AA%E0%A4%B0-nibandh/
References Books	
MOOC Courses	https://fliphtml5.com/jhnr/hnsm/basic
Videos	https://fliphtml5.com/jhnr/hnsm/basic

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	3	2	2	-	-	-	-	-	-	3	2	3
CO2	2	1	2	2	-	3	-	-	-	-	-	-	2	2	2
CO3	2	2	2	3	3	2	-	-	-	-	-	-	-	2	3
CO4	1	2	3	2	2	-	-	-	-	-	-	-	3	2	1
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Animal Physiology
Course Code	BSMB GEIV (T)

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Electives							
Pre-Requisite/s	basic concepts of physiology and the organ systems physiology of animals determine and understand working and functioning of different systems with their anatomical and biochemical aspects describe the system physiology of mammals			**Co-Requisite/s**	Relate with organic mechanisms in biology			
Course Outcomes & Bloom's Level	**CO1-** To describe fundamental knowledge of animal physiology**(BL1-Remember)** **CO2-** To understand the detailed concepts of digestion respiration excretion the functioning of nerves and muscles Hormones and reproduction**(BL2-Understand)** **CO3-** To understand the importance of Physiology and its applications**(BL3-Apply)** **CO4-** To provide experimental basis, and to enable students to basic concept of physiology**(BL4-Analyze)** **CO5-** To evaluate the applications of Physiology in various fields such as research and development as well as in various industries**(BL5-Evaluate)** **CO6-** To apply the understanding of Physiology in their future perspective fields i.e. Medical and clinical, Pathological, drug industries etc. **(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG2(Zero hunger) SDG4(Quality education) SDG14(Life below water) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours
1	Animal Nutrition- Nutrients and their Functions Physiology of Digestion Hormonal control of digestion absorption of Food and disorders.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Physiology of Respiration in Mammals Respiratory Pigments Regulation of Respiration Osmo-regulation in animals. Circulatory System: Heart Cardiac Cycle Blood pressure Blood Vessels ECG – its principle and significance	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Immune System In Mammals : An overview. Excretory System & Physiology of Excretion in Mammals Counter current theory Thermoregulation in Animals Hibernation Aestivation.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	Nervous tissue- Structure, Properties Function and Physiology of nerve Impulse Conduction EEG: its principle and significance Muscular Tissue -Types structure Muscular Physiology Chemical Changes during muscular physiology	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Endocrine gland- Pituitary gland Thyroid and Parathyroid gland Adrenal gland Thymus gland Pancreas and other glands Mechanism of Hormonal action Physiology of Reproduction in mammals	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Spotting vis permanent slides of digestivesystem and experiments based onmetabolism	Experiments	BL2-Understand	8
VI	Detection of Carbohydrates, Protein and fats in given samples	PBL	BL4-Analyze	6
III	determination of Blood group Bloodpressure and study of Immune organs	Experiments	BL4-Analyze	4
IV	Spotting Muscular and nervouse tissue	Experiments	BL2-Understand	4
V	Study of harmonal action and study ofgonads	Experiments	BL4-Analyze	4

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Prasad.N.K ;Enzyme Technology: Pacemaker of Biotechnology;2nd Edition Palmer;Enzymes; Horwood Publishing Series. 2001
Articles	https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/enzyme-activity https://www.jbc.org/article/S0021-9258(20)34049-7/fulltext https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8169242/ https://pubs.acs.org/doi/10.1021/acsomega.2c07560
References Books	Biocatalysts and enzyme technology, Buchholz.K;Kasche.V, Bornscheuer.U.V, Published by Wiley-VCH, 2005. Wiseman, A: Handbook of Enzyme Biotechnology, 3rd Edition, Ellis Horwood Publication,2010 Buchholz.K;Kasche.V;Bornscheuer.U.T.;Biocatalysts and enzyme technology, Published by Wiley-VCH, 2005. Palmer.T; Enzymes: Biochemistry, Biotechnology, Clinical Chemistry ;Horwood Publishing House, Chichester, England, 2001. Bisswanger.H;Practical enzymology.. Wiley Publication. 2nd Edition, 2011
MOOC Courses	https://nptel.ac.in/courses/102103097
Videos	https://nptel.ac.in/courses/102103097

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	1	2	2	2	-	-	-	-	-	-	2	-	1
CO2	3	1	1	2	2	2	-	-	-	-	-	-	1	2	2
CO3	2	1	1	2	1	1	-	-	-	-	-	-	2	3	1
CO4	3	-	-	1	1	1	1	-	-	-	-	-	1	2	2
CO5	-	-	-	-	1	-	1	-	-	-	-	-	2	-	1
CO6	-	2	-	-	1	-	-	-	-	-	-	-	1	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Basics of Forensic Science
Course Code	BSMB SEC II (T)

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Discipline Electives							
Pre-Requisite/s	Knowledge about basic science and tools used in Biotechnology			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember the structure of various branches, tools and techniques and causes of crime in forensic science.**(BL1-Remember)** **CO2-** To comprehend the human genetics, mutation and DNA typing techniques.**(BL2-Understand)** **CO3-** To understand the importance of various chromatographic methods and their role in forensic science.**(BL2-Understand)** **CO4-** To provide experimental basis, of detection and identification of blood and other seminal fluids.**(BL4-Analyze)** **CO5-** To apply the understanding of various identification methods in evaluation in various samples in forensic science.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction and principles of forensic science, forensic science laboratory and its organization and service, tools and techniques in forensic science, branches of forensic science, causes of crime, role of modus operandi in criminal investigation.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	5
2	Introduction, History of DNA Typing, Human Genetics- Heredity, Alleles, Mutations and Population Genetics, Molecular Biology of DNA, Variations, Polymorphism, DNA Typing Systems- RFLP Analysis, PCR Amplifications, Sequence Polymorphism, Forensic Significance of DNA Profiling	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	4
3	History, Introduction, Definition, Principles of Chromatographic Techniques, Classification of Chromatographic Methods, Adsorption and Partition Chromatography, Application of different Chromatographic Methods in Forensic Science	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	5
4	Detection and identification of blood stains. Determination of blood group systems and species of origin. Techniques for the determination of blood group and stains. Detection of seminal and other body fluids, Red cells enzymes, Serum proteins of forensic significance	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	4
5	Introduction, Basic Principles, Instrumentation & Forensic Applications of various Electrophoresis, Paper Electrophoresis, Cellulose Acetate Membrane Electrophoresis, Gel Electrophoresis, Agarose Gel Electrophoresis, Polyacrylamide Gel Electrophoresis, Sodium dodecyl sulphate (SDS),Two Dimensional Electrophoresis, Capillary Electrophoresis	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	5

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Detection and Identification of Blood Stains	Seminar	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	S.H. James and J.J. Nord by, Forensic Science: An Introduction to Scientific and Investigative Techniques, Forensic Science: An Introduction to Scientific and Investigative Techniques 2nd Edition, CRC Press, Boca Raton (2005)
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7838326/
References Books	Molecular Biotechnology Principles and Applications of recombinant DNA. ASM Press, Washington. Molecular Biotechnology□Principles and Applications of recombinant DNA. 2 Edition ASM Press, Washington B.B. Nanda and R.K. Tiwari, Forensic Science in India: A Vision for the Twenty First Century, Forensic Science in India: A Vision for the Twenty First Century, Publishers, New Delhi (2001) W.G. Eckert and R.K. Wright Introduction to Forensic Sciences, W.G. Eckert (ED.), CRC Press, Boca Raton (1997). 2nd Edition, W.J. Tilstone, M.L. Hastrup and C. Hald Fisher's Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013)
MOOC Courses	https://nptel.ac.in/courses/109106408
Videos	https://nptel.ac.in/courses/109106408

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	2	-	-	-	2	-	-	1	-	1
CO2	2	3	2	2	2	2	-	-	-	2	-	-	1	-	3
CO3	3	1	1	-	-	-	-	-	-	-	-	-	3	2	3
CO4	3	2	1	1	-	-	-	-	-	2	-	-	2	3	2
CO5	2	2	1	1	-	-	-	-	-	2	-	-	2	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Biostatistics and Computer Applications
Course Code	BSMB SECIII (T)

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	Understanding of basic concepts of Computers, operating systems, their designing, and applications of Biostatistics in research and development.			**Co-Requisite/s**	Basic concepts of Biostatistics and Computer Applications, its applications and future prospects in research and analysis using statistical tools.			
Course Outcomes & Bloom's Level	**CO1-** The course prepares the student to understand the basic concepts of Fundamentals of Biostatistics and Computer Applications, its applications and future prospects**(BL1-Remember)** **CO2-** The subject Fundamentals of Biostatistics and Computer Applications is designed for under graduate students of biotechnology for understanding of basic concepts of each and every division of the subject along with its applications in other fields. **(BL2-Understand)** **CO3-** The course aims to provide experimental basis, and to enable students to acquire a specialized knowledge and understanding**(BL2-Understand)** **CO4-** The course aims to provide basis of analyzing the applications of Fundamentals of Biostatistics and Computer Applications in various fields of research and industries.**(BL3-Apply)** **CO5-** The course aims to provide basis of experimental design, computer applications and use of statistical tools in research and industries.**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to Computer Systems – Basics of Computer Systems, various Hardware Components – Data Storage and various Memory Units – Central Processing Unit, Introduction to Software and its life cycle.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	DOS, MS-Offices and its application, Operating System: types of operating system, application, process and its characteristics. WWW, web browser, E-mail.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	DOS, MS-Offices and its application, Operating System: types of operating, Topologies & Technologies – LAN, WAN, MAN,PAN, Wireless LAN.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	Introduction to Biostatistics ,common terms ,notions and Applications, Statistical population and Sampling Methods,Classification and tabulation of Data, Diagrammatic and graphical presentation,Frequency Distribution, Measures of central value,Measures of variability; Standard deviation, standard Error, Range, Mean Deviation, Coefficient Variation, Analysis of variance.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Basic tests, tests of significance, t-test, chi-square test, Regression , Basis of regression, regression analysis, Estimation, testing, Prediction, Checking residual analysis. Multivariate Analysis. Design of Experiments, randomization, replication, local control, complementary randomized, randomized block design	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Methods of Sampling	Case Study	BL2-Understand	2
2	Frequency Distributions of data	Experiments	BL2-Understand	2
3	Diagrammatic and graphical presentation of data	Experiments	BL2-Understand	2
4	Calculation of Standard deviation	Case Study	BL3-Apply	2
5	Analysis of Variance	Field work	BL3-Apply	2
6	Tests of significance: t-test	Field work	BL4-Analyze	2
7	Tests of significance: Chi Square Test	Case Study	BL4-Analyze	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	Computer fundamentals, P.K. Sinha
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3469943/
References Books	Working in MS- Office, Ron Mansfield, TMH
MOOC Courses	https://nptel.ac.in/courses/102101056
Videos	https://nptel.ac.in/courses/102101056

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	-	-	-	1	2	-	-	1	2	-
CO2	1	2	-	-	-	-	-	-	1	1	-	-	1	2	-
CO3	1	2	-	-	-	-	-	-	1	1	-	-	2	1	-
CO4	1	2	-	-	-	-	-	-	1	2	-	-	1	2	-
CO5	1	2	-	-	-	-	-	-	1	2	-	-	1	2	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	India in 21st Century
Course Code	BSMB VAC II (T)

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Ability Enhancement Courses							
Pre-Requisite/s	1. *Understanding of Sociological Concepts*: A foundational knowledge of sociological concepts is essential to grasp the composition of Indian society discussed in Unit I. This includes understanding social institutions, cultural environments, and threats to national integration. 2. *Historical Background*: Familiarity with the history of India, particularly the Indian Freedom Movement, is crucial for comprehending Unit II. Knowledge of events such as the Revolt of 1857, the emergence of nationalism, and the various phases of the freedom struggle provides context for understanding the birth of the Indian nation-state. 3. *Awareness of Political Movements*: A basic understanding of political movements in India, particularly those led by figures like Gandhi, is necessary for Unit III. Familiarity with concepts like non-cooperation, civil disobedience, and the Quit India movement aids in analyzing the dynamics of Indian freedom and partition. 4. *Knowledge of Post-Independence Era*: Understanding the phases of nation-building since independence is vital for Unit IV. This includes awareness of the planned progress era, populist policies, and the paradigm shift towards liberalization and globalization. Knowledge of responses from different societal groups and regions enriches the understanding of India's post-independence journey. 5. *Global Awareness*: Unit V delves into global concerns such as environmental issues, globalization, and movements for democracy and sustainability. A broad understanding of global trends and their impact on nations is necessary to engage with this content effectively.			**Co-Requisite/s**	1. *Foundational Understanding of Sociological Concepts*: - Understanding social institutions, cultural environments, and threats to national integration is fundamental. - Familiarity with sociological theories such as functionalism, conflict theory, and symbolic interactionism can provide a deeper comprehension of societal dynamics. 2. *Historical Context of India*: - Knowledge of Indian history, including the colonial period, the struggle for independence, and post-independence developments, offers context for understanding the evolution of Indian society. - Understanding the socio-economic impacts of colonial rule and the transition to independence enhances insight into contemporary social issues. 3. *Understanding of Political Movements in India*: - Knowledge of key figures, ideologies, and strategies of political movements in India, including those led by Gandhi, Nehru, and other prominent leaders, is essential. - Awareness of the socio-political context of colonial India and the role of various stakeholders in the struggle for independence enriches understanding. 4. *Familiarity with Post-Independence Developments*: - Understanding the socio-economic and political changes in post-independence India, including the Nehruvian era, economic reforms, and social movements, is crucial. - Awareness of key policies, such as the Green Revolution, reservation system, and economic liberalization, provides insights into contemporary Indian society. 5. *Global Perspective and Awareness*: - Knowledge of global trends in areas such as technology, economics, environment, and geopolitics enhances understanding of India's position in the global context. - Understanding global issues like climate change, international trade, and human rights movements enables students to analyze their impact on India and vice versa.	
Course Outcomes & Bloom's Level	**CO1-** It will help students to remember their personality and thinking horizon for being a good and concerned Indian citizen**(BL1-Remember)** **CO2-** The students will have an understanding of making of India as a nation .**(BL2-Understand)** **CO3-** The students will have an analyse salient features of modern India .**(BL3-Apply)** **CO4-** At the end of this course, students would analyze intellectually well equipped to have a sense of modern Indian history and culture .**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✓	**SDG (Goals)**	SDG1(No poverty) SDG3(Good health and well-being) SDG4(Quality education) SDG5(Gender equality) SDG10(Reduced inequalities) SDG12(Responsible consuption and production) SDG13(Climate action)					

Part B

Modules	Contents	Pedagogy	Hours
Unit 1	Idea of India in historical perspective a) Indian culture, b) cultural commonness, c)cultural diversities, d)unity in diversity, e) culturall accomodations ,f) cultural conflicts, g)Idea of India and British Rule , h) Role of Indian Intelligentsia	lecture method and video clips/films on specific themes/topics, illustrations, classroom discussions, role play	8 hrs
Unit 2	. Emergence and growth of Indian Nationalism a) Anti-colonial basis ,b) Economic Nationalism ,c) communalism and nationalism ,d) revivalism and Indian nationalism ,e)Enlightenment values ,f)European Nationalism and Indian Nationalism	lecture method and video clips/films on specific themes/topics, illustrations, classroom discussions, role play	8 hrs
Unit 3	Social Reform Movements a) British Rule and Indian introspection ,b)Raja Rammohan Roy, c) social reform movements in 19th century , d)Swami Vivekanand ,e)The women issue ,f)Caste system	lecture method and video clips/films on specific themes/topics, illustrations, classroom discussions, role play	8 hrs
Unit 4	Indian National Movement a)Early Revolts and 1857 Revolt, b)Early Nationalists ,c) Bang Bhang Movement , d) Gandhi led Mass Movements, e) Socialist and Left trends , f) Princely States and their integration into nation, h)Partition and Independence .	lecture method and video clips/films on specific themes/topics, illustrations, classroom discussions, role play, debates	8 hrs
Unit 5	India after independence a)Making of Indian Constitution ,b) Post Independent Nehru Era , c) India facing Wars , d) Indian econmy- From Planning to LPG ,e) Achievements, f) Challenges in 21st century India.	lecture method and video clips/films on specific themes/topics, illustrations, classroom discussions, role play	8 hrs

M

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
0	0	Experiments		00

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	28
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
00	00	00		00	

Part E

Books	Bipan Chandra and others: India's Struggle For Independence , Penguine Publishers. Bipan Chandra: History Of Modern India, Orient Blackswan publishers. Sunil Khilnani: The Idea of India, Penguine publishers.
Articles	.https://www.youtube.com/watch?v=i8N6YRTJsDk
References Books	Shekhar Bandopadhyay: From Plastic to Partition and After, A History of Modern India, Orient Blackswan publishers. Shekhar Bandopadhyay: From Plastic to Partition and After, A History of Modern India, Orient Blackswan publishers. A R Desai:Social Background of Indian Nationalism, Popular Prakashan . B R Nanda: Mahatma Gandhi ,A Biography,London
MOOC Courses	1.https://www.youtube.com/watch?v=i8N6YRTJsDk
Videos	1.https://www.youtube.com/watch?v=i8N6YRTJsDk 2. https://youtu.be/MWsT7x3qd3E 3.https://www.youtube.com/watch?v=pQghqJSUAK4&list= 4.https://youtu.be/9BEU8A_JZPU 5.https://youtu.be/pPsKQwaZ4dg

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	1	-	-	1	-	-	-	-	1
CO2	-	-	-	-	-	1	1	-	1	-	-	1	-	-	1
CO3	-	-	-	-	-	1	3	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	2	-	-	-	1	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Fundamentals of Biochemistry
Course Code	BSMB101[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Knowledge about basic chemistry and science			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember the structure of various biomolecules like carbohydrates, fats, amino acids, etc**(BL1-Remember)** **CO2-** To comprehend the biological material; and its relation to living matter and elaborate the structure and functions of different biomolecules**(BL2-Understand)** **CO3-** To understand the importance of biophysical chemistry and its applications.**(BL3-Apply)** **CO4-** To provide experimental basis, and to enable students to analyze the various biomolecules in food samples.**(BL4-Analyze)** **CO5-** To evaluate the applications of biomolecules in various fields such as research and industries**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Bonds in biological system: Principles of biophysical chemistry (ph2Henderson Hasselback equation) Buffers and its role in biological systems. Solution and its types. Osmosis, diffusion and its significance in biological systems	Tutorials, Collaborative, Demonstrations, Project methods Experiments	8
2	Carbohydrates: Monosaccharide: Classification, Common Disaccharides, Structure and occurrence of storage and structural polysaccharides	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments	9
3	Lipids: Classification, structure-function, role in biological membrane, Lipoprotein, structure and functions. Prostaglandins and its role in biological systems	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	9
4	Amino Acids: structure, nomenclature and general properties, Peptide bond, Classification of amino acids Proteins; Levels of organization Primary, Secondary structure, domains, motif and folds)., tertiary and Quaternary Conformation of proteins (Ramachandran plot, Stability of Proteins	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lectures	9
5	Composition, structure and function of nucleic acids. Conformation of nucleic acids (helix (A, B, Z), t-RNA, micro-RNA). Vitamins: Classification: source and biochemical function, RDA. Nucleic acids: DNA, RNA-basic structure (nucleosides and nucleotides): double helical structure of DNA (Watson - Crick Model), types of DNA, B-, A- and Z-DNA.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lectures	9

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Quantitative analysis of sugar in the given plant sample	PBL	BL4-Analyze	4
2	Qualitative analysis of sugars.by Molisch's Test	Experiments	BL4-Analyze	2
3	Qualitative analysis of reducing sugars by Fehling's Test	Experiments	BL4-Analyze	2
4	Qualitative analysis of sugars.by Barfoed's Test	Experiments	BL4-Analyze	2
5	Qualitative analysis of ketose sugars by Seliwanoff Test.	PBL	BL4-Analyze	2
6	Qualitative analysis of amino acids by ninhydrin Test.	Experiments		2
7	Qualitative analysis of peptide bond by Biuret Test	Experiments	BL5-Evaluate	2
8	Qualitative analysis of protein by Xanthoproteic Test.	Experiments	BL5-Evaluate	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	U Satyanarayan,U Chakrapani Biochemistry 3rd Edition
Articles	https://www.mdpi.com/1422-0067/22/22/12219
References Books	G.Zubay Biochemistry 3rd Edition
MOOC Courses	https://nptel.ac.in/courses/104105076
Videos	https://nptel.ac.in/courses/104105076

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	2	-	-	-	2	-	-	1	-	1
CO2	2	3	2	2	2	2	-	-	-	2	-	-	1	-	3
CO3	3	1	1	-	1	-	-	-	-	-	-	-	3	2	3
CO4	3	2	-	2	1	-	-	-	-	-	-	-	2	3	3
CO5	3	1	-	2	1	-	-	-	-	-	-	-	2	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	General Microbiology
Course Code	BSMB102[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	the basic concepts and view of professional and scientific communication approaches for microbiology settings			**Co-Requisite/s**	comprehensive understanding of sterilization processes and media preparation pipelines			
Course Outcomes & Bloom's Level	**CO1-** To identify the basic concepts and view of professional and scientific communication approaches for microbiology settings **(BL1-Remember)** **CO2-** To understand the gene transfer mechanisms and a detailed insight into mutations and their analysis **(BL2-Understand)** **CO3-** To describe comprehensive understanding of sterilization processes and media preparation pipelines **(BL3-Apply)** **CO4-** To provide experimental basis, and to enable students to analyse the basic concepts of microbial evolution, phylogeny, nutritional aspects, and elements of microbial genetics**(BL4-Analyze)** **CO5-** To apply Appraise the current regulatory, quality control, and legal frameworksthat impact biotechnology and ethical behaviours that foster positive and productive interactions in diverse microbiology and biotechnology settings. **(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕			**SDG (Goals)**	SDG4(Quality education)			

Part B

Modules	Contents	Pedagogy	Hours
1	History and scope of microbiology, modern development of microbiology, Classification of microorganism: Haeckel's; three kingdom concepts, Whittaker; five kingdom concepts. Introduction and general characteristic of bacteria, fungi. Algae and virus and their physiological characteristics	Tutorials, Collaborative, Demonstrations, Project methods Experiments	8
2	Concept of Sterilization - Definition of sterilization, methods of sterilization; dry and moist heat, pasteurization, tantalization; radiation, filtration, disinfection, sanitization. Stains and staining techniques -Mechanism of gram staining, acid fast staining, negative staining, capsule staining, flagella staining.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Culture media: Type of media and their uses, pure culture techniques. Microbial growth: growth curve, measurement of growth and factor affecting the growth, Microbial nutrition: Nutritional classification of microorganism. Cultivation of microorganism: aerobic and anaerobic culture and preservation of microbial culture. Oxygen toxicity: Study of catalase, peroxidase, superoxidase, dismutase, mechanism of oxygen toxicity	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	9
4	Gene transfer mechanisms: transformation, transduction, conjugation and transfection, Mechanism and applications, genetic analysis of microbes- bacteria and yeast. Plasmids: characteristics and their uses.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Genetic analysis of bacteria: Importance and uses of Mutation analysis. Inheritance in bacteria, types of mutations, spontaneous and induced mutagenesis.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Preparation of broth and liquid culture media to grow the test bacterial culture.	Experiments	BL2-Understand	2
X	To isolate bacteria flora from the different location of the university campus.	PBL	BL5-Evaluate	7 days
III	Perform the simple staining of the given test organisms to observe their shape.	Experiments	BL2-Understand	2
IV	Perform the negative staining of the given test organisms to observe their shape.	Experiments	BL2-Understand	2
V	Perform the Gram's staining of the given test organism	Experiments	BL2-Understand	2
VI	Perform the Endospore staining of the given test organisms.	Experiments	BL3-Apply	2
VII	Check the effect of UV radiation on the growth of microorganisms.	Experiments	BL3-Apply	2
VIII	Demonstrate the acid and gas production by the organisms.	Experiments	BL4-Analyze	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	Nancy Trun and Janine Trempy-Fundamental Bacterial Genetics-1st Edition
Articles	https://bmcmicrobiol.biomedcentral.com/articles
References Books	U.N. Streips and R.E. Yasbin-Modern Microbial Genetics-2nd Edition
MOOC Courses	https://nptel.ac.in/courses/102105087 https:el.ac.in/courses/102103015//n
Videos	https://nptel.ac.in/courses/102105087 https:el.ac.in/courses/102103015//npt

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	3	1	3	-	-	-	-	-	-	1	2	3
CO2	2	3	3	2	1	3	1	-	-	-	-	-	2	3	3
CO3	3	3	1	1	3	3	-	-	-	-	-	-	3	3	3
CO4	1	3	1	3	1	3	-	-	-	-	-	-	1	3	3
CO5	2	1	3	3	3	2	2	-	-	-	-	-	2	1	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Cell Structure and Dynamics
Course Code	BSMB103[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Student must have basic knowledge of cell, its structure and functions			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Students should develop the concept of the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles**(BL1-Remember)** **CO2-** Students will understand how these cellular components are used to generate and utilize energy in cells**(BL2-Understand)** **CO3-** Students will recognize the cellular components underlying mitotic cell division**(BL3-Apply)** **CO4-** Students will apply their knowledge of cell biology to selected examples of changes or losses in cell function**(BL4-Analyze)** **CO5-** Students will create a model by using cell biology basics**(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
I	Introduction of Cell Structure: Prokaryotic and Eukaryotic cell Bio membrane: Composition and Models, fluid mosaic model and movement of lipids Diffusion potential and Nernst Equation Transport across cell membrane and Types and Function	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
II	Intracellular compartments and protein sorting, Compartmentalization Protein sorting and its types, Co translational translocation of protein and its types, Protein sorting into Golgi body and Lysosomes, Protein sorting into nucleus and mitochondria	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
III	Cytoskeleton Structure: Types of Filaments and its working mechanism, Microtubules, Intermediate filaments, Actin Filaments, Cell contraction and Locomotion (Sliding Filament Theory)	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
IV	Cell –Cell interaction: Extra cellular matrix: Composition and Function Cell-cell junction (anchoring. Occluding and Gap junctions). Proteins involved in junctional complex: structure and function	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
V	Cell- Cell communication and Physiological function of the cell Mechanism of cell signalling and its types, Signalling molecule and receptors: types and functions, Comparison in Apoptosis and Necrosis with Examples	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Introduction to chromosome preparation: Pre-treatment, Fixation, Staining, Squash and Smear preparation. Preparation of permanent slides	Experiments	BL2-Understand	2
II	Determination of miotic index and frequency of different mitotic stages in pre-fixed root tips of Allium cepa	Experiments	BL4-Analyze	2
III	Study of mitotic chromosome: Metaphase chromosome preparation	Experiments	BL2-Understand	2
IV	The determine osmolarity in RBCs.	Experiments	BL4-Analyze	2
V	The fractionation of rat Liver	Experiments	BL5-Evaluate	2
VI	Estimation of chlorophyll content in spinach leaves.	Experiments	BL4-Analyze	2
VII	Isolation of chlorophyll types by TLC.	Experiments	BL4-Analyze	2
VIII	Differential Centrifugation of various organalles	PBL	BL4-Analyze	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	20	60	

Part E

Books	Molecular Biology of the Gene. Seventh Edition (2013). James D. Watson, Tania A. Baker, Stephen Molecular Cell Biology, Eighth Edition (2013). Harvey Lodish, Arnold Berk. W. H. Freeman Co.,
Articles	https://training.seer.cancer.gov/anatomy/cells_tissues_membranes/cells/structure.html
References Books	Molecular Biology of the Cell. Sixth Edition (2014). Bruce Alberts, Alexander Johnson, Julian Lewis
MOOC Courses	https://nptel.ac.in/courses/102103012
Videos	https://nptel.ac.in/courses/102103012

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	3	2	3	-	-	-	-	-	-	-	3	2
CO2	1	2	3	1	2	1	1	-	-	-	-	-	3	2	2
CO3	1	1	1	1	-	1	-	-	-	-	-	-	3	2	1
CO4	3	1	1	3	-	-	1	-	-	-	-	-	2	1	1
CO5	1	1	2	3	1	2	-	-	-	-	-	-	2	1	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Plant Tissue Culture
Course Code	BSMB302(T)

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Should be acquainted with the basic knowledge of plants, cell biology, botany and genetics.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To understand and recall the basic terms, techniques, historical landmarks of plant tissue culture**(BL1-Remember)** **CO2-** To prepare the plant tissue culture media using sterilization techniques for inoculation**(BL2-Understand)** **CO3-** To observe and differentiate the behavior of various explants towards the different types of nutrient media.**(BL4-Analyze)** **CO4-** To standardize the techniques and nutrient media for the growth and development of in vitro cultures.**(BL3-Apply)** **CO5-** To develop in vitro regenerated and transgenic plantlets using various tools and techniques of plant tissue culture.**(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
I	History: Important events and landmarks in the history of plant tissue culture. Introduction to cell and tissue culture, terms and definitions. Cellular Totipotency: Introduction cytodifferentiation, organ genic differentiation. Laboratory requirements and general techniques.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
II	Tissue culture media: Introduction, media constituents, types, selection, media preparation. Callus culture and its maintenance. Plant growth regulators. Cell and Suspension cultures, Somatic embryogenesis :Technique and application	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
III	Micropropagation in Plants, Acclimatization : Process and challenges. Haploid production:: Anther culture and embryo culture: Introduction, techniques, culture requirements and applications. Protoplast Culture: Protoplast isolation, culture and regeneration. Soma clonal Variation	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
IV	Somatic hybridization: technique and application.. Elicitors, Secondary metabolites and their production. Cryopreservation: technique and application	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
V	Plant cloning vectors and their applications. Agrobacterium mediated transformation in plants. Transgenic plants: technique and application. Application of plant tissue culture in agriculture and forestry. Concept of Intellectual property right (IPR)	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Plant tissue culture: Applications and commercial importance	Experiments	BL2-Understand	2
II	Laboratory design and set up of plant tissue culture unit.	Experiments	BL2-Understand	2
III	Preparation of culture media.	Experiments	BL3-Apply	2
IV	Surface sterilization, sealing of culture, sources of contamination and their check measures	Experiments	BL3-Apply	3
V	Sterilization of media and apparatus.	Experiments	BL3-Apply	2
VI	Collection and preparation of explants	Experiments	BL4-Analyze	2
VII	Preparation of MS media for the inoculation of seeds.	Experiments	BL3-Apply	2
VIII	To establish seeds cultures	PBL	BL6-Create	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Razdan M.K.;An Introduction to Plant Tissue Culture;3rd Edition Smith.R, Plant Tissue Culture: Techniques and Experiments. Academic Press, 2012
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7356144/ https://link.springer.com/article/10.1007/s11627-022-10301-9
References Books	Bhojwani.S.S & Razdan.M.K;Plant Tissue Culture; 5th Edition Kole, C., Michler, C., Abbott, A.G., Hall, T.C. (Eds.) Transgenic Crop Plants: Volume 1: Principles and Development. Springer. 2010. Kole, C., Michler, C., Abbott, A.G., Hall, T.C. (Eds.) Transgenic Crop Plants: Volume 2: Utilization and Biosafety. Springer. 2010.
MOOC Courses	https://nptel.ac.in/courses/102103016
Videos	https://nptel.ac.in/courses/102103016

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	-	2	2	-	-	-	2	-	-	1	1	1
CO2	3	3	2	2	2	2	-	-	-	2	-	-	1	-	3
CO3	3	1	1	-	1	1	-	-	-	-	-	-	3	2	3
CO4	2	2	-	2	1	1	-	-	-	-	-	-	2	3	3
CO5	3	2	-	2	1	-	-	-	-	-	-	-	2	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Genetics
Course Code	BSMB303(T)

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Knowladge about Fundamentals and principles about genetics also provide knowladge about Genetic techniques.			**Co-Requisite/s**	Relate all Biotech and microbiology engeneering techniques like RDT PTC ATC etc.			
Course Outcomes & Bloom's Level	**CO1-** To describe basic principles and concepts of genetics**(BL1-Remember)** **CO2-** To understand the Mendalian and non Mendalian inheritance**(BL2-Understand)** **CO3-** To understand the importance of heredity and its applications**(BL3-Apply)** **CO4-** To provide experimental basis, and to enable students to acquire a specialized knowledge and understanding in advanced the field of genetics**(BL4-Analyze)** **CO5-** To evaluate the applications of genetics in various fields such as research **(BL5-Evaluate)** **CO6-** To apply the understanding of heredity and variation and genetic disorders and mutations and others in various fields or industries**(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG1(No poverty) SDG4(Quality education) SDG11(Sustainable cities and economies) SDG14(Life below water) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours
1	Chromosomes: Transmitters of heredity structure, types and special type of chromosomes Mendalism: Law of Inheritance Concept of gene : Allele, Multiple alleles: ABO System and Rh factor Importance of Blood Groups in Blood transfusion Extensions of Mendalism: Co-dominance, incomplete dominance gene interaction: Epistasis	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Sex determination and sex linkage: Sex chromosomes mechanism of sex determination Sex linked inheritance (Color blindness and Hemophilia) Linkage and crossing over gene expression Chromosome mapping: Gene mapping methods Linkage maps Twins: physical and mental traits	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Gamete formation: Spermatogenesis and Oogenesis Mitosis & Meiosis: Stages and significance differences. Nucleic Acids, DNA Replication Introduction to Genetic Engineering in brief Fine structure of gene genetic Code Split gene overlapping and pseudo gene.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	Extra chromosomal inheritance in Mitochondrial and Chloroplast effect Maternal inheritance Nucleo-cytoplasmic interaction Genetic disorders: Human Syndromes	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Mutation : Types causes and detection Types of mutants – lethal, conditional, biochemical, loss of function gain of function, germinal verses somatic mutants Gene mutation: Causes, insertion mutagenesis Chromosomal aberrations: variation in chromosome number Change in chromosome structure	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Identification of chromosomes and spotting as per theory syllabus	Experiments	BL2-Understand	4
2	Study of Linkage and sex linked inheritance	Experiments	BL3-Apply	4
3	Study of Mitosis and meiosis	Experiments	BL3-Apply	4
4	Study of Nucleic acids	Experiments	BL2-Understand	4
5	study of syndroms and other mutation	Field work	BL4-Analyze	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Principles of genetics By P K Gupta
Articles	https://www.nature.com/scitable/topicpage/gregor-mendel-and-the-principles-of-inheritance-593/
References Books	Genetics BY B D singh Genetics By: A G Gardner
MOOC Courses	https://nptel.ac.in/courses/102104052
Videos	https://www.google.com/search?sca_esv=e2da69de12d3bb4c&sca_upv=1&rlz=1C1NMEO_enIN999IN999&q=Principles+of+Genetics&tbm=vid&source=lnms&prmd=ivsnbmtz&sa=X&ved=2ahUKEwiHpqq9ioqGAxVG4zgGHcRzAgkQ0pQJegQIDBAB&biw=1366&bih=625&dpr=1#fpstate=ive&vld=cid:d538888b,vid:-PtxId_Ga7k,st:0

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	1	2	-	-	-	-	-	-	-	-	1	2	3
CO2	2	3	1	2	-	-	-	-	-	-	-	-	2	2	3
CO3	2	2	2	1	-	-	-	-	-	-	-	-	2	1	3
CO4	1	2	2	1	-	-	-	-	-	-	-	-	1	1	2
CO5	1	2	1	1	-	-	-	-	-	-	-	-	1	1	2
CO6	-	1	-	2	-	-	-	-	-	-	-	-	-	1	1

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Genetic Engineering, Tools and applications
Course Code	BSMB401(T)

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Student must have the detailed knowledge of Gene expression and hereditary information			**Co-Requisite/s**	Detailed study of genomics, proteomics and metabolomics tool			
Course Outcomes & Bloom's Level	**CO1-** To remember the role of all the enzymes used in the DNA editing**(BL1-Remember)** **CO2-** To understand the method of creating new molecules such as DNA & RNA**(BL2-Understand)** **CO3-** To understand the importance Nucleic acid editing tools**(BL2-Understand)** **CO4-** To evaluate the applications of in various fields such as research, Agriculture, Pharmaceutical industries**(BL5-Evaluate)** **CO5-** To apply the understanding of creation of new DNA , RNA & Protein and its use in different Fields.**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✓ Gender ✓ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to gene cloning and its necessity: DNA modifying enzymes: Restriction enzymes (RE)- structure function and types, polymerase, kinases, ligase, alkaline phosphatase, exonuclease etc.. Cloning methods. linkers and adaptors.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Methods of introduction of DNA into living cells, E.coli, plant and animal cells, Genetic transformation in plants:Agrobacterium mediated transformation in plants,structure and features of Ti and Ri plasmids.Genomic libraries and cDNA libraries.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Cloning vectors: Plasmids and Bacteriophages, Phagemids, Cosmids, Artificial chromosomes (BAC and YAC) for E.coli, yeast. Strategies for identification of recombinant clones containing cloned genes: Nucleic acid hybridization, immune screening etc. Expression vectors for E.coli andYeast.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	Tools for RDT: Restriction mapping, Southern and northern blotting, Forensic application of biotechnology: DNA fingerprinting and its applications, forensic medicine Molecular Pharming: Application	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Applications of RDT, Production of recombinant protein (Insulin, Growth hormone), production of Recombinant vaccine. Golden rice, Artifical seed production, biofertilizers and biopesticide production GM crops and GM food	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Preparation of stock and buffer solutions for DNA isolation	Experiments	BL3-Apply	2
2	Isolation of DNA from yeast cells.	Experiments	BL3-Apply	2
3	Isolation of DNA from Plant cell.	Experiments	BL3-Apply	2
4	Isolation of plasmid DNA	Experiments	BL3-Apply	2
5	Agarose gel electrophoresis of Genomic DNA	Experiments	BL4-Analyze	2
6	Isolation of RNA	Experiments	BL4-Analyze	2
7	Quantification of DNA by spectrophotometer(260/280nm)	Experiments	BL4-Analyze	2
8	To isolate the Auxotrophic mutants from the mixed culture sample of Microorganism	PBL	BL5-Evaluate	3 days

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	20

Part E

Books	TA Brown, Gene cloning 4 edition
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3078015/
References Books	James D watson.Molecular Biology Of gene, 4 edition
MOOC Courses	https://nptel.ac.in/courses/102103074
Videos	https://nptel.ac.in/courses/102103074

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	-	-	1	-	-	-	-	-	-	1	1	2
CO2	1	2	3	-	-	3	2	-	-	-	-	-	2	-	-
CO3	1	2	3	-	-	1	1	-	-	-	-	-	-	2	1
CO4	1	2	3	-	-	1	-	-	-	-	-	-	2	-	3
CO5	1	2	3	-	-	2	-	-	-	-	-	-	2	-	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Bioprocess Engineering
Course Code	BSMB402(T)

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	The student should have basic understanding of units, use of living organisms for the production of different metabolites			**Co-Requisite/s**	The student should have basic understanding of basic concepts of bioprocesses for the benefit of society			
Course Outcomes & Bloom's Level	**CO1-** The course prepares the student to understand the basic concepts of Bioprocess Engineering, its applications and future prospects.**(BL1-Remember)** **CO2-** The subject Bioprocess Engineering is designed for under graduate students of biotechnology for understanding of basic concepts of each and every division of the subject along with its applications in other fields. **(BL2-Understand)** **CO3-** The course aims to provide experimental basis, and to enable students to acquire a specialized knowledge and understanding.**(BL2-Understand)** **CO4-** The course aims to provide basis of analyzing the applications of Bioprocess Engineering in various fields of research and industries.**(BL3-Apply)** **CO5-** The course aims to provide basis of design, production and purification of bioproducts produced through research and in industries.**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕			**SDG (Goals)**	SDG4(Quality education)			

Part B

Modules	Contents	Pedagogy	Hours
Unit I	Units and dimensions: dimensional analysis, stiochiometric and composition relationship, Newton's law of viscosity and its measurement. Introduction to Bioprocess technology	Class room teaching (chalk-board), Power Point Presentations, Online Classes, Interactive Videos	8
Unit-II	Kinetics of microbial growth, death and product synthesis; Air and media sterilization, Types of bioreactor. Kinetics of batch and continuous reactor.	Class room teaching (chalk-board), Power Point Presentations, Online Classes, Interactive Videos	8
Unit-III	Transport phenomenon in biochemical engineering: Mass transfer, heat transfer, rheology Product recovery processes, centrifugation, chromatography, extraction process, crystallization, drying.	Class room teaching (chalk-board), Power Point Presentations, Online Classes, Interactive Videos	8
Unit-IV	Microbial Production of Vitamin B12, amino acids (Glutamic acid), Microbial production of Organic acids (Citric acid), solvents (Ethanol)	Class room teaching (chalk-board), Power Point Presentations, Online Classes, Interactive Videos	8
Unit-V	Aeration and agitation, Immobilization techniques and their applications, Microbial production of food-SCP, Product recovery processes.	Class room teaching (chalk-board), Power Point Presentations, Online Classes, Interactive Videos	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Media balancing experiments	Experiments	BL2-Understand	2
1	Isolation of industrially important microbes from the environment.	Experiments	BL3-Apply	2
3	Production of alcohol using different substrates and its downstream process	Experiments	BL3-Apply	2
4	Microbial production of citric acid using Aspergillus niger	Experiments	BL3-Apply	2
5	Microbial production of acetic acid.	Experiments	BL3-Apply	2
6	Organic Solvent production	Experiments	BL3-Apply	2
7	Microbial production of different biological products.	Experiments	BL4-Analyze	21 days

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	Bioprocess Engg. Principles, P.M. Doran, Elsevier
Articles	https://www.frontiersin.org/journals/bioengineering-and-biotechnology/sections/bioprocess-engineering
References Books	Principles of Fermentation Technology, Peter F. Stanbury, Allan Whitaker, Stephen Hall, Pergamon.
MOOC Courses	https://nptel.ac.in/courses/102106022 https://nptel.ac.in/courses/102106048
Videos	https://nptel.ac.in/courses/102106022 https://nptel.ac.in/courses/102106048

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	-	-	-	1	1	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	1	1	-	-	-	-	-
CO3	1	1	-	-	-	-	-	-	1	1	-	-	-	-	-
CO4	1	2	-	-	-	-	-	-	1	2	-	-	-	-	-
CO5	1	2	-	-	-	-	-	-	1	2	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Enzymology
Course Code	BSMB403(T)

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Should be acquainted with the historical aspects and concepts of enzymes and catalysis			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Student will be able to learn the major classes of enzyme and their functions in the cell**(BL1-Remember)** **CO2-** Student will understand the role of co-enzyme cofactor in enzyme catalyzed reaction**(BL2-Understand)** **CO3-** Differentiate between equilibrium and steady state kinetics and analyzed simple kinetic data and estimate important parameter (Km. Vmax, Kcat etc); **(BL2-Understand)** **CO4-** To define and describe the properties of enzymes in and regulates biochemical pathways (inhibition, allosterism)**(BL3-Apply)** **CO5-** To analyze options for applying enzymes and their inhibitors in medicine and various industries**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
I	Introduction to enzymes. Historical aspect of enzymes. Chemical nature and properties of enzymes. Classification and nomenclature of enzymes. Enzyme Commission Number. Enzyme Models: Fischer's Lock and key and Koshland's Induced fit hypothesis. Factors affecting enzyme activity	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
II	Mechanism of enzyme action (active site, chemical modification) and regulation (Zymogens, Isozymes). Enzyme specificity, Coenzymes and Cofactors Allosterism: Allosteric regulation of enzymes, Enzyme catalysis	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
III	Enzyme Catalysis and types. Free energy of activation and effect of catalyst. Enzyme kinetics: Kinetics of enzyme catalysed Reactions: The Michaelis Menten Equation. Line Weaver Burk Plot. Significance of Km and Vmax	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
IV	Enzyme purification, Isolation of enzymes, Homogenization techniques. Purification and large-scale production of enzymes, Stable storage of enzymes.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
V	Immobilization of enzymes, Methods, Advantages and disadvantages. Applications of enzymes in food and beverage industries, leather industries, textile industries. Abzymes and Plastic enzymes	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	To understand the various enzymes present in the different types of fruits and vegetbales	Experiments	BL2-Understand	3
II	To analyses the effect of substrate concentration on the enzyme activity	Experiments	BL4-Analyze	2
III	To determine the effect of temperature on the reaction rate of peroxidase enzyme	Experiments	BL5-Evaluate	2
IV	To determine the effect of pH on the reaction rate of peroxidase enzyme.	Experiments	BL5-Evaluate	2
V	To prepare the standard curve of protein using Folin Lowry method	Experiments	BL6-Create	2
VI	Immobilization of yeast cells by gel entrapment method	Experiments	BL6-Create	2
VII	To assay the activity of Urease enzyme in the legumes.	Experiments	BL5-Evaluate	2
VIII	Isolation and immobilization of various enzymes from natural resources	Internships	BL5-Evaluate	45 days

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Prasad.N.K ;Enzyme Technology: Pacemaker of Biotechnology;2nd Edition Palmer;Enzymes; Horwood Publishing Series. 2001
Articles	https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/enzyme-activity https://www.jbc.org/article/S0021-9258(20)34049-7/fulltext https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8169242/ https://pubs.acs.org/doi/10.1021/acsomega.2c07560
References Books	Biocatalysts and enzyme technology, Buchholz.K;Kasche.V, Bornscheuer.U.V, Published by Wiley-VCH, 2005. Wiseman, A: Handbook of Enzyme Biotechnology, 3rd Edition, Ellis Horwood Publication,2010 Buchholz.K;Kasche.V,Bornscheuer.U.T.;Biocatalysts and enzyme technology, Published by Wiley-VCH, 2005. Palmer,T; Enzymes: Biochemistry, Biotechnology, Clinical Chemistry ;Horwood Publishing House, Chichester, England, 2001. Bisswanger.H;Practical enzymology.. Wiley Publication. 2nd Edition, 2011
MOOC Courses	https://nptel.ac.in/courses/102103097
Videos	https://nptel.ac.in/courses/102103097

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	1	2	2	2	-	-	-	-	-	-	2	-	1
CO2	3	1	1	2	2	2	-	-	-	-	-	-	1	2	2
CO3	2	1	1	2	1	1	-	-	-	-	-	-	2	3	1
CO4	3	-	-	1	1	1	1	-	-	-	-	-	1	2	2
CO5	-	-	-	-	1	-	1	-	-	-	-	-	2	-	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Inorganic Chmeistry
Course Code	BSMBGEIII (T)

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Generic Elective							
Pre-Requisite/s	Knowledge of coordination bonding in complexes, Transition elements their properties			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember Knowledge of Transition elements, Acids and Bases, Oxidation and reduction, Complexes , Lanthanides, Actinides**(BL1-Remember)** **CO2-** To understand Properties and uses of Transition elements, Coordination compounds, Acids and Bases , Non aqueous solvents Lanthanides, Actinides**(BL2-Understand)** **CO3-** To Apply the Transition elements, Complexes, Lanthanides, Actinides in the different application**(BL3-Apply)** **CO4-** To Analyze the Structure , Bonding ,Magnetic Properties of Transition elements, Complexes**(BL4-Analyze)** **CO5-** To Evaluate the results analyzed**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
Module 1	Chemistry of Elements of First Transition Series: Characteristic properties of d-block elements Properties of the elements of the first transition series, their binary compounds such as Carbides, Oxides and Sulphides Complexes illustrating relative stability of their oxidation states, co-ordination number and geometry	Stoy telling activity Mnemonics Experienced examples, Quizzes Summarizing, PPT's	8
Module 2	UNIT – II: Chemistry of Elements of second and Third Transition Series: General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behavior, spectral properties and stereochemistry	Mnemonics , Experienced examples, , Videos , PPT's	8
Module 3	UNIT – III: A. Co-ordination Compounds Werner's co-ordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of co-ordination compounds, isomerism in co-ordination compounds, valance bond theory of transition metal complexes theory of transition metal complexes B. Oxidation and Reduction Use of redox potential data: analysis of redox cycle, redox stability in water: Frost, latimer and Pourbaix diagrams, Principles involved in the extraction of elements	Demonstrations, Videos, PPT's Virtual labs Group discussions	8
Module 4	Chemistry of Lanthanide Elements Electronic structure, oxidation states, ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds. B. Chemistry of Actinides General features and chemistry of actinides, chemistry of separation of Np. Pu and Am from U, similarities between the later actinides and the later lanthanide	Interactive videos PPT's Experienced examples	8
Module 5	UNIT – V A. Acids and Bases Arrhenius, Bronsted- Lowry, the Lux-Flood, solvent system and lewis concepts of acids and bases B. Non-aqueous Solvents Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH3 and liquid SO2.	Interactive videos , PPT's Experienced examples, Seminar	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
Module 3	Synthesis of Complex and Double salt	PBL	BL3-Apply	6
Experiment	To determine Acid Radical Nitrate Sulphate	Experiments	BL3-Apply	2
Experiment	To determine Acid radical Sulphide Nitrite	Experiments	BL3-Apply	2
Experiment	To determine th Basic Radical Group Zero	Experiments	BL3-Apply	2
Experiment	To determine the Basic Radical Group One	Experiments	BL3-Apply	2
Experiment	To determine Basic Radical Group 2	Experiments	BL3-Apply	2
Experiment	To determine the Basic Radical Group 3	Experiments	BL3-Apply	2
Experiment	o determine the Basic Radical Group 4	PBL	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	M.N.N Tandon Unified Chemistry 2010
Articles	
References Books	J.D.Lee Concise Inorganic Chemistry Fifth edition
MOOC Courses	https://nptel.ac.in/courses/104101093
Videos	https://nptel.ac.in/courses/104101093

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	3	3	2	-
CO2	3	2	1	-	-	-	-	-	-	-	-	3	3	2	-
CO3	2	2	1	-	-	-	-	-	-	-	-	2	2	1	-
CO4	2	3	1	-	-	-	-	-	-	-	-	1	1	2	-
CO5	2	2	2	-	-	-	-	-	-	-	-	1	1	2	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Bioethics and Biosafety
Course Code	BSMBSECIV (T)

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Theory only							
Course Category	Discipline Electives							
Pre-Requisite/s	scientific communication approaches for Bioethics and Biosafety			**Co-Requisite/s**	concept of containment level and Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).			
Course Outcomes & Bloom's Level	**CO1-** To remember the basic concepts and view of professional and scientific communication approaches for Bioethics and Biosafety **(BL1-Remember)** **CO2-** To understand the Introduction to science, technology and society, issues of access-Case studies/experiences from developing and developed countries. Ownership, monopoly and an environmental sustainability, public vs. private funding, biotechnology in international relations, globalization and development and their analysis.**(BL2-Understand)** **CO3-** To describe comprehensive understanding of Challenges for the Indian Biotechnological research and industries Bioethics – Necessity of Bioethics, different paradigms of Bioethics – National & International.**(BL3-Apply)** **CO4-** To provide Theoretical basis,and to enable students to analyze the basic concepts of the concept of containment level and Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP). Cartagena Protocol for biosafety **(BL4-Analyze)** **CO5-** To apply Appraise the current regulatory, quality control, and legal frameworksthat impact biotechnology and ethical behaviors that foster positive and productive interactions in diverse bioterrorism and convention on biological weapons. Social and ethical implications of biological weapons settings **(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Biotechnology And Society: Introduction to science, technology and society, issues of access-Case studies/experiences from developing and developed countries. Ownership, monopoly, traditional knowledge, biodiversity, benefit sharing, environmental sustainability, public vs. private funding, biotechnology in international relations, globalization, and development divide.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	6
2	Public acceptance issues for biotechnology: Biotechnology and hunger: Challenges for the Indian Biotechnological research and industries Bioethics – Necessity of Bioethics, different paradigms of Bioethics – National & International. Ethical issues against the molecular technologies	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Biosafety– Introduction to biosafety and health hazards concerning biotechnology. Introduction to the concept of containment level and Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP). Cartagena Protocol for biosafety	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	6
4	Biosafety assessment procedures in India and abroad. International dimensions in biosafety, bioterrorism, and convention on biological weapons. Social and ethical implications of biological weapons.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	6
5	Principles of bioethics: Legality, morality and ethics, autonomy, human rights, beneficence, privacy, justice, equity etc. The expanding scope of ethics from biomedical practice to biotechnology, bioethics vs. business ethics	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	Thomas J.A.-Biotechnology and Safety Assessment Thomas J.A., Fuch R.L Academic Press 3rd Edition 2002-ASM Press 3rd. ed. 2000
Articles	https://www.ndcebios.in/v1n1/2021010110.pdf https://www.researchgate.net/publication/353346609_ON_BIOETHICS_AND_BUSINESS_ETHICS
References Books	Fleming D.A., Hunt D.-Biological safety Principles and practices-ASM Press 3rd. ed. 2000
MOOC Courses	https://nptel.ac.in/courses/109106092
Videos	https://nptel.ac.in/courses/109106092

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	1	3	3	3	1	2	3	1	3	2	3
CO2	1	1	2	3	1	3	3	3	2	1	3	2	1	1	2
CO3	3	3	2	1	3	3	3	2	1	1	3	2	2	3	2
CO4	3	3	3	3	2	2	3	3	1	1	3	2	3	3	2
CO5	3	3	2	2	1	3	3	3	1	1	3	2	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Environmental Issues and Sustainable Development
Course Code	BSMBVACIV (T)

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Community Enganement and Service							
Pre-Requisite/s	Basic Knowledge of Environmental Issues and Sustainable Development			**Co-Requisite/s**	Goals and Targets of Sustainable Development Goals. Strategies for the implementation of Sustainable Development goals			
Course Outcomes & Bloom's Level	**CO1-** CO1. To develop sentiments and sensitize them towards environmental challenges and concept of sustainable development.**(BL2-Understand)** **CO2-** CO2. To acquire analytical skills/methods in assessing environmental impacts through a multidisciplinary approach;**(BL4-Analyze)** **CO3-** CO3. Ability to design sustainability performance metric to assess the impact on community's sustainable development**(BL5-Evaluate)** **CO4-** CO4. Acquire expertise and skills to evaluate feedback systems that can readjust the pathways of processes and procedures to ensure success in implementing sustainable development initiatives.**(BL1-Remember)** **CO5-** CO5. Students acquire skills to communicate, prepare, plan and implement the sustainable development project to achieve milestone of SDGs.**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG4(Quality education) SDG5(Gender equality) SDG12(Responsible consuption and production) SDG13(Climate action)				

Part B

Modules	Contents	Pedagogy	Hours
1	History and emergence of the concept of Sustainable Development, Environmental issues and crisis, Resource degradation, greenhouse gases and Effects, desertification, social insecurity, Industrialization, Globalization and Environment. Dimensions of Sustainable Development, Principles of Sustainable Development.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, discussion (questions & answers section)	8
2	Sustainable Development Goals: Capacity Building for Sustainable Environment, Sustainable Land Management. Global and regional progress on SD, Individual and collective actions for SD, Sustainable Mountain development, Clean air for Climate Mitigation and Human Health, Sustainable Corporate Practices, Sendai Framework for Disaster Risk Reduction, Conservation and Management of Global Forest Ecosystem	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	8
3	Society, environment, culture and economy; current challenges - natural, political, socio-economic imbalance; sustainable development initiatives and policies of various countries: global, regional, national, local; needs of present and future generation - political, economic, and environmental.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	8
4	GSD-2019, GSD 2023. Implementation Progress: SDG Progress report, Sustainability and development indicators and SDGs, UN's outlook of sustainable development and efforts	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures,Audio/Video clips, Group discussion.	8
5	Case Studies & Projects on Rural Sustainable Development (Indian village perspectives) - Village resources (broad perspectives); current challenges and thematic areas; village social hierarchy; village economy; needs of present and future generation; conflicts - sustainability and rural culture & tradition; road to achieving sustainable development goals - bridging conflicts and way forward.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion. Field visits. Industrial Visit (MSW/BMW/STP/ETP)	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Sustainable development aims to use natural resources and the environment to raise the standard of living while preserving future generations' capacity to meet their own needs	PBL	BL3-Apply	2 MONTHS
II	Analyze the current situation to identify specific challenges and opportunities in the targeted area or community in order to Assess environmental, economic, and social factors.	Internships	BL4-Analyze	1 MONTHS
III	Monitor energy production and savings, and assess environmental impact.	Field work	BL4-Analyze	1 MONTHS
IV	Plan a community solar farm where residents can buy or lease solar panels	Field work	BL3-Apply	2 MONTHS

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	1. Chiras, D. D and Reganold, J. P. (2010). Natural Resource Conservation: Management for a Sustainable Future.10th edition, Upper Saddle River, N. J. Benjamin/Cummins/Pearson. 2. John W. Twidell and Anthony D. (2015). Renewable Energy Sources, 3rd Edition, Weir Publisher (ELBS) 3. William P.Cunningham and Mary A. (2015) Cunningham Environmental Science: A Global Concern, Publisher (Mc-Graw Hill, USA)
Articles	1. Nhamo, Godwell, and Vuyo Mjimba. Sustainable Development Goals and institutions of higher education. Springer, 2020. 2. Bell, Simon, and Stephen Morse. Sustainability indicators: measuring the immeasurable?. Routledge, 2012. 3. Sørensen, Bent. Energy, Resources and Welfare: Exploration of Social Frameworks for Sustainable Development. Academic Press, 2016. 4. Dent, David, Olivier Dubois, and Barry Dalal-Clayton. Rural planning in developing countries: supporting natural resource management and sustainable livelihoods. Routledge, 2013. 4. Sala, Serenella, Biagio Ciuffo, and Peter Nijkamp. "A systemic framework for sustainability assessment." Ecological Economics 119 (2015): 314-325.
References Books	1. Elliott, Jennifer. 2012. An Introduction to Sustainable Development. 4th Ed. Routledge, London. 2. Rogers, Peter P., Kazi F. Jalal, and John A. Boyd. "An introduction to sustainable development." (2012).
MOOC Courses	https://nptel.ac.in/courses/109106200
Videos	https://nptel.ac.in/courses/109106200

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-1	3	2	-	-	-	1	-	1	-	-	-	2	2	3
CO2	1	3	2	-	-	-	2	-	1	-	-	-	1	2	3
CO3	3	2	1	-	-	-	3	-	2	-	-	-	1	2	-
CO4	2	3	1	-	-	-	3	-	2	-	-	-	-	3	1
CO5	2	3	1	-	-	-	3	-	3	-	-	-	-	-	-
CO6	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Environemntal Microbiology
Course Code	DSE I (T)

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	define microbes and environmental microbiology.			**Co-Requisite/s**	explain the distribution of microbes in several different environments, including water, sediments, soil and air.			
Course Outcomes & Bloom's Level	**CO1-** To define microbes and environmental microbiology.**(BL1-Remember)** **CO2-** explain the distribution of microbes in several different environments, including water, sediments, soil and air.**(BL2-Understand)** **CO3-** To describe the diversity of microbes in the different environments**(BL2-Understand)** **CO4-** To demonstrate how diversity is assessed and identify methodological issues associated with each technique.**(BL3-Apply)** **CO5-** To illustrate the ecological importance of microbes and their function in natural ecosystems**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG4(Quality education) SDG6(Clean water and sanitation)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to Environmental Microbiology, Significance, History and Challenges of Environmental Microbiology, cultured and uncultured microorganisms.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	7
2	Microbiology of soil:- Soil, Edaphon, Edaphic factors, Distribution, of Microorganisms in, Soil Activity of microorganisms, Symbiosis, forms, Soil bioremediation	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	8
3	Microbial ecology- Concept, development of microbial community in biosphere, biofilm and its ecological implication. Microbial diversity, extremophiles ecological adjustment and molecular adaptations in extreme conditions. Community ecology: community structure, benevolent - interactions, antagonistic interactions, (competition, antibiosis predation etc.)	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	7
4	Microbiology of air:- The air as an environment of microorganisms , Adaptation of microorganisms to the air environment, Important Airborne Pathogens Biological aerosols, Mechanisms protecting lungs against bioaerosol penetration, Survival and spread of bioaerosols Biological aerosols as a hazardous source for humans, Basic sources, of bioaerosol emission, Investigation of microbiological air pollutions Bioaerosol Control.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	8
5	Introduction to Waste water treatment, activated sludge process, bulking a foaming in activated sludge plants, process based on attached microbial growth, waste stabilization ponds. Sludge microbiology anaerobic digestion of wastewater and biosolids, biological aerosols and bioodors from wastewater treatment plants, Microbiological aspects of drinking w distribution of bioterrorsm and drinking ater safety.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Isolation of organisms from air.	Experiments	BL2-Understand	2
6	microbial test of milk with methylene blue reductase enzyme	Experiments	BL4-Analyze	3
3	Isolation of organisms from food sources	Experiments	BL2-Understand	2
4	Isolation of Yeast.	Experiments	BL3-Apply	2
5	Isolation of phosphorous solubilizing bacteria/fungus from soil sample.	PBL	BL2-Understand	6

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	30	40	

Part E

Books	Nuzhat Ahmed, Fouad M. Qureshi and Obaid Y. Khan, Industrial and environmental biotechnology Vol. I
Articles	https://www.epa.gov/sites/default/files/2015-12/documents/9131.pdf https://cdn.who.int/media/docs/default-source/wash-documents/water-safety-and-quality/dwq-guidelines-4/gdwq4-with-add1-chap7.pdf?sfvrsn=3bdd70a5_3
References Books	Michael T Madigan Brock Biology of Microorganisms 11th Edition
MOOC Courses	https://nptel.ac.in/courses/105107173 https://nptel.ac.in/courses/109105203 https://nptel.ac.in/courses/102105087
Videos	https://nptel.ac.in/courses/105107173 https://nptel.ac.in/courses/109105203 https://nptel.ac.in/courses/102105087

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	2	2	3	-	-	-	-	-	-	1	3	-
CO2	1	1	1	2	-	3	3	-	-	-	-	-	1	3	3
CO3	2	1	-	1	2	3	3	-	-	-	-	-	2	-	2
CO4	3	3	3	3	3	2	3	-	-	-	-	-	3	1	3
CO5	1	2	1	1	2	3	-	-	-	-	-	-	1	2	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Agricutlure Microbiology
Course Code	DSE II (T)

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Basic knowledge of microscope and other microbiological techniques			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** TO Understand and accurately apply terminology used in the field of microbiology, and understand the fundamental differences between different types of microorganisms including bacteria, viruses, fungi, prions and protozoa**(BL1-Remember)** **CO2-** Describe the structure and biology of bacterial cells, including the arrangement and replication of genetic material, and understand the concept of virulence and virulence factors**(BL2-Understand)** **CO3-** To analyse how microorganisms may be detected within various environments, including how they may be cultivated within the laboratory setting, and molecular methods of detection**(BL3-Apply)** **CO4-** To identify specific microorganisms important to animals, plants and soil ecosystems, and explain why these microorganisms are significant**(BL4-Analyze)** **CO5-** Review and evaluate readings relating to microbiology and agricultural production**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction – Soil as an environment for microorganisms. Classification of soil, physical and chemical properties of soil, structure of soil. Microbial interactions - mutualism, commensalism, amensalism, synergism, parasitism, predation and competition. Microbial interactions between plants–phyllosphere, mycorrhizae, rhizosphere and symbiotic association in root nodules. Biofertilizer – VAM, Rhizobium, Frankia, Azospirillum, Azotobacter, cyanobacteria and Azolla.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	8
2	Soil microbes and fertility of soil. Roles of microbes in biogeochemical cycles, Microorganisms in soil processes, carbon cycle, organic matter decomposition, humus formation, nitrogen cycle, nitrogen fixation, symbiotic, non-symbiotic, associative organisms, ammonification, nitrification, denitrification, reactions, organisms involved.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	8
3	Plant protection – phenolics – phytoalexins and related compounds. Bio insecticides – viral, bacterial and fungal, Chemical Pesticide and their adverse effect on agriculture (soil and crop).	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	8
4	Plant pathogenic Microorganisms :- Historical Background, Disease symptoms, Mode of Entry of pathogens, Plant Disease Resistance, Physiology of Parasitism, Factors effecting disease Incidence, Algal, Fungal, Viral, Bacterial disease. Bacterial diseases of agricultural crops -pathogens, symptoms and control measures with reference to paddy, cotton, maize, tomato, citrus, mango and potato. Mycoplasma Disease, Nematode Disease.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	8
5	Microorganisms Harmful to Man and Animal: - Resentence of animal to pathogens, Group of organisms causing disease, Foot mouth disease, Johne's disease, Control of Johne's disease (JD) in cattle, poisoning of livestock by blue-green algae	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Enumeration of microbial population in soil; qualitative and quantitative distribution;	PBL	BL3-Apply	1 month
2	isolation of symbiotic nitrogen fixing bacteria –non symbiotic and associative symbiotic bacteria;	Experiments	BL3-Apply	2
3	soil algae ; nitrification	Experiments	BL4-Analyze	4
4	isolation of sulphur and iron bacteria;	Experiments	BL5-Evaluate	2
5	Isolation and study of phosphobacteria and phosphorus solubility	Experiments	BL5-Evaluate	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	20	60	

Part E

Books	Martin Alexander 1976. Introduction to soil microbiology Willy Eastern Ltd. New Delhi. Robert LTate III. 1995. Soil Microbiology. John Wiley & Sons, New York, pp 398.
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8313292/
References Books	Subbarao, N.S. 1977. Soil microorganisms and plant growth, Oxford & IBH Publishing Co., New Delhi. Walker, N. 1975. Soil Microbiology. Butterworths, London AGRICULTURAL MICROBIOLOGY By D. J. BAGYARAJ, G. RANGASWAMI Alexander M. 1997. Introduction to soil microbiology, John Wiley & Sons, Inc, New York. EcEldowney S., Hardman, D.J. and Waite, S. 1993. Pollution Ecology and Biotreatment-Longman Scientific Technical.
MOOC Courses	https://nptel.ac.in/courses/105107173
Videos	https://nptel.ac.in/courses/105107173

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	-	-	2	-	-	-	2	2	-	2	2	3
CO2	2	1	2	-	-	3	-	-	-	2	1	-	1	2	2
CO3	2	2	2	-	-	1	-	-	-	1	1	-	1	1	2
CO4	1	2	1	-	-	2	-	-	-	1	2	-	3	1	1
CO5	2	2	1	-	-	1	-	-	-	1	-	-	3	2	1
CO6	2	2	3	-	-	3	-	-	-	-	2	-	2	1	1

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Agriculture Biotechnology and Intellectual property rights
Course Code	DSE II (T)

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	Student should have basic knowledge of botany and genetic engineering			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To define and contrast the terms agriculture and agricultural biotechnology**(BL1-Remember)** **CO2-** To understand the techniques, skills, and modern engineering tools necessary for engineering practice in agriculture biotechnology**(BL2-Understand)** **CO3-** To define the concept of utilizing plants for production of vaccines and production of biofertilizers**(BL2-Understand)** **CO4-** To apply the knowledge of engineering principles of agriculture biotechnology to living entities for societal welfare**(BL3-Apply)** **CO5-** The students will be able to develop the relationship between science and society and will be able to give justification for biotechnological manipulation of plants for human use**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
I	Introduction To Agricultural Biotechnology: Origin of cultivated plants and plant indication, Introduction to Indian Agriculture heritage; Soil management and its relevance in Pre-modern India. Review of plant cell structure and function; Review of water uptake Introduction to plant nutrition; Mineral availability- uptake of minerals	Lecture method, demonstrations, field visit, ABL, Case studies, ABL.	8
II	Methods of breeding self-pollinated and vegetatively propagated plants; Seed Germination and Seedling Growth; Photoperiodism and its significance; Vernalization and hormonal control. Heterosis-Genetic and Molecular basis, Apomixis -Mechanism and significance in crop improvement	Lecture method, demonstrations, field visit, ABL, Case studies, ABL.	9
III	Post Harvest Biotechnology: Importance of post harvest physiology; Stages of growth; Maturity indices; Fruit ripening- changes during ripening; Post harvest losses-types; Technologies to control post harvest losses; Respiration and transpiration loss, methods to measure respiration and transpiration losses; Spoilage of fruit and vegetable, Microbial contaminants and post-harvest pathology	Lecture method, demonstrations, field visit, ABL, Case studies, ABL.	8
IV	Biotechnology In Organic Farming: Organic farming, principles and its scope in India; Role of Biotechnology in organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming; Molecular Farming And Nitrogen Fixation: Molecular farming for the production of industrial enzymes, biodegradable plastics, polyhydroxybutyrate, antibodies, edible vaccines; Metabolic engineering of plants for the production of fatty acids, industrial oils, flavonoids etc.,.	Lecture method, demonstrations, field visit, ABL, Case studies, ABL.	9
V	Introduction to Intellectual Property Rights Concept and Theories Kinds of Intellectual Property Rights Economic analysis of Intellectual Property Rights Need for Private Rights versus Public Interests Advantages and Disadvantages of IPR, International Regime Relating to IPR TRIPS and other Treaties (WIPO,WTO, GATTS)		8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	To analyze the soil samples of various locations to check it sfertility.	PBL	BL4-Analyze	1 week
II	To study the mechanism and significance in crop improvement.	Industrial Visit	BL4-Analyze	8 hrs
III	To apply for the patent for a specific product, product developement process or any idea	PBL	BL6-Create	15 days

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	MS Swamynathan,Biotechnology in Agriculture, a Dialogue,1981 Arun K. Sharma,Hand book of organic farming Agrobios,2002
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8751662/
References Books	Arie Altman Paul Hasegawa,Plant Biotechnology and Agriculture,2011 K. Lindsey and M.G.K. Jones,Plant biotechnology in Agriculture, 1989
MOOC Courses	https://nptel.ac.in/courses/126105014 https://nptel.ac.in/courses/126105337 https://nptel.ac.in/courses/109106128
Videos	https://nptel.ac.in/courses/126105014 https://nptel.ac.in/courses/126105337 https://nptel.ac.in/courses/109106128

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	1	2	-	-	-	-	-	1	2	3	2
CO2	1	-	2	3	-	3	2	-	-	-	-	-	1	2	2
CO3	1	3	1	3	1	1	1	1	-	-	-	-	-	1	2
CO4	2	1	2	2	1	-	2	-	-	-	-	-	2	2	1
CO5	2	3	1	2	2	2	1	-	-	-	-	-	3	2	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Waste Management
Course Code	DSE III (T)

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	Knowledge of basic science and environment			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Learn basic concepts of waste management, beginning from source generation to waste disposal.**(BL1-Remember)** **CO2-** Develop understanding on various technological applications for processing of waste and their disposals in various ways.**(BL2-Understand)** **CO3-** Acquire knowledge on waste to energy productions in the perspectives of sustainable development.**(BL2-Understand)** **CO4-** Apply basic concepts in hazardous waste management and integrated waste management for urban areas..**(BL3-Apply)** **CO5-** Creating knowledge on waste characterization and its management practiced in various cities of India**(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to Waste, Definitions, sources, types and composition of various types of wastes. Characterization of Municipal Solid Waste (MSW), Industrial waste, Biomedical Waste (BMW) and Chemical waste. Classification and Quantification of waste. Waste generation rates. Impact of waste on environmental health.	lecture method, collaborative learning, ABL	8
2	Municipal Soild Waste Disposal Methods – composting, incineration, pyrolysis, medical waste disposal strategies. Disposal in landfills: site selection and operation of sanitary landfills; leachate and landfill gas management.	lecture method, collaborative learning, ABL, field visit, demonstrations	8
3	Hazardous wastes Disposal Method and treatment technologies. Hazardous waste landfills: site selection, design and operation. Different type of incineration; land fill classification, types, methods and sitting consideration.	lecture method, collaborative learning, ABL, field visit, demonstrations	8
4	Handling and segregation of wastes at source. Collection, transportation and storage of municipal solid wastes; labeling and handling of hazardous wastes. Public participation and the role of NGOs. Concepts of waste reduction, recycling and reuse. Concepts of waste reduction, recycling and reuse.	lecture method, collaborative learning, ABL, field visit, demonstrations	8
5	Sources of energy generation, incineration, pyrolysis, gasification of waste using gasifiers, direct combustion of MSW- production, land fill gas generation and utilization, present status of technologies for conversion of waste into energy. Environmental and health impacts of waste to energy conversion. Rules related to the handling, treatment and disposal of MSW, BMW and Hazardous waste in India	lecture method, collaborative learning, ABL, field visit, demonstrations	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Impact of waste on human health & environment	Seminar	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	Sustainable solid waste management: issues, policies, and structures. Academic Foundation, New Delhi. Dhamija, U., (2009).
Articles	https://www.sciencedirect.com/science/article/pii/S2666049020300244
References Books	Handbook of solid waste management, McGraw-Hill Publication, USA Kreith F, Tchobanoglous G (2002)
MOOC Courses	https://nptel.ac.in/courses/105103205
Videos	https://nptel.ac.in/courses/105103205

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	2	-	-	-	2	-	-	1	-	1
CO2	2	3	2	2	2	2	-	-	-	2	-	-	1	-	3
CO3	3	1	1	-	1	-	-	-	-	-	-	-	3	2	3
CO4	3	2	-	2	1	-	-	-	-	-	-	-	2	3	3
CO5	-	-	1	-	2	-	-	-	-	-	-	-	-	1	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Organic Mechanisms in Biology
Course Code	DSE III (T)

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	Provide knowladge about Metabolic Mechanisms in Living Beings			**Co-Requisite/s**	relate with other clinical and research as well as toxicological feilds.			
Course Outcomes & Bloom's Level	**CO1-** To describe the concept of organic mechanisms (metabolism) in animals**(BL1-Remember)** **CO2-** Understandabout the metabolism of biomolecules and toxicology**(BL2-Understand)** **CO3-** To understandthe importanceofmetabolism in lifeanditsapplications in other sciences**(BL3-Apply)** **CO4-** To provideexperimentalbasis andtoenablestudentstobasic concept of metabolism and toxicology**(BL4-Analyze)** **CO5-** Toevaluatetheapplicationsofbiological mechanism and toxicology invariousfieldssuchasresearch anddevelopment.**(BL5-Evaluate)** **CO6-** Toapply theunderstanding of metabolism and toxicologyinvarious levels.**(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Integration of metabolism. Carbohydrate metabolism: Glycolysis Krebs Cycle glycogenolysis glycogenesis PPP cycle ETS Gluconeogenesis, regulation of Carbohydrate metabolism	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Degradation of fatty acids: Beta oxidation Oxidation of odd carbon chain and unsaturated fatty acids. Biosynthesis of lipids in prokaryotes Regulation of lipid metabolism	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Biosynthesis of amino acids Degradation of amino acids regulation of amino acid metabolism; Urea Cycle.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	Biosynthesis and degradation of purine nucleotides, and regulation; Biosynthesis and Degradation of Pyrimidine nucleotide and regulation. Inborn errors in metabolism	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Basic concept of Toxicology toxicity testing LC 50 and LD 50 & chronic toxicity LD50 acute & chronic toxicity Occupational health hazards Heavy metal toxicity- Pb Cd & Hg Pesticides and their toxicological effects	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	IDetermination of Cabohydrate oin serum	Experiments	BL4-Analyze	8
2	Determination of Protein in blood serum and BMI	Experiments	BL4-Analyze	8
3	Determination of Cholestrol in blood	Experiments	BL4-Analyze	4
4	determination of urea and uric acid	Experiments	BL4-Analyze	4
5	Toxicity testing	Experiments	BL5-Evaluate	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	20	60	0

Part E

Books	Biochemistry by: Satyanarayana U Ch akrapani U
Articles	https://pubs.acs.org/doi/10.1021/acs.jchemed.5b00901
References Books	Principles of Biochemistry by: Nelson Cox & Lehninger A.L.
MOOC Courses	https://www.khanacademy.org/science/ap-biology/cellular-energetics/cellular-
Videos	https://www.khanacademy.org/science/ap-biology/cellular-energetics/cellular-energy/v/introduction-to-metabolism-anabolism-and-catabolism

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	1	2	2	-	-	-	-	-	-	-	1	2	3
CO2	2	3	1	2	2	-	-	-	-	-	-	-	2	2	3
CO3	2	2	2	1	1	-	-	-	-	-	-	-	2	1	3
CO4	1	2	2	1	1	-	-	-	-	-	-	-	1	1	2
CO5	1	2	1	1	2	-	-	-	-	-	-	-	1	1	2
CO6	2	1	-	1	1	-	-	-	-	-	-	-	-	1	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Molecular Diagnostics
Course Code	DSE IV (T)

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Embedded theory and lab							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	Student must be aware of basic immulogy and immunological assays.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** understanding of the basic principles and clinical significance of laboratory testing in the field of molecular diagnostics.**(BL1-Remember)** **CO2-** Demonstrate an understanding of basic molecular diagnostic techniques**(BL2-Understand)** **CO3-** Demonstrate an understanding of electrophoresis in the separation of DNA fragments**()** **CO4-** Apply molecular diagnostic techniques to the identification and diagnosis of diseases**(BL3-Apply)** **CO5-** Understand the basics in quality control and quality assurance**(BL2-Understand)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG8(Decent work and economic growth)				

Part B

Modules	Contents	Pedagogy	Hours
I	Enzyme Immunoassays: Comparison of enzymes available for enzyme immunoassays, conjugation of enzymes. Solid phases used in enzyme immunoassays. Homogeneous and heterogeneous enzyme immunoassays.Enzyme immunoassays after immuno blotting.	lecture method,Demonstrations, experiments, ABL, PBL , case studies	6
II	Enzyme immuno histochemical techniques: Use of polyclonal or monoclonal antibodies in enzymes immuno assays. Applications of enzyme immunoassays in diagnostic microbiology; Molecular methods in clinical microbiology: Applications of PCR, RFLP, Nuclear hybridization methods, Single nucleotide polymorphism and plasmid finger printing in clinical microbiology	lecture method,Demonstrations, experiments, ABL, PBL , case studies	7
III	Laboratory tests in chemotherapy: Susceptibility tests: Micro-dilution and macro-dilution broth procedures. Susceptibility tests: Diffusion test procedures. Susceptibility tests: Tests for bactericidal activity. Automated procedures for antimicrobial susceptibility tests.	lecture method,Demonstrations, experiments, ABL, PBL , case studies	8
IV	Automation and rapid diagnostic approach: Automation in microbial diagnosis, rapid diagnostic approach including technical purification and standardization of antigen and specific antibodies.	lecture method,Demonstrations, experiments, ABL, PBL , case studies	8
V	Idiotypes and immunodiagnostic: Concepts and methods in idiotypes.Immunodiagnostic tests- Immuno florescence. Radioimmunoassay. Diagnostic tools: HPLC, Electron microscopy, flow cytometry and cell sorting.	lecture method,Demonstrations, experiments, ABL, PBL , case studies	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	To isolate genomic DNA from the animal sample	Experiments	BL3-Apply	6
II	To anlayse immunological activity using various assays	PBL	BL3-Apply	7
III	To perform ELISA test	PBL	BL5-Evaluate	6
IV	To preform radial immunodiffsion	Experiments	BL3-Apply	5
V	To analyse the AIDS patients through immunological assays and moelcular markers	Case Study	BL5-Evaluate	1 week
VI	Detection and identification of microorganisms using molecular techniques	PBL	BL3-Apply	1 week

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Williams, Bethany Jill, Chloe Knowles, and Darren Treanor. "Maintaining quality diagnosis with digital pathology: a practical guide to ISO 15189 accreditation." Journal of clinical pathology 72.10 (2019): 663-668. Modern Approaches to Quality Control. Croatia, IntechOpen, 2011.
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1214554/
References Books	Moumtzoglou, Anastasius, ed. Laboratory Management Information Systems: Current Requirements and Future Perspectives: Current Requirements and Future Perspectives. IGI Global, 2014. Burnett, David. A Practical Guide to ISO 15189 in Laboratory Medicine. United Kingdom, ACB Venture Publications, 2013.
MOOC Courses	https://nptel.ac.in/courses/127105391
Videos	https://nptel.ac.in/courses/127105391

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	1	-	1	-	-	-	-	-	-	3	3	1
CO2	1	3	2	2	1	3	-	-	-	-	-	-	2	2	1
CO3	1	1	2	-	1	3	-	-	-	-	-	-	2	2	1
CO4	2	1	2	1	3	1	-	-	-	-	-	-	2	1	3
CO5	1	1	-	1	1	1	-	-	-	-	-	-	1	1	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Frontiers in Biotechnology & Microbiology
Course Code	DSE IV (T)

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	To be familiar with the basics of biomolecules, physiology and genetic composition of prokaryotic and eukaryotic cell.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To understand the strategies and applications of genetically modifies crops. **(BL2-Understand)** **CO2-** To understand and apply the working principles of biofertilizers and bioinsecticides for crop improvement.**(BL3-Apply)** **CO3-** To analyze the gene behavior and genetic modifications in the field of health and medicine.**(BL4-Analyze)** **CO4-** To identify the genetic and infectious diseases using various biotechnological tools.**(BL1-Remember)** **CO5-** To develop an improved & efficient drug using homology modelling & structure-based drug designing for the treatment of various diseases**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
I	Artificial Seed – Definition, Techniques, factors affecting, applications limitations, Germplasm preservation-Introduction, principle, Long term, storage, factors affecting, short/medium storage techniques, applications , limitations, GM Crops - Herbicide resistance, bacterial, fungal, virus, insect , Molecular farming.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
II	Biofertilizers and Biopesticide: Biofertilizers – Definition, Principle advantages. Mass production and field application – Rhizobium Azotobacter, Azospirillum, Acetobacter, Azolla, Cyanobacteria, PSB, VAM, Green manure and compost, Principle and applications of bacterial, fungal, viral and plant origin pesticides	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
III	Stem cells : unipotent, pleurepotent and totipotent stem cells, fertilization: Process, types and application, Gene therapy: Types –, Somatic, Germ line, Augmentation. Gene therapy strategies for cancer Gene therapy: Types – Somatic, Germ line, Augmentation. Gene therapy, strategies for cancer.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
IV	Forensic medicine: Preparation of DNA sample, Approaches of DNA analysis, Public Health: Epidemiology, Diagnosis of infectious diseases, Diagnosis of genetic diseases. Diagnosis of cancer.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
V	Structure -based drug designing: Introduction , Structure based- drug designing approaches, , Target identification and validation , Homology modelling and protein folding, pharmacophore mapping.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Application of molecular markers in sex determination of various plants	Internships	BL5-Evaluate	30 days
II	Production of Artificial seeds and its preservation	PBL	BL5-Evaluate	6 days

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	Gupta.P.K ;Biotechnology and Genomics
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8488131/
References Books	Kumar.J;Pharmaceutical Biotechnology
MOOC Courses	https://nptel.ac.in/courses/102103041 https://nptel.ac.in/courses/102106070 https://nptel.ac.in/courses/102103013 https://nptel.ac.in/courses/102103016 https://nptel.ac.in/courses/102103074
Videos	https://nptel.ac.in/courses/102103041 https://nptel.ac.in/courses/102106070 https://nptel.ac.in/courses/102103013 https://nptel.ac.in/courses/102103016 https://nptel.ac.in/courses/102103074

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	2	-	-	-	-	-	-	1	2	2
CO2	3	2	2	2	2	-	2	-	-	-	-	-	2	2	2
CO3	2	1	3	2	2	1	1	-	-	-	-	-	3	2	3
CO4	1	1	2	2	1	2	2	-	-	-	-	-	3	1	3
CO5	2	-	1	-	2	2	2	-	-	-	-	-	2	3	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Medical Microbiology
Course Code	DSE V (T)

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	This course provides learning opportunities in the basic principles of medical microbiology and infectious disease.			**Co-Requisite/s**	It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora.			
Course Outcomes & Bloom's Level	**CO1-** This course provides learning opportunities in the basic principles of medical microbiology and infectious disease.**(BL1-Remember)** **CO2-** It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora. **(BL1-Remember)** **CO3-** It also provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases. **(BL2-Understand)** **CO4-** To understand the importance of pathogenic bacteria in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract, skin and soft tissue.**(BL3-Apply)** **CO5-** Helps to understand the use of lab animals in medical field. Explain the methods of microorganisms control, e.g., chemotherapy & vaccines. Solve problems in the context of this understanding. Recall the relationship of this infection to symptoms, relapse and the accompanying pathology.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Fundamental Concepts: History of microbiology, Discovery of microorganisms, Contributions of Louis Pasteur and Robert Koch in Medical Microbiology. Requirements for microbial growth, growth factors, culture media- synthetic and complex, types of media. Obtaining Pure Cultures, Preserving Bacterial Cultures, Growth Curves and generation time, Control of microbial growth, general concept of effect of environmental factors on growth of microbes.	Tutorials, Collaborative, Demonstrations, videos, case studies , tutorials	8
2	Bacterial Cells - fine structure and function: Size, shape and arrangement of bacterial cells. Cell membrane, cytoplasmic matrix, inclusion bodies (e.g. magnetosomes), nucleoid, Ultrastructure of Gram +ve and Gram –ve bacterial cell wall, Pili, Capsule, Flagella and motility.	Tutorials, Collaborative, Demonstrations, videos, case studies , tutorials	8
3	Principles of Diseases and Epidemiology: Relationship between Normal microbiota and host, Opportunistic microorganisms, nosocomial infections, Development and spread of infectious disease: invasion, pathogen, parasite, pathogenicity, virulence, carriers and their types.	Tutorials, Collaborative, Demonstrations, videos, case studies , tutorials	7
4	Bacterial Diseases (with reference to etiology, clinical symptoms, virulence factors involved, detection and prevention) Respiratory tract infections: Diphtheria and Tuberculosis, Gastrointestinal tract infections, staphylococcal food poisoning and E. coli gastroenteritis, Urinary tract infections: gonorrhea and syphilis.	Tutorials, Collaborative, Demonstrations, videos, case studies , tutorials	8
5	Antimicrobial chemotherapy and emerging antimicrobial resistance: Spectrum of antimicrobial activity, action of antimicrobial drugs, inhibitors of cell wall synthesis, anti-mycobacterial antibiotics, inhibitors of protein synthesis and nucleic acid synthesis, competitive inhibitors of essential metabolites, antifungal, antiviral, anti-protozoan drugs; effectiveness of chemotherapeutic agents, concepts of antimicrobial resistance, novel methods to combat increasing antimicrobial resistance.	Tutorials, Collaborative, Demonstrations, videos, case studies , tutorials	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
5	Antibiotic sensitivity test against microorganism	PBL	BL3-Apply	1 week

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	Gerard J. Tortora, Berdell R. Funke, Christine L. Case-Microbiology: An Introduction-9th edition
Articles	http://microbiology.free.fr/Presentations/antimicrobialchemotheray.pdf
References Books	Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, Prescott, Harley, and Klein's Microbiology 8th edition
MOOC Courses	https://nptel.ac.in/courses/102105087 https://nptel.ac.in/courses/102103015
Videos	https://nptel.ac.in/courses/102105087 https://nptel.ac.in/courses/102103015

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	2	1	3	-	-	-	-	-	-	1	3	2
CO2	1	2	1	-	1	3	-	-	-	-	-	-	2	2	1
CO3	3	3	3	3	3	-	3	-	-	-	-	-	3	1	3
CO4	1	2	1	1	1	3	3	-	-	-	-	-	3	2	1
CO5	3	2	2	2	3	3	-	-	-	-	-	-	1	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Medical Biotechnology
Course Code	DSE V (T)

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Embedded theory and lab							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	Students acquainted with the fundamental concepts of nanotechnology and develop an understanding to employ its principles in modern biotechnology applications.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** The students are introduced to the biological revolutions in this field.**(BL1-Remember)** **CO2-** To understand the role of biotechnology in the world wide market**(BL2-Understand)** **CO3-** To learn about biosensors, vaccine production, monoclonal antibodies, nanotechnology and its applications.**(BL2-Understand)** **CO4-** The students will be able to demonstrate the use of biotechnology in solving various medical problems**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
I	Introduction – Origin, significance & worldwide market of Medical Biotechnology. Revolution in clinical diagnosis, Antibody and Nucleic Acid Hybridization techniques, Imaging techniques (Nanodiagnosis).	Lectue methods, demonstrations, experiments, ABL, PBL, Field visits	8
II	Genetic & Metabolic Disorders – Introduction, Classification, Impact of genetic diseases on human health - Chromosome errors - Down syndrome, Klinefelter's and Turner's syndrome. Metabolic disorders – Phenylketonuria, Homocystinuris, Mucopolysaccharidosis, Gangliosidosis, Gaucher's disease, Diabetes, Hemophilia and sickle cell anemia. Treatment of Genetic diseases - prenatal diagnosis, Genetic Counseling - Ethical, Legal and Social Issues	Lectue methods, demonstrations, experiments, ABL, PBL, Field visits	8
III	Revolution in treatment – Recombinant DNA technology for human insulin, Hepatitis B vaccine. Tissue plasminogen activator, clotting factor VIII. Antibody Engineering and Therapeutic Antibodies. Phage therapy.	Lectue methods, demonstrations, experiments, ABL, PBL, Field visits	8
IV	Cancer - Molecular, cellular and genetic basis of cancer, tumor virus and oncogenes, tumor suppressor genes and mechanism of action of p53 proteins. Stem Cells - Sources and types of stem cells, Stem cell transplant and its types, Potential targets for stem cell treatment, Therapeutic applications of stem cells, Regenerative medicine and Stem cell ethics. Skin Grafting	Lectue methods, demonstrations, experiments, ABL, PBL, Field visits	8
V	Gene therapy- basic approaches and types of gene therapy, vectors used in gene therapy, application of gene therapy in medicine. Nanobiotechnology - Introduction, types and structures of nanoparticles, biosynthesis of nanoparticles, application of nanoparticles in treatment.	Lectue methods, demonstrations, experiments, ABL, PBL, Field visits	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Biochemical test for identification of bacteria	Experiments	BL4-Analyze	3
II	Extraction and separation of Antigen proteins from Bacteria & protozoa	Experiments	BL4-Analyze	3
III	Estimation of blood glucose.	Experiments	BL4-Analyze	2
IV	Estimation of cholesterol in blood.	Experiments	BL4-Analyze	2
V	Estimation of iron in blood.	Experiments	BL5-Evaluate	3
VI	Biological synthesis of nanoparticles	Experiments	BL6-Create	2
VII	Widal test	PBL	BL4-Analyze	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Glick B.R. and Pasurank..Molecular biotechnology – Principle and Applications of Recombinant DNA- J.I.(4th edition), ASM Press. 2010. Anthony D. Ho, Hoffman. R, and Esmail D. Zanjani, Stem Cell Transplantation (4th edition), Wiley – liss publishers, 2006. Hornyak. G.L , Moore. J.J. Tibbals H.F., Dutta. J. Fundamentals of Nanotechnology (1st edition), CRC press, 2008.
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6153617/
References Books	Jogdand. S. N. Medical Biotechnology –, (4th edition), Himalayan publishing house, 2004. Freshney.I, Stacey. G. N, Auerbach.J.M, Culture of Human Stem Cells (1st edition) , Wiley – Liss publishers, 2007.
MOOC Courses	NA
Videos	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6153617/

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	1	1	-	-	-	-	-	-	-	1	2	1
CO2	2	2	2	2	3	1	2	-	-	-	-	-	2	1	2
CO3	3	1	1	2	2	-	2	-	-	-	-	-	2	1	2
CO4	2	1	1	2	1	3	1	-	-	-	-	-	1	1	1
CO5	1	2	2	1	1	-	1	-	-	-	-	-	1	3	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Industrial Microbiology
Course Code	DSE VI (T)

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Explain the various fermentation strategies and the growth kinetics of industrial microorganisms			**Co-Requisite/s**	the environmental and nutritional factors affecting the production of various metabolites. the best conditions and optimization protocol needed for various microbial products			
Course Outcomes & Bloom's Level	**CO1-** To identify the different types of fermenters**(BL1-Remember)** **CO2-** Explain the various fermentation strategies and the growth kinetics of industrial microorganisms **(BL2-Understand)** **CO3-** Discuss the methods for the production of certain products (metabolites) using different microorganisms **(BL2-Understand)** **CO4-** Describe the environmental and nutritional factors affecting the production of various metabolites**(BL3-Apply)** **CO5-** Select the best conditions and optimization protocol needed for various microbial products**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG4(Quality education) SDG8(Decent work and economic growth)				

Part B

Modules	Contents	Pedagogy	Hours
1	Bioreactor / Fermenter – types & operation of Bioreactors, physico-chemical standards used in bioreactors, limitations of bioreactors, stages of fermentation processes, Media design for fermentation processes, Solid substrate fermentation, Fermenters (Stirred tank, bubble columns, airlift. Bioreactors, Static, Submerged and agitated fermentation), advantages & disadvantages of solid substrate & liquid fermentation	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
2	Technology of Microbial cell maintenance – steps to maintain microbial culture in an aseptic & sterile environment (how to inoculate, preserve & maintain), Strain preservation, maintenance and strain improvement by mutation of gene transfer processes.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visits	8
3	Downstream processing – extraction, separation, concentration, recovery & purification, operations (Insulin, Vitamins, Metabolites), Industrial production of Ethyl alcohol, Acetic Acid (Vinegar), Citric acid, lactic acid, α-amylase, protease penicillin, tetracycline and vitamin B12, with reference to easily available raw materials, Production of herbal drugs.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visits	8
4	Enzyme technology – nature of enzymes, application of enzymes, limitations of microbial cells used as catalysts in fermentation, multi-enzyme reactors, genetic engineering & protein engineering of enzymes, cloning strategy for enzymes, technology of enzyme production, use of immobilized cells and enzymes (Ca-alginate beads, polyacrylamide), industrial applications of immobilized enzymes.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
5	Biotechnology in specific medical & industrial applications - Retting of jute, microbial process for immunization (Production of monoclonal antibodies), Deterioration of paper, textiles, painted surfaces and their prevention, Biofilms, microbial biopolymers, bio-surfactants, Microbial culture selection with high yield potential.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visits	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Study different parts of fermenter	Experiments	BL2-Understand	2
1	To check the antimicrobial properties of Asoca sarca	PBL	BL4-Analyze	2 months
4	Solid state fermentation – Mushroom production	Experiments	BL3-Apply	2
5	Production of Wine from Grapes	Experiments	BL3-Apply	2
6	Cell separation of yeast and LAB by Centrifugal and Filtration	Experiments	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	L. E. Casida Industrial Microbiology (1st Edition)
Articles	strainimprovement-130430125756-phpapp02.pdf
References Books	Nduka Okafor Modern Industrial Microbiology and Biotechnology-1st Edition
MOOC Courses	https://nptel.ac.in/courses/102106053 https://nptel.ac.in/courses/102106022
Videos	https://nptel.ac.in/courses/102106053 https://nptel.ac.in/courses/102106022

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	1	1	3	1	-	-	-	-	-	1	2	1
CO2	1	1	1	3	3	2	-	-	-	-	-	-	2	3	-
CO3	3	2	3	-	3	-	1	-	-	-	-	-	3	1	3
CO4	3	2	3	2	2	3	2	-	-	-	-	-	1	2	3
CO5	3	3	3	2	3	2	2	-	-	-	-	-	2	3	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Industrial Biotechnology
Course Code	DSE VI (T)

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	This course provides learning opportunities in the basic principles of medical microbiology and infectious disease.			**Co-Requisite/s**	It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora.			
Course Outcomes & Bloom's Level	**CO1-** This course provides learning opportunities in the basic principles of medical microbiology and infectious disease.**(BL1-Remember)** **CO2-** It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora. **(BL1-Remember)** **CO3-** It also provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases. **(BL2-Understand)** **CO4-** To understand the importance of pathogenic bacteria in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract, skin and soft tissue.**(BL3-Apply)** **CO5-** Helps to understand the use of lab animals in medical field. Explain the methods of microorganisms control, e.g., chemotherapy & vaccines. Solve problems in the context of this understanding. Recall the relationship of this infection to symptoms, relapse and the accompanying pathology.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Fundamental Concepts: History of microbiology, Discovery of microorganisms, Contributions of Louis Pasteur and Robert Koch in Medical Microbiology. Requirements for microbial growth, growth factors, culture media- synthetic and complex, types of media. Obtaining Pure Cultures, Preserving Bacterial Cultures, Growth Curves and generation time, Control of microbial growth, general concept of effect of environmental factors on growth of microbes.	Tutorials, Collaborative, Demonstrations, videos, case studies , tutorials	8
2	Bacterial Cells - fine structure and function: Size, shape and arrangement of bacterial cells. Cell membrane, cytoplasmic matrix, inclusion bodies (e.g. magnetosomes), nucleoid, Ultrastructure of Gram +ve and Gram –ve bacterial cell wall, Pili, Capsule, Flagella and motility.	Tutorials, Collaborative, Demonstrations, videos, case studies , tutorials	8
3	Principles of Diseases and Epidemiology: Relationship between Normal microbiota and host, Opportunistic microorganisms, nosocomial infections, Development and spread of infectious disease: invasion, pathogen, parasite, pathogenicity, virulence, carriers and their types.	Tutorials, Collaborative, Demonstrations, videos, case studies , tutorials	7
4	Bacterial Diseases (with reference to etiology, clinical symptoms, virulence factors involved, detection and prevention) Respiratory tract infections: Diphtheria and Tuberculosis, Gastrointestinal tract infections, staphylococcal food poisoning and E. coli gastroenteritis, Urinary tract infections: gonorrhea and syphilis.	Tutorials, Collaborative, Demonstrations, videos, case studies , tutorials	8
5	Antimicrobial chemotherapy and emerging antimicrobial resistance: Spectrum of antimicrobial activity, action of antimicrobial drugs, inhibitors of cell wall synthesis, anti-mycobacterial antibiotics, inhibitors of protein synthesis and nucleic acid synthesis, competitive inhibitors of essential metabolites, antifungal, antiviral, anti-protozoan drugs; effectiveness of chemotherapeutic agents, concepts of antimicrobial resistance, novel methods to combat increasing antimicrobial resistance.	Tutorials, Collaborative, Demonstrations, videos, case studies , tutorials	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
5	Antibiotic sensitivity test against microorganism	PBL	BL3-Apply	1 week

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	Gerard J. Tortora, Berdell R. Funke, Christine L. Case-Microbiology: An Introduction-9th edition
Articles	http://microbiology.free.fr/Presentations/antimicrobialchemotheray.pdf
References Books	Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, Prescott, Harley, and Klein's Microbiology 8th edition
MOOC Courses	https://nptel.ac.in/courses/102105087 https://nptel.ac.in/courses/102103015
Videos	https://nptel.ac.in/courses/102105087 https://nptel.ac.in/courses/102103015

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	2	1	3	-	-	-	-	-	-	1	3	2
CO2	1	2	1	-	1	3	-	-	-	-	-	-	2	2	1
CO3	3	3	3	3	3	-	3	-	-	-	-	-	3	1	3
CO4	1	2	1	1	1	3	3	-	-	-	-	-	3	2	1
CO5	3	2	2	2	3	3	-	-	-	-	-	-	1	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Pharmaceutical Biotechnology
Course Code	DSE VII (T)

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Student must know Genetic engineering applications in relation to production of pharmaceuticals and the use of microorganisms in fermentation technology			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember the basic concpet of enzymes, drug , gene and genome interaction **(BL1-Remember)** **CO2-** Understanding the importance of Immobilized enzymes in Pharmaceutical Industries**(BL2-Understand)** **CO3-** To apply Genetic engineering applications in relation to production of pharmaceuticals**(BL3-Apply)** **CO4-** To understand the Importance of Monoclonal antibodies in Industries**(BL2-Understand)** **CO5-** To apply and anlayze the Appreciate the use of microorganisms in fermentation technology**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG8(Decent work and economic growth) SDG9(Industry Innovation and Infrastructure)				

Part B

Modules	Contents	Pedagogy	Hours
I	Brief introduction to Biotechnology with reference to Pharmaceutical Sciences,Enzyme Biotechnology- Methods of enzyme immobilization and applications,Biosensors- Working and applications of biosensors in Pharmaceutical Industries, Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase	Lecture method, demonstrations, experiments, field visit, ABL, PBL	7
II	Basic principles of genetic engineering,cloning vectors, restriction endonucleases and DNA ligase,Recombinant DNA technology. Application of genetic engineering in medicine,production of: i) Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin	Lecture method, demonstrations, experiments, field visit, ABL, PBL	8
III	Types of immunity- humoral immunity, cellular immunity,General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity,Storage conditions and stability of official vaccines	Lecture method, demonstrations, experiments, field visit, ABL, PBL	8
IV	,Hybridoma technology- Production, Purification and Applications, Immuno blotting techniques- ELISA, Western blotting, Southern blotting,Introduction to Microbial biotransformation and applications.	Lecture method, demonstrations, experiments, field visit, ABL, PBL	8
V	Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring.,Large scale production fermenter design and its various controls,Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid,Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substituties	Lecture method, demonstrations, experiments, field visit, ABL, PBL	7

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Isolation of enzymes from natural isolates	PBL	BL3-Apply	1 week
II	production of immobilized enzymes using isolated enzymes	PBL	BL6-Create	7
III	Isolation of genomic DNA	Experiments	BL3-Apply	6
IV	To perform restriction digestion using kit and its visualization using agarose gel electrophoresis	Experiments	BL4-Analyze	7
V	Preparation of culture media and necessary arrangements for production of amino acids	Field work	BL6-Create	30 days
VI	To demonstarte the working of PCR	Industrial Visit	BL2-Understand	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	J.W. Goding: Monoclonal Antibodies
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3525971/
References Books	B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of RecombinantDNA: ASM Press Washington D.C. RA Goldshy et. al., : Kuby Immunology J.M. Walker and E.B. Gingold: Molecular Biology and Biotechnology by Royal
MOOC Courses	https://nptel.ac.in/courses/102105342
Videos	https://nptel.ac.in/courses/102105342

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	2	1	1	-	-	-	-	-	-	1	1	2
CO2	2	2	1	1	2	-	1	-	-	-	-	-	2	2	3
CO3	2	1	2	3	2	1	2	-	-	-	-	-	2	3	1
CO4	3	1	3	3	1	1	1	-	-	-	-	-	3	3	1
CO5	1	1	3	1	3	2	-	-	-	-	-	-	2	3	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Food and Dairy Microbiology
Course Code	DSE VII (T)

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Explain the interactions between microorganisms and the food environment, and factors influencing their growth and survival.			**Co-Requisite/s**	Describe the characteristics of foodborne, waterborne, and spoilage microorganisms, and methods for their isolation, detection, and identification.			
Course Outcomes & Bloom's Level	**CO1-** Explain the interactions between microorganisms and the food environment, and factors influencing their growth and survival.**(BL1-Remember)** **CO2-** Explain the significance and activities of microorganisms in food.**(BL2-Understand)** **CO3-** Describe the characteristics of foodborne, waterborne and spoilage microorganisms, and methods for their isolation, detection and identification.**(BL3-Apply)** **CO4-** Explain why microbiological quality control programmes are necessary in food production.**(BL3-Apply)** **CO5-** Explain the effects of fermentation in food production and how it influences the microbiological quality and status of the food product.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to microbiology: Microbiology in daily life, Characteristics and morphology of bacteria, fungi, virus, protozoa and algae. Control of micro-organisms- Growth curve; Influence of environmental factors on growth- PH, Water activity, O2 availability, Temperature, Pressure, and Radiation.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
2	Principles, physical methods of food preservation: temperature (low, high, canning, drying), irradiation, hydrostatic pressure, high voltage pulse, microwave processing, and aseptic packaging, chemical methods of food preservation: salt, sugar, organic acids, SO2, nitrite and nitrates, ethylene oxide, antibiotics, and bacteriocins.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
3	Contamination and spoilage of different foods: Cereals, sugar and their products, Milk and milk products, Fruits and vegetables, canned foods, Meat, fish, egg, and poultry.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visit	8
4	Foodborne illness: Food intoxication- Staphylococcal intoxication, botulism. Food infection- Salmonellosis, Clostridium perfringens, Bacillus cereus gastroenteritis, E. coli infection, Yersinia enterocolitica, Listeria monocytogenes, Campylobacter jejuni, and others. Pre-biotic and pro-biotic	utorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visit	8
5	SCP- Microorganisms used, raw materials used as substrate, condition for growth and production, nutritive value and use of SCP; Fat from microorganisms- Microorganisms used raw materials, production of fat; Production of amino acids; Production or other substances added to foods. Production of enzymes- amylases, invertase, pectolytic enzymes, proteolytic enzymes, and other enzymes	utorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visit	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Staining of microorganisms	Experiments	BL3-Apply	2
2	Composition, preparation and sterilization of media	Experiments	BL3-Apply	2
3	Demonstration of techniques for pure culture of microorganisms	Experiments	BL4-Analyze	2
4	Streak plate method	Experiments	BL3-Apply	2
5	Pour plate method.	Experiments	BL3-Apply	2
6	Serial dilution agar plate method	Experiments	BL4-Analyze	2
7	Microbiology testing of milk	PBL	BL4-Analyze	2
8	Serial dilution agar plate method	Experiments	BL4-Analyze	2
9	To visit the various food industries in order to learn the basic methodologies	Industrial Visit	BL2-Understand	5
10	To visualize the effect of antibiotics on the expression and growth of fungi and Bacterial cell.	PBL	BL3-Apply	4
11	To determine the production of primary and secondary metabolites by Endophytic Microorganism.	PBL	BL3-Apply	4

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	Virendra Kumar Pande Textbook of Food Microbiology 1st Edition
Articles	https://academic.oup.com/jimb
References Books	John C. Ayres Microbiology of Foods 2nd Edition Frazier, W.C. Food Microbiology 4th edition Pelzar, H.J. and Rober, D. Microbiology 5th edition
MOOC Courses	https://onlinecourses.nptel.ac.in/noc24_ag03/preview https://onlinecourses.nptel.ac.in/noc23_ag02/preview https://nptel.ac.in/courses/126105015 https://onlinecourses.nptel.ac.in/noc24_ag07/preview
Videos	https://nptel.ac.in/courses/102105058

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	2	2	1	-	-	-	-	-	2	3	1	2
CO2	2	2	1	3	1	3	2	-	-	-	-	2	1	2	1
CO3	1	1	2	2	2	1	2	3	-	-	-	1	3	3	2
CO4	3	2	3	3	1	1	3	2	-	-	-	1	2	3	1
CO5	2	3	3	2	3	2	1	2	-	-	-	3	1	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Field Project/Internship
Course Code	FP/In I

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					0	0	8	8
Course Type	Project							
Course Category	Projects and Internship							
Pre-Requisite/s	Deep knowledge of all disciple core subject of Microbiology program			**Co-Requisite/s**	Presentation of research project/ internship			
Course Outcomes & Bloom's Level	**CO1-** Understand themselves in relation to their community and develop among themselves since of social and civic and responsibility**(BL1-Remember)** **CO2-** Identify the needs and problem of the community and involve them in problem solving.**(BL2-Understand)** **CO3-** Utilize their knowledge in finding practical solution to individual and community problem**(BL3-Apply)** **CO4-** Develop the confidence require for group living and sharing of responsibilities of acquire leader ship qualities and democratic attitudes. **(BL4-Analyze)** **CO5-** Develop the capacity to meet emergencies and natural disasters and practice national integration and social harmony**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
300					

Part E

Books	
Articles	
References Books	
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	-	-	1	-	-	-	-	3	2	2
CO2	1	2	1	1	-	1	-	-	-1	-	-	-	3	2	3
CO3	1	2	1	1	1	-	-	-	-	-	-	-	3	3	3
CO4	2	2	1	1	-	-	1	-	-	-	-	-	3	3	3
CO5	2	2	1	1	1	-	-	1	1	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Field Project/Internship
Course Code	FP/In II

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					0	0	8	8
Course Type	Project							
Course Category	Internships							
Pre-Requisite/s	Deep knowledge of all disciple core subject of microbiology program			**Co-Requisite/s**	Presentation of research project/ internship			
Course Outcomes & Bloom's Level	**CO1-** Understand themselves in relation to their community and develop among themselves since of social and civic and responsibility**(BL1-Remember)** **CO2-** Identify the needs and problem of the community and involve them in problem solving.**(BL2-Understand)** **CO3-** Utilize their knowledge in finding practical solution to individual and community problem**(BL3-Apply)** **CO4-** Develop the confidence require for group living and sharing of responsibilities of acquire leader ship qualities and democratic attitudes. **(BL4-Analyze)** **CO5-** Develop the capacity to meet emergencies and natural disasters and practice national integration and social harmony**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
400					

Part E

Books	
Articles	
References Books	
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	-	-	1	-	-	-	-	3	2	2
CO2	1	2	1	1	-	1	-	-	-1	-	-	-	3	2	3
CO3	1	2	1	1	1	-	-	-	-	-	-	-	3	3	3
CO4	2	2	1	1	-	-	1	-	-	-	-	-	3	3	3
CO5	2	2	1	1	1	-	-	1	1	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Organic Farming
Course Code	SEC V (T)

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					2	0	1	3
Course Type	Embedded theory and lab							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	Student must be aware of basic plant physiology and soil classification			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Students will understand various principles, need and prospect of organic farming including the importance of sustainability, biodiversity and ecological balance. **(BL2-Understand)** **CO2-** To equip learners with the knowledge and skills necessary to practice sustainable agriculture and the production of healthy, organic food**(BL2-Understand)** **CO3-** Students will gain hands on experience through field work, farm visits or practical exercises to apply their knowledge in a real world setting**(BL3-Apply)** **CO4-** learners will explore the significance of soil health in organic farming and various methods to enhance soil fertility through composting and crop rotation. **(BL4-Analyze)** **CO5-** Students will learn about marketing organic products, understanding consumer demand and the economic aspect of Organic farming**(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG2(Zero hunger) SDG3(Good health and well-being) SDG4(Quality education) SDG6(Clean water and sanitation) SDG7(Affordable and clean energy) SDG8(Decent work and economic growth) SDG11(Sustainable cities and economies) SDG13(Climate action) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours
I	History and development, IFOAM Definition and Principle- health, fairness, ecology and care,Methods, advantages and limitations, Need of Organic farming in present context and future prospects- barrier	Lecture methods, group discussions, demonstrations, field work, experiments, ABL, PBL, Trainings	7
II	ORGANIC ECOSYSTEM & THEIR CONCEPT Structure and function, Productivity, Decomposition,Nutrient cycling, Eutrophication, Biological magnification	Lecture methods, group discussions, demonstrations, field work, experiments, ABL, PBL, Trainings	8
III	SOIL □ Definition, Composition of Soil- Soil texture and Types, Soil structure, Soil Profile, Humus & Soil pH,Role of Soil in Organic Farming,Soil factors affecting plant Growth: light, heat, water,humidity, pH and Nutrition,C: N ratio of good fertile Soil	Lecture methods, group discussions, demonstrations, field work, experiments, ABL, PBL, Trainings	7
IV	PLANT NUTRITION □ Structural organization & function of different Plant organ,Plant nutrient- Micro and Macro, Importance & Deficiency,Symptoms,Sources : Organic, Green manure- Method of composting,Benefit & Limitations,oil microorganism: Mycorrhiza, Rhizosphere- Significance	Lecture methods, group discussions, demonstrations, field work, experiments, ABL, PBL, Trainings	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Visit to Organic farm to study the various components, identification and utilization of Organic products.	Field work		6
II	Preparation of Organic Compost-Over ground compost, Pit compost, Liquid compost, Vermi compost.	PBL	BL3-Apply	1 MONTH
III	Preparation of Neem products and other botanicals for Pest and disease control	Internships	BL6-Create	1 MONTH
IV	Weed control through organic way	Experiments	BL3-Apply	30 days
V	Soil analysis: pH determination.	Experiments	BL4-Analyze	2
VI	Seed bed preparation, seed selection and seedling preparation	Experiments	BL3-Apply	1 WEEK
VII	Method of application of different types of fertilizer and Green manure.	PBL	BL3-Apply	1 MONTH
VIII	Preparation of Panchagavya/ Amrit Jol	PBL	BL6-Create	1 MONTH

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Sharma, Arun K. 2002. A Handbook of Organic farming. Agrobios, India. Sathe, T.V. 2004, Vermiculture and Organic Farming. Daya Publishers Gupta, M., 2004. Organic Agriculture Development in India. ABD publishers, Jaipur, India. Dr. Pratiksha Raghuvanoki. Handbook of Organic Farming
Articles	https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/organic-farming
References Books	Dongarjal R. P. and Zade S.B. 2019. Insect Ecology and Integrated Pest Management, Akinik Publications, New Delhi. Dushyent Gehlot. 2005. Organic Farming- standards, accreditation, certification and inspection. Agribios, India.
MOOC Courses	https://nptel.ac.in/courses/126105014
Videos	https://nptel.ac.in/courses/126105014

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1	1	2	-	-	-	-	-	-	2	2	2
CO2	1	2	3	3	2	2	1	-	-	-	-	-	2	1	2
CO3	1	1	1	3	2	2	1	-	-	-	-	-	1	1	1
CO4	2	1	3	2	1	1	1	-	-	-	-	-	2	1	2
CO5	3	1	3	3	1	1	-	-	-	-	-	-	1	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Marine Microbiology
Course Code	SEC V (T)

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	Understand the marine ecosystem and familiarize the structure and various habitat of marine environment.			**Co-Requisite/s**	To realize marine pollution and control measure, bio-corrosion and bioremediation.			
Course Outcomes & Bloom's Level	**CO1-** To Understand the marine ecosystem and familiarize the structure and various habitat of marine environment.**(BL1-Remember)** **CO2-** To comprehend water borne diseases and water borne pathogen **(BL2-Understand)** **CO3-** To understand various biotechnology applications of marine microbiology such as biosensor, transgenic, biosurfactant etc.**(BL3-Apply)** **CO4-** To realize marine pollution and control measure, bio-corrosion and bioremediation.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to oceanography: the world's oceans and seas, properties of seawater, physico-chemical factors in the marine environment such as temperature, density, nutrients, salinity, dissolved gases, waves, tides, oceanic currents	Tutorials, Collaborative, Demonstrations, videos, case studies ,	8
2	Marine microbial habitats: estuaries, mangroves, salt marshes, beach and coastal ecosystems, reef and coral reefs, water column, sediments.	Tutorials, Collaborative, Demonstrations, videos, case studies ,	7
3	Marine microbes – bacteria, fungi, phytoplankton, zooplankton, viruses: their growth, physiology and contribution to ocean processes,Physiology of marine microbes: metabolic diversity and energy-yielding processes: microbial loop; marine snow; phototrophy and primary productivity, fermentation, aerobic respiration, anaerobic respiration (denitrification	Tutorials, Collaborative, Demonstrations, videos, case studies ,	7
4	Marine ecosystem: Environment of marine bacteria, bacterial growth in sea and its regulation by environmental conditions, modeling of growth and distribution of marine micro plankton, mechanism of dissolved, organic matter production (DOM), strategies of organic matter utilization and microbial utilization of organic matter in sea.	Tutorials, Collaborative, Demonstrations, videos, case studies ,	8
5	Methods in marine microbiology:- Sampling equipment: water samplers such as Niskin sampler, Hydro-Bios, sampler, Rosette samplers; sediment samplers such as van Veen grabs and corers. Tools to study marine microbial diversity: flow cytometry (bacteria, picoplankton, picoeukaryotes, viruses); molecular approaches such as metagenomics, community fingerprinting and Fluorescence in situ hybridization (FISH)	Tutorials, Collaborative, Demonstrations, videos, case studies ,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Composition, preparation, and sterilization of media:	Experiments	BL2-Understand	3
2	Demonstration of techniques for pure culture of microorganisms:	Experiments	BL2-Understand	3
3	Microbiology testing of milk	Experiments	BL3-Apply	4
4	Serial dilution agar plate method	Experiments	BL3-Apply	3
5	isolating and culturing marine microbes from their collected samples.	PBL	BL4-Analyze	4
6	To determine the production of primary and secondary metabolites by marine microbes.	PBL	BL3-Apply	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	0

Part E

Books	Meller, C. B., Wheeler, P. A Biological Oceanography, Wiley-Blackwell Publishers. Volume3
Articles	https://www.ncbi.nlm.nih.gov/books/NBK559439/
References Books	Belkin, S. and Colwell, R. R.-Ocean & Health: Pathogens in the Marine Environment, Springer-3rd Edition
MOOC Courses	https://www.microbiologyresearch.org/content/marine-microbiology
Videos	https://www.microbiologyresearch.org/content/marine-microbiology

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	3	1	3	3	1	1	1	3	1	2	1	3
CO2	3	1	2	2	1	3	3	1	2	1	3	3	3	2	1
CO3	1	3	1	1	3	3	3	2	1	2	3	2	3	1	2
CO4	2	1	2	1	3	1	3	1	1	2	1	1	1	3	2
CO5	3	3	2	1	3	1	2	3	2	2	1	3	3	2	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Entrepreneurship development
Course Code	SEC VI (T)

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Generic Elective							
Pre-Requisite/s	Students must have studied food business managemnet in previous semester			**Co-Requisite/s**	Students should have prior knowledge of economics and basics of management			
Course Outcomes & Bloom's Level	**CO1-** Communicate with required clarity ensuring that the information communicated is clear and accurate.**(BL1-Remember)** **CO2-** Comprehend and apply basic computer working, basic operating system and uses internet services to get accustomed & take benefit of IT developments in the industry.**(BL2-Understand)** **CO3-** To demonstrate knowledge of entrepreneurship and identify establishment for supporting the development of businesses/entrepreneurship.**(BL3-Apply)** **CO4-** To illustrate procedures to achieve a safe working environment in line with occupational health, safety, environment regulations.**(BL4-Analyze)** **CO5-** Comply time management technique in day-to-day work.**(BL5-Evaluate)**						
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG3(Good health and well-being)				

Part B

Modules	Contents	Pedagogy	Hours
1	Concept and definition of Entrepreneurship; The conceptual model of Entrepreneurship given by John Kao. Views given by Schumpeter Walker & Drucker on Entrepreneurship - Entrepreneur and Manager -Enterprise and Entrepreneur. Managing Creativity Issues to be addressed in working the definition of creativity –Definition - Attributes of a creative person - Creative Thinking and Motivation - Managing Creativity - Organizational Actions that enhance and hinder Creativity -Organizational priorities and Creativity -Managerial responsibilities in a creative organization	Lecture method, quiz, group discussion	10
2	Definition of Small Business - Composition of Small Business- Economic Contribution of Small Business. Strategic Planning for Small Business -Steps in Strategic Planning. Forms of Ownership: Sole Proprietorship, Partnership& Corporation form of Organization Advantages and Disadvantages. Franchising- What is Franchising - Advantages and Disadvantages to Franchising - Franchise Evaluation Checklist –Franchise contracts - Types of Franchise arrangements. Brief insight of Startup, Entrepreneurship, features, related scheme and benefits.	Lecture method, Quiz, Illustrate with analogies	10
3	Introduction: Project - definition, features, types infrastructure creation-a special type of projects. The advantages and disadvantages of starting your business. The advantages and disadvantages of buying all existing business – Critical areas to be examined while buying all existing business Project Appraisal: technical appraisal, marketing appraisal, legal and environment appraisal, financial appraisal- cost estimation of the project and evaluating project using pay back and NPV, Detailed project report. Introduction to SCBA (Social cost benefit analysis).	Lecture Method, Expert Lecture, audio-video clips	12
4	Arrangement of funds: Traditional sources of financing – Equity shares, preference shares, Debentures/bonds, loan from financial institutions- Loan syndication and consortium finance; Alternative sources of financing- Foreign Issue, FDI & FII. SWOT analysis and its usefulness	Audio/Video clips, group discussion, lecture with ppt, quiz	8
5	Government schemes and incentives for promotion of entrepreneurship development Government policy for entrepreneurship development-Prime Minister's Employment Generation Program (PMEGP), Market Development Assistance Scheme for Micro/ Small Manufacturing Enterprises/ Small & Micro Exporters, Rajiv Gandhi Udyami Mitra Yojana - A Scheme of "Promotion and Handholding of Micro and Small Enterprises", Schemes for Women Entrepreneurs a) Mahila Udyami Yojana (MUY) b) SBI Stree Sakthi Package c) Priya Darshini Yojana	Audio/Video clips, group discussion, lecture with ppt, quiz	10

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	
Articles	https://www.forbes.com/entrepreneurs/?sh=3e2b77403035
References Books	Effective Small Business Management by Scarborough & Zimmerer
MOOC Courses	https://nptel.ac.in/courses/110106141
Videos	https://www.youtube.com/watch?v=N3-FZn_iQFU&t=3s

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	-	1	1	-	3	1	3	3	1	1
CO2	3	3	2	1	1	-	-	-	-	2	-	2	3	1	1
CO3	1	1	3	3	2	2	1	-	-	-	1	1	3	1	1
CO4	3	1	-	-	-	2	2	1	-	-	2	-	3	3	3
CO5	1	2	-	-	-	-	1	1	-	3	1	3	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Introduction to Good Laboratory practices
Course Code	SEC VI (T)

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	Knowledge of food laboratory euipments and testing protocols			**Co-Requisite/s**	To study guidelines on good laboratory practices and SOPs and calibration procedure of different instruments.			
Course Outcomes & Bloom's Level	**CO1-** to learn the regulations and various guidelines on good laboratory practices and SOPs and calibration procedure of different instruments.**(BL1-Remember)** **CO2-** to gain the knowledge of the various hazards and safety procedures to be followed in laboratory. **(BL2-Understand)** **CO3-** To provide the students a specialized knowledge about implementation of laboratory standard practices, their records and analyze laboratory data with accuracy.**(BL3-Apply)** **CO4-** To apply the subject knowledge in minimization of errors related with handling of laboratory accessories and equipment's**(BL4-Analyze)** **CO5-** To evaluate the theoretical knowledge of good laboratory practices and its implementation in food industry laboratories to ensure the quality and safety of the foods**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕			**SDG (Goals)**	SDG1(No poverty) SDG2(Zero hunger) SDG3(Good health and well-being) SDG6(Clean water and sanitation) SDG12(Responsible consuption and production)			

Part B

Modules	Contents	Pedagogy	Hours
1	Concept and evolution and scopes of Quality Control and Quality Assurance; Good laboratory practices (GLP) - Introduction, history, definition, principles and WHO guidelines on GLP. Levels of Laboratories,	Lecture method, group discussion, seminar	06
2	General Rules/Protocols for Lab Safety measures, Precaution and Safety in handling of chemicals, laboratory tools, glasswares, food ingredients/raw materials, and instruments; Biosafety in laboratory - Laboratory associated infections and other hazards, assessment of biological Hazards and levels of biosafety, fire prevention methods	Lecture method, group discussion, seminar, Quiz, Illustrate with analogies	07
3	Food laboratory sanitation, Control of rats, rodents, birds, insects and microbes. Cleaning and Disinfection: Physical and Microbiological Approach, cleaning of glasswares and utensils, Basic SOPs for instrument handling and maintenance and raw material/ingredients storage	Quiz, Illustrate with analogies	07
4	Internal and External Audit, Log Book Maintenance, Keeping data records, its analysis by using statistical and mathematical tools. Result analysis and its interpretation; Arrangement of chemicals, reagents, glasswares, etc in laboratory.	Audio/Video clips, group discussion, lecture with ppt, Review Analysis	05
5	Calibration of common food technology instruments: pH meter, spectrophotometer, water bath, moisture analyzer, hot air oven, pipettes, scales and balances, centrifuge, etc.; Quality management in industry and laboratory, Laboratory Design & Layout of food technology laboratory	Audio/Video clips, group discussion, lecture with ppt, Review Analysis	05

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	World health organization (WHO); Handbook Good Laboratory Practices
Articles	
References Books	Indian council of medical research, New Delhi; Guidelines for good laboratory practices B.W.Wenclawiak, M.Koch E. Hadjicostas; Quality Assurance in Analytical Chemistry.
MOOC Courses	https://nptel.ac.in/courses/126105020
Videos	https://youtu.be/h5NpTku5BGc?si=U-GL_p3nLe4_7pZM

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	1	-	1	1	1	-	1	1	1
CO2	2	2	1	1	1	1	1	1	-	1	-	-	2	1	1
CO3	2	2	1	2	1	2	-	-	1	1	-	-	2	1	2
CO4	2	3	2	2	1	2	1	1	-	1	1	-	3	2	2
CO5	3	3	2	2	1	2	-	1	1	1	1	-	3	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Human Health and Vaccinology
Course Code	SEC VII (T)

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Discipline Electives							
Pre-Requisite/s	Student should know about the basic conpets of vaccines, its types and categories.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To understand to develop novel agents useful in immunotherapy**(BL2-Understand)** **CO2-** To understand basic concepts of Human Heath and Vaccinology and their types. **(BL2-Understand)** **CO3-** To remember about the various disease and their causes, symptoms and preventions and their interaction with human body. **(BL1-Remember)** **CO4-** The course aims to provide experimental basis, and to enable students to acquire a specialized knowledge and understanding.**(BL3-Apply)** **CO5-** To apply the understanding of Human Heath and Vaccinology in evaluation in various Biological Samples for the development of DNA vaccines, recombinant vaccines, edible vaccines, nanoparticles in vaccine delivery systems. and to evaluate the applications of Human Heath a Vaccinology in various fields such as research and industries. **(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG12(Responsible consuption and production)				

Part B

Modules	Contents	Pedagogy	Hours
I	Definition and Concept of Public Health, Historical aspects of Public Health, Changing Concepts of Public Health, Public Health versus Medical Care, Unique Features of Public Health, Public Health as a System. Determinants of Health (Social, Economic, Cultural, Environmental, Education, Genetics, Food and Nutrition).	lecture method, collaborative learning, Field visits, ABL	8
II	Indicators of health, Burden of disease, Health promotion, Concept of Prevention, Intervention, Role of different disciplines in Public Health, Scope of Public Health.Historical aspects of epidemiology, Basic concepts, definition and significance, aims of epidemiology, Clinical versus epidemiological approach, Applications and uses of epidemiology,	lecture method, collaborative learning, Field visits, ABL, PBL	9
III	Concept of diseases, Natural history of disease, spectrum of disease, Concept of control, frequency, distribution of disease, Measurements of mortality Measurements of morbidity (prevalence and incidence), Methods of descriptive epidemiology, analytical epidemiology, experimental epidemiology	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
IV	History of Vaccinology, conventional approaches to vaccine development, live attenuated and killed vaccines, adjuvants, quality control, preservation and monitoring of microorganisms in seed lot systems. Instruments related to monitoring of temperature, sterilization, environment	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
V	Preservation techniques to maintain good antigen quality, freeze drying, Introduction to newer vaccine approaches namely- subunit vaccines, synthetic vaccines, DNA vaccines, virus like particles, recombinant vaccines, edible vaccines, nanoparticles in vaccine delivery systems.	Tutorials, Collaborative, Demonstrations, videos, PBL	9

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Case Study: Influenza Vaccination	Case Study	BL4-Analyze	15 days
II	How Vaccines Protect Populations I: Understanding Quantitative Concepts in Vaccinology: Susceptibility, R0, Contact Rate, Critical Vaccination Fraction	PBL	BL5-Evaluate	30 days

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Mary-Jane Schneider and Henrey Schneider,Introduction to Public Health, Jones and Bartlett Publishers.,2006 (2nd edition),
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7371956/
References Books	Kirch, Wilhelm,Environmental Biotechnology. Theory and Application. Willey and Sons,2008, Volume 1 & 2, Kluwer Academic Publishers. Barry R Bloom, Paul-Henri Lambert,The Vaccine Book,2002, Academic Press Levine MM, Kaper JB, Rappuoli R, Liu MA, Good MF.,The new generation vaccines. 3rd Ed. Informa Healthcare. John Yarnell,Epidemiology and Prevention,2007, A system Based Approach, Oxford.
MOOC Courses	https://onlinecourses.nptel.ac.in/noc20_hs20/preview https://onlinecourses.nptel.ac.in/noc23_hs05/preview
Videos	https://onlinecourses.nptel.ac.in/noc20_hs20/preview https://onlinecourses.nptel.ac.in/noc23_hs05/preview

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	1	-	-	-	-	-	-	-	1	-	2
CO2	1	3	-	1	-	1	1	-	-	-	-	-	2	1	2
CO3	1	1	1	2	1	2	1	-	-	-	-	-	2	1	1
CO4	2	1	1	2	2	1	-	-	-	-	-	-	3	1	-
CO5	2	1	2	2	2	1	1	-	-	-	-	-	1	-	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

Bsc_Microbiology

Title of the Course	Bioinstrumentation
Course Code	SECI[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	The course prepares the student to understand the Bio-Instrumentation; and how doesnit interacts with living and non-living molecules. and how it predicts their structure and function.			**Co-Requisite/s**	The subject Fundamental of Bio-Instrumentation is designed for graduate biotechnology students to understand the basic concepts of every part of Bio-Instrumentation and their types. the course aims to provide the basis for analyzing the applications of Bio-Instrumentation in various fields such as research and industries			
Course Outcomes & Bloom's Level	**CO1-** This course provides learning opportunities in the basic principles of medical microbiology and infectious disease.**(BL1-Remember)** **CO2-** It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora. **(BL1-Remember)** **CO3-** It also provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases. **(BL2-Understand)** **CO4-** To understand the importance of pathogenic bacteria in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract, skin and soft tissue.**(BL3-Apply)** **CO5-** Helps to understand the use of lab animals in medical field. Explain the methods of microorganisms control, e.g., chemotherapy & vaccines. Solve problems in the context of this understanding. Recall the relationship of this infection to symptoms, relapse and the accompanying pathology.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Preparation of broth and liquid culture media to grow the test bacterial culture.	Experiments	BL2-Understand	2
2	To the determine of unknown Protein Concentration & Nucleic Acid (NA) Quantification: Estimate protein and NA concentration using absorbance at 280 & 260 nm.	Experiments	BL3-Apply	3
3	To determine of the food additives, preservatives, and contaminants.	Experiments	BL4-Analyze	4
4	Essential for observing biological samples at various magnifications. Includes light microscopes.	PBL	BL3-Apply	4
5	• quantifying nucleic acids, proteins, and small molecules by UV Visible Microscopy.	PBL	BL3-Apply	4

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	Nelson, Cox and Leininger Biochemistry 8th Edition
Articles	https://pubs.acs.org/doi/full/10.1021/acs.jchemed.0c00404
References Books	Stryer Biochemistry 9th Edition
MOOC Courses	https://nptel.ac.in/courses/102108082
Videos	https://nptel.ac.in/courses/102108082

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	2	2	3	1	2	3	1	1	3	1	2	2
CO2	1	2	1	2	2	3	2	1	2	1	2	2	3	2	1
CO3	1	3	2	1	3	3	2	1	2	2	1	3	2	1	2
CO4	2	3	3	3	1	2	2	3	1	2	2	2	3	3	2
CO5	1	2	2	1	3	2	1	3	1	3	2	1	2	1	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Hindi[T]
Course Code	AEC0101

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Foundation core							
Pre-Requisite/s	varn gyan , shabd gyan			**Co-Requisite/s**	lipi , samajdari			
Course Outcomes & Bloom's Level	**CO1-** भारतीय ज्ञान परम्परा सेवि द्यार्थि यर्थि ों को अवगत कराना**(BL1-Remember)** **CO2-** सांस्कृतिक ,एवं राष्ट्रिय एकता।।**(BL3-Apply)** **CO3-** भाषा अध्ययन एवं अध्यापन का उद्देश्य विद्यार्थियों के सर्वांगीण विकास में सहायक है। छात्र जीविकोपार्जन के लक्ष्यों का सहज संधान कर सके । जीविकोपार्जन के लक्ष्यों का सहज संधान कर सके । **(BL2-Understand)** **CO4-** पाठ्यक्रम में व्याकरण ,सामान्य तथा पारम्परिक साहित्य , लेखन परम्परा का बोध करना एवं समग्र व्यक्तित्व का विकास करना है। **(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**					

Part B

Modules	Contents	Pedagogy	Hours
1	स्वतंत्रता पुकारती {कविता} वाक्य संरचना और अशुद्धियाँ {३ संकलित } जयशंकर प्रसाद वाक्य संरचना और अशुद्धियाँ {३ संकलित } जयशंकर प्रसाद वाक्य संरचना और अशुद्धियाँ {३ संकलित } जयशंकर प्रसाद पुष्प की अभिलाषा२ {कविता}	Audio/Video clips, group discussion, lecture with PPTs, quiz	5
2	१ नमक का दरोगा} { कहानी} ---प्रेमचंद २ एक थे राजा भोज { निबंध } --त्रिभुवननाथ शुक्ल ३ पर्यायवाची , विलोम , एकार्थी ,अनेकार्थी एवं शब्दयुग्म शब्द {संकलित }	Audio/Video clips, group discussion, lecture with ppt, quiz	4
3	} { निबंध } ---स्वा1मी विवेकानंद २ लोकतंत्र एक धर्म है{ निबंध --डॉ सर्वपल्ली राधा कृष्णन ३ नहीं रूकती है नदी --हीरालाल बाछोतिया ४ पल्लवन १ भगवान् बुद्ध	Audio/Video clips, group discussion, lecture with ppt, classroom presentations	5
4	अफसर{ निबंध -शरद जोशी २ हमारी सांस्कृतिक एकता संग्रह में -भारत एक है{ निबंध -रामधारी सिंह दिनकर ३ संक्षेपण {संकलित }	Audio/Video clips, group discussion, lecture with ppt, classroom presentations	4
5	नैतिक मूल्य परिचय एवं वर्गीकरण{ आलेख } --डॉ शशि राय २ आचरण की सभ्यता --सरदार पूर्ण सिंह ३ अंतर्ज्ञान और नैतिक जीवन{लेख --डॉ सर्वपल्ली राधाकृ ४ अप्प दीपोभव {लेख } -स्वामी श्रद्धानन्द	Audio/Video clips, group discussion, lecture with ppt	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	hindi bhasha aur naitik mulay
Articles	
References Books	hindi bhasha aur naitik mulay
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	2	-	-	-	-	2	-	-	-	-	-	-
CO2	-	2	-	-	-	2	-	1	-	-	-	-	-	-	-
CO3	2	-	-	1	-	-	-	-	-	2	-	-	-	-	-
CO4	2	-	-	-	-	2	-	-	1	-	-	-	-	-	-
CO5	1	-	-	-	1	-	-	2	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	English-I
Course Code	AEC0201[T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Ability Enhancement Courses							
Pre-Requisite/s	The students have a basic knowledge and understanding of the English language and communication.			**Co-Requisite/s**	Communication skills, Leadership development etc.			
Course Outcomes & Bloom's Level	**CO1-** Determine interpersonal skills and be an effective goal-oriented team player**(BL1-Remember)** **CO2-** Elaborate creativity and lateral thinking**(BL2-Understand)** **CO3-** Examine attitudes, emotional intelligence and understand its influence on behavior**(BL3-Apply)** **CO4-** Justify approaches to conflict resolution.**(BL4-Analyze)** **CO5-** Evaluate goal setting, management, decision-making skills.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
Module 1	Where the Mind is Without Fear, The Tryst with Destiny The Hero, Indian Weavers The Portrait of a Lady The Solitary Reaper	Classroom Lecture, PPts, Videoes	10
Module 2	Basic Language Skills Synonyms, Antonyms,Homonyms, Word Formation,Prefix, Suffix	Classroom Lecture, PPts,	6
Module 3	Uncountable Noun, Verb, Tense, Adverb	Classroom Lecture, PPts,	6
Module 4	Trading Comprehension, Unseen Passage	Classroom Lecture, PPts, Videos	4
Module 5	Introduction to Report Writing, Major Objectives of Writing Reports, Significance of Business/Technical, Types and Forms of Reports, Styles of Writing Reports – Printed format, Memo Format, Letter Format, Book/Letter Text Format, Layout and Structure of Reports, Components of Report Writing.	Classroom Lecture, PPts, Videos	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	C. Muralikrishna and S. Mishra (2011) Communication Skills for Engineers, Pearson education. ISBN: 9788131733844
Articles	Carnegie Dale, How to win Friends and Influence People, New York: Simon & Schuster, 1998.
References Books	Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2007, New Delhi.
MOOC Courses	https://nptel.ac.in/courses/109103020
Videos	https://nptel.ac.in/courses/109103020

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	2	-	-	-	2	-	-	1	-	1
CO2	2	2	1	2	2	2	-	-	-	2	-	-	1	-	3
CO3	2	1	1	-	1	-	-	-	-	2	-	-	3	2	3
CO4	3	2	-	2	1	-	-	-	-	2	-	-	2	3	3
CO5	3	2	-	2	1	-	-	-	-	2	-	-	2	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Fundamental of Chemistry -I
Course Code	BSCH0101[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Knowledge of periodic table and atomic structure			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember basic knowledge of Atomic Structure, Chemical bonding **(BL1-Remember)** **CO2-** To understand Properties of Inorganic Compounds**(BL2-Understand)** **CO3-** To Apply the compounds in the application**(BL3-Apply)** **CO4-** To Analyse the Structure and Properties of Inorganic Compounds**(BL4-Analyze)** **CO5-** To Evaluate the results analyzed**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
Module 1	Dual Nature of matter idea of de Broglic matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of Y and Y', quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p and d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule, Electronic configuration of the elements, effective nuclear charge. B. Periodic Properties Atomic and ionic radii, ionization energy, electron affinity and electro negativity-definition, methods of determination or evaluation, Trends in periodic table and applications in predicting and explaining the chemical behavior	Stoy telling activity Experienced examples, Quizzes Summarizing, PPT's Leaving Questions	8
Module 2	UNIT – II: Chemical Bonding – part I (A) Covalent Bond-valence bond theory and its limitations. Directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion (VSEPR) theory to NH3,H3O SF4, CIF3 and H2O MO theory, homo nuclear and hetero nuclear (CO and NO)4 diatomic molecules, multicenter bonding in electron deficient molecules, bond strength and bond energy.		8
Module 3	UNIT – III: Chemical Bonding – part II (A) Ionic Solids-Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions. Fajan's rule. Metallic bond-free electron, balance bond and band theories. (B) Weak Interactions-Hydrogen bonding, van der waals forces 1. Chemistry of nobles gases	Demonstrations, Videos, PPT's Quizes, Group discussions	8
Module 4	S-Block Elements Comparative study Li and Mg. diagonal relationship, salient features of hydrides, solvation and complexation tendencies including their function in bio systems an introduction to alkyls and aryls. p-Block Elements part – I Comparative study Be and Al (including diagonal relationship) of groups 13-17 elements. Compounds like hydrides. Oxides, oxyacids and halides of groups 13-16	Interactive videos PPT's Experienced examples, Quizzes', Seminar	8
Module 5	p-Block Elements Part – II Hydrides of boron-diborane and higher boranes, borazine, boroydrides, Fullerenes, fluorocarbons, silicates (structural principle), tetra-sulphur tetra-nitride, basic properties of halogens, interhalogens and Polyhalides.	Interactive videos , PPT's Experienced examples, Quizzes',	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
Module 4	Anionic Radical Testing	Experiments	BL3-Apply	8
Module 4	Cationic Radical Testting	Experiments	BL3-Apply	8
Module 4	To study the structure of Ionic solids	PBL	BL3-Apply	6
Experiment	To Identify the Acid Radical(Acetate)	Experiments	BL3-Apply	2
Experiment	To Identify the Acid Radical (Sul hide)	Experiments	BL3-Apply	2
Experiment	To Identify the Acid Radical(Carbonate)	Experiments	BL3-Apply	2
Experiment	To Identify the Acid Radical (Oxalate)	Experiments	BL3-Apply	2
Experiment	To Identify the Ammonium Basic Radical	Experiments	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	M.N.N Tandon Unified Chemistry 2010 O.P Tandon Chemistry Third Edition
Articles	
References Books	J.D.Lee Concise Inorganic Chemistry Fifth Edition J.E. Huheey Inorganic Chemistry Fourth Edition Cotton Wilkinson Advanced Inorganic Chemistry Third Edition
MOOC Courses	https://nptel.ac.in/courses/104103069
Videos	https://nptel.ac.in/courses/104103069

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	-	-	-	-	-	-	-	3	2	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	3	2	1
CO3	3	3	1	-	-	-	-	-	-	-	-	-	2	2	1
CO4	3	3	1	-	-	-	-	-	-	-	-	-	1	2	2
CO5	3	2	1	-	-	-	-	-	-	-	-	-	1	1	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Analytical Chemistry
Course Code	BSCH0201[T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Knowledge of Fundamentals of Analytical Chemistry			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember basic concept and principle of analytical techniques**(BL1-Remember)** **CO2-** To understand the difference between the analytical techniques**(BL2-Understand)** **CO3-** To use/apply the basic statistical treatment of the analytical data for getting a correct result and analytical methods**(BL3-Apply)** **CO4-** To Analyse Qualitative and Quantitative aspects**(BL4-Analyze)** **CO5-** To Evaluate the data obtained from the analysis**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
Module 1	General purification techniques Purification of solid organic compounds, recrystallisation, use of miscible solvents, use of drying agents and their properties, sublimation. Purification of liquids. Different types of extraction: use of immiscible solvents solvent extraction, efficiency of extraction, selectivity of extraction, liquid phase and solid phase extraction systems, methods of extraction, applications. Chemical methods of purification and test of purity	Problem solving sessions, Experienced examples, Quizzes Summarizing, Leaving Questions Hand on Experience ,Tutorials	8
Module 2	Titrimetric Methods of Analysis General Introduction General principle. Types of titrations. Requirements for titrimetric Analysis. Concentration systems: Molarity, formality, normality, wt % ppm, milliequivalents and millimoles-problems Primary and secondary standards, criteria for primary standards, preparation of standard solutions, standardization of solutions. Limitation of volumetric analysis, end point, equivalence point	Learn by doing, Simulations/ Virtual labs, Videos	8
Module 3	Chromatography, Introduction, Principle of chromatography, Classifications of chromatography, Techniques of paper and column chromatography, Thin Layer Chromatography(TLC) Partition chromatography, Ion exchange chromatography	Tutorials, Virtual labs, Demonstrations, Experiments	8
Module 4	Thermal Analysis Thermal analytical methods, principle involved in thermogravimetric analysis differential gravimetric analysis and differential scanning calorimeter, discussion of various components with block diagram, characteristics of TG and DTA, Factors affecting TG, DTA and DSC Curves	Problem solving sessions, Expeienced examples,	8
Module 5	Evaluation and procession of analytical data, Precision and accuracy, Types of errors, Normal distribution curve, Standard deviation, Confidence limit, Graphical presentation of result-method of average, Method of linear list square, Significant figures, Statistical aid to hypothesis testing: t–test & F-test, Correlation coefficient, Rejection of data	. Problem solving sessions, Expeienced examples,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Complexometric titration	Experiments	BL3-Apply	4
VIII	Qualitative Analysis using Thin Layer Chromatography	PBL	BL4-Analyze	6
IX	Purification of sample by Crystallization technique	PBL	BL6-Create	7
IV	To determine the Percentage of Copper in copper alloy solution	Experiments	BL3-Apply	2
V	To determine the percentage of Chromium in chrome alloy	Experiments	BL3-Apply	2
VI	To purify the given sample Ammonium Chloride	Experiments	BL3-Apply	
VII	Qualitative Analysis using Paper, Chromatography	PBL	BL4-Analyze	6

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	Y Anjaneyulu Textbook of Analytical Chemistry 2008
Articles	https://nptel.ac.in/courses/104105084
References Books	Skoog D.A. and West D.M. Saunders Fundamental of Analytical Chemistry Ninth Edition
MOOC Courses	https://nptel.ac.in/courses/104105084
Videos	https://nptel.ac.in/courses/104105084

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	3	2	1
CO3	3	1	-	2	-	-	-	-	-	-	-	-	1	1	2
CO4	2	3	-	-	-	-	-	-	-	-	-	-	1	1	2
CO5	2	2	-	-	-	-	-	-	-	-	-	-	2	2	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Inorganic Chemistry
Course Code	BSCH0301[T]

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	knowledge of Coordination bonding in complexes Transition elements and their properties			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember Knowledge of Transition elements, Acids and Bases, Oxidation and reduction, Complexes , Lanthanides, Actinides**(BL1-Remember)** **CO2-** To understand Properties and uses of Transition elements, Coordination compounds, Acids and Bases , Non aqueous solvents Lanthanides, Actinides**(BL2-Understand)** **CO3-** To Apply the Transition elements, Complexes, Lanthanides, Actinides in the different application**(BL3-Apply)** **CO4-** To inspect the Structure , Bonding ,Magnetic Properties of Transition elements, Complexes**(BL4-Analyze)** **CO5-** To Assess the results analyzed**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
Module 1	Chemistry of Elements of First Transition Series: Characteristic properties of d-block elements Properties of the elements of the first transition series, their binary compounds such as Carbides, Oxides and Sulphides Complexes illustrating relative stability of their oxidation states, co-ordination number and geometry	Stoy telling activity Mnemonics Experienced examples, Quizzes Summarizing, PPT's Leaving Questions	8
Module 2	UNIT – II: Chemistry of Elements of second and Third Transition Series: General characteristics, Periodic Properties Atomic Radii Ionic Radii Ionization Energy comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behavior, spectral properties and stereochemistry	Mnemonics , Experienced examples, , Videos , PPT's Quizes	8
Module 3	UNIT – III: A. Co-ordination Compounds Werner's co-ordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of co-ordination compounds, isomerism in co-ordination compounds, valance bond theory of transition metal complexes theory of transition metal complexes B. Oxidation and Reduction Use of redox potential data: analysis of redox cycle, redox stability in water: Frost, latimer and Pourbaix diagrams, Principles involved in the extraction of element	Demonstrations, Videos, PPT's Quizes, Virtual labs Group discussions	8
Module 4	UNIT – IV A. Chemistry of Lanthanide Elements Electronic structure, oxidation states, ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds. B. Chemistry of Actinides General features and chemistry of actinides, chemistry of separation of Np. Pu and Am from U, similarities between the later actinides and the later lanthanides	Interactive videos PPT's Experienced examples, Quizzes', Mnemonics	8
Module 5	UNIT – V A. Acids and Bases Arrhenius, Bronsted- Lowry, the Lux-Flood, solvent system and lewis concepts of acids and bases B. Non-aqueous Solvents Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH3 and liquid SO2	Interactive videos , PPT's Experienced examples, Quizzes', Seminar	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
Module 3	Synthesis of Complex and Double salt	PBL	BL3-Apply	6
Module 5	Non Aqueous Titration	PBL		8
Experiment	Identify the Acid Radical in given inorganic mixture	Experiments	BL3-Apply	2
Experiment	Identify the Acid Radical (Sulphate)in the given inorganic sample	Experiments	BL3-Apply	2
Experiment	Identify the Acid Radical (Sulphite)in a given inorganic sample	Experiments	BL3-Apply	2
Experiment	Identify the Acid Radical (Nitrite)in the given inorganic sample	Experiments	BL3-Apply	2
Experiment	Identify the Basic Radical (Zero group) in the given sample	Experiments	BL3-Apply	2
Experiment	Identify the Basic Radical (First Group) in the given sample	Experiments	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	M.N.N Tandon Unified Chemistry 2010
Articles	
References Books	J.D.Lee Concise Inorganic Chemistry Fifth Edition
MOOC Courses	https://nptel.ac.in/courses/104101121
Videos	https://nptel.ac.in/courses/104101121

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	-	-	-	-	-	-	-	2	2	1
CO2	3	3	1	-	-	-	-	-	-	-	-	-	3	2	2
CO3	3	3	1	-	-	-	-	-	-	-	-	-	2	2	1
CO4	2	3	1	-	-	-	-	-	-	-	-	-	1	2	2
CO5	3	2	-	-	-	-	-	-	-	-	-	-	1	1	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Organic Chemistry
Course Code	BSCH0401[T]

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	The students should have basic knowledge of organic chemistry			**Co-Requisite/s**	The student must have studied organic chemistry in B.Sc. Certificate course			
Course Outcomes & Bloom's Level	**CO1-** To remember concept of substitution reactions**(BL1-Remember)** **CO2-** To understand the concept of addition and elimination reactions **(BL2-Understand)** **CO3-** To apply the various reagents in the organic synthesis**(BL3-Apply)** **CO4-** To recognize mechanism of oxidation reaction.**(BL4-Analyze)** **CO5-** To know the chemistry of photochemical reactions. **(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education) SDG9(Industry Innovation and Infrastructure)				

Part B

Modules	Contents	Pedagogy	Hours
Unit 1	Substitution Reactions: Aliphatic Nucleophilic Substitution : Introduction, the SN1, SN2 and SNi mechanisms, neighbouring group participation, effect of substrate, nucleophile, leaving group and reaction medium. Aliphatic Electrophilic Substitution : Elementary treatment	Lecture methods, short vedios, ABCA	8 hrs
Unit 2	Addition and Elimination Reactions Addition Renctions: Introduction, reactions involving addition of nucleophile, electrophile and frec radicals, regio-selectivity and chemo-selectivity, orientation and reactivity, Markovnikov and Anti-Markovnikov's addition. Elimination Reactions : Introduction, E1, E2 and ElcB mechanisms, effect of substrate, attacking species, leaving group and reaction medium, orientation Saytzeff and Hofmann rule	Audio/Video clips, group discussion, lecture with methods	8 hrs
Unit 3	Reagents and Catalysts (Mechanisms and Applications) Reagents and Catalysts : Preparation, properties and applications of important reagents and catalysts in organic synthesis with mechanistic details : Grignard reagent, N-bromo succinimide (NBS), diazomethane, anhydrous aluminium chloride (AlCl3), sodamide (NaNH2), Ziegler-Natta catalyst	Summarizing, PBL (small working models), Quiz, Virtual Lab, Tutorials sessions, Expert Lecture, lecture methods	8 hrs
Unit 4	Oxidation Reactions : Introduction, metal based and non-metal based oxidations, oxidation of alcohols to carbonyls (chromium, manganese, and silver based reagents), alkenes to epoxides (peroxides/ peracids based, alkenes to diols (manganese and osmium based), alkenes to carbonyls with bond cleavage (manganese and lead based), Oppenauer oxidation	Lecture methods, short vedios, ABCA	8 hrs
Unit 5	Photochemical Reactions : Introduction to photochemistry, electronic excitations, Jablonski diagram, Norrish type I and II reactions and cis-trans isomerization	Summarizing, PBL (small working models), Virtual Lab, Tutorials sessions, Expert Lecture	8 Hrs

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Qualitative analysis: Separtion of binary organic micture, Systematic identificationof separated organic compounds.	Experiments	BL4-Analyze	8 hrs
2	Oxidation of benzaldehyde to benzoic acid by KMnO4	Experiments	BL5-Evaluate	2hrs
3	Oxidation of cyclohexanone to adipic acid by HNO3	Experiments	BL5-Evaluate	2hrs
4	(4+2) Cycloaddition reaction of antracene and maleic anhydride	Experiments	BL4-Analyze	4hrs
5	Preparation and purification of product and determination of melting point of Acetanilide to p-nitro acietanilide to para nitroaniline	Experiments	BL6-Create	4 hrs
6	Preparation and purification of product and determination of melting point o azo dyesf	PBL	BL6-Create	8hrs
7	Application of Substitution reactions	Seminar	BL2-Understand	1hr
8	To see the use of reagents in organic synthesis	Industrial Visit	BL2-Understand	5hrs
9	To study the conversion of alkenes to diols (manganese and osimium based	Research Paper Presentation	BL3-Apply	5hrs

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	30	40	

Part E

Books	Unified Chemistry by MMN tondon
Articles	
References Books	Clayden, J., Greeves, N. and Warren S. Organic Chemistry, Oxford University Press, India, 1012, Second Edition Jerry March Advanced Organic Chemistry" John Wiley and Sons (Asia) Hornback, 1. M. "Organic Chemistry" Thomson Learning, Singapore, 2006, Second Edition. Ahluwalia, V. K. and Parashar R. K., "Organic Reaction Mechanisms", Narosa Publication, India, 2010, Fourth Edition. Goswami, C., "Snatkottar Prakash Rasayan evm Thos Avastha Rasayan", Hindi Granth Academy, Bhopal, Madhya Pradesh, 2019 .
MOOC Courses	https://nptel.ac.in/courses/104/101/10401115/ https://nptel.ac.in/courses/104/103/10403111/ https://nptel.ac.in/courses/104/106/10406077/
Videos	http://www.mphindigranthacademy.org/

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	3	2	3	3	3
CO2	3	2	2	2	-	-	-	-	-	-	2	2	2	2	2
CO3	3	2	2	1	-	-	-	-	-	-	1	2	2	2	1
CO4	3	3	1	1	-	-	-	-	-	-	1	2	1	1	1
CO5	3	2	1	1	-	-	-	-	-	-	1	1	1	1	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Physical Chemistry
Course Code	BSCH0501[T]

Part A

					L	T	P	C
Year	3rd	**Semester**	5th	**Credits**	3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Knowledge of Quantum Mechanics Plank Theory of Radiation			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember Knowledge of Quantum Mechanics, Spectroscopy, Photochemistry**(BL1-Remember)** **CO2-** To understand Mechanism of Quantum Mechanics, Spectroscopy, Photochemistry**(BL2-Understand)** **CO3-** To Apply the concept in the different application**(BL3-Apply)** **CO4-** To Analyze the Physical Pope ties of compounds**(BL4-Analyze)** **CO5-** To Evaluate the results analyzed**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
Module 1	Elementary Quantum Mechanics: Black-body radiation. Planck's radiation law, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects. Compton Effect. De-Broglie hypothesis, the Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, Particle in a one- dimensional	Story telling Experienced examples, Quizzes Summarizing, PPT's Leaving Questions Interactive videos	8
Module 2	Spectroscopy introduction: electromagnetic radiation. Regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, Degrees of freedom Rotational Spectrum: Diatomic molecules, Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect. Vibrational Spectrum: Infra-red spectrum: Energy levels of simple harmonic oscillator, selection rules, pure Vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of an harmonic motion and isotope on the spectrum, Idea of Vibrational frequencies of different functional groups	Demonstrations, Tutorials Experienced examples, , Videos , PPT's Quizzes', Group discussions	8
Module 3	Ra man Spectrum: Concept of polarisability, pure rotational and pure Vibrational Raman spectra of diatomic molecules, Selection rules. Electronic Spectrum: Concept of potential energy curves for bonding and anti bonding molecular orbitals, qualitative description of selection rules and Franck- Condon principle. Qualitative description of σ,π and n M. O. their energy levels and the respective transition UV Spectroscopy: Electronic excitation, elementary idea of instrument used. Application to organic molecules, Woodward- Fieser rule for determining λmax of enes, polyenes and α,β unsaturated carbonyl compounds	Demonstrations, Videos, PPT's Quizzes', Virtual labs	8
Module 4	Unit -IV: Photochemistry Interaction of radiation with matter, difference between thermal and photochemical processes, Laws of photochemistry: Grothus-Draper law, Stark-Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radioactive processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions energy transfer processes (simple examples.)	Interactive videos PPT's Experienced examples, Quizzes' Seminar	8
Module 5	V: Physical Properties and Molecular Structure Optical activity, Polarisation (Clausius – Mossotti equation), Oriented of dipoles in an electric field, dipole moment, induced dipole moment measurement of dipole moment, temperature method and refractive method, dipole moment and structure of molecules, magnetic properties – paramagnetism, diamagnetism and ferromagnetism	Interactive videos , PPT's Experienced examples, Quizzes', Seminar	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
Module 2	Determination of Concentration of the solution using colorimetry	Experiments	BL3-Apply	6
Module 3	Determination of wavelength maxima using UV-Visible spectroscopy	PBL	BL3-Apply	6
Module 2	Determination of functional groups using IR Spectroscopy	PBL	BL3-Apply	6
Experiment	Deterime the strength of NaOH using N/10 HCl BY PH Metric titration	Experiments	BL3-Apply	2
Experiment	Determine the strength of NaOH using N/10 Acetic Acid	Experiments	BL3-Apply	2
Experiment	Determine the strength of Base using Acid BY Conductometric titration	Experiments	BL3-Apply	2
Experiment	Determine the strength of Strong Base with weak acid by Conductometric titration	Experiments	BL3-Apply	2
Experiment	Verify Lambert - Beer Law by Colorimetric method	Experiments	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	M.N.N Tandon Unified Chemistry 2010
Articles	
References Books	Puri Sharma Pathania Physical Chemistry Fourth Edition
MOOC Courses	https://nptel.ac.in/courses/104101126
Videos	https://nptel.ac.in/courses/104101126

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	-	-	-	-	-	-	-	3	2	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	2	1	1
CO3	3	3	1	-	-	-	-	-	-	-	-	-	2	2	1
CO4	3	3	1	-	-	-	-	-	-	-	-	-	1	2	2
CO5	3	2	-	-	-	-	-	-	-	-	-	-	1	1	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Environmental Studies
Course Code	BSFC0201[T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					2	0	2	4
Course Type	Theory only							
Course Category	Interdisciplinary Major							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** -The course shall develop in student the scientific background needed to understand how the earth works and how we, as human beings, fit into that.**(BL1-Remember)** **CO2-** At the end of the course, it is expected that students will be able to identify and analyze environmental problems as well as the risks associated with these problems.**(BL2-Understand)** **CO3-** Ability to distinguish between various methods of various pollution analysis.**(BL3-Apply)** **CO4-** Students acquire skills for to communicate, prepare, plan and implement the environmental management project.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG5(Gender equality) SDG6(Clean water and sanitation) SDG7(Affordable and clean energy) SDG9(Industry Innovation and Infrastructure) SDG11(Sustainable cities and economies) SDG12(Responsible consuption and production) SDG13(Climate action) SDG14(Life below water) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours
Unit 1. Study of Environment and Ecology	(a) Environment – Definition and Its segments (Atmosphere, Lithosphere, Hydrosphere and Biosphere). (b) Environmental education- Definition, scope, importance, Need for Public Awareness & multidisciplinary nature of Environmental Science. (c) Elements of ecology (d) Ecosystem- Concepts, components, structure & function, energy flow, food chain, food web, ecological pyramids and types.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	6
Unit 2. Environmental Pollution and Population	(a) Air, water, noise, soil and nuclear pollution- definition, causes, effect and prevention of pollution. (b) Environmental issues (c) Population growth, disparities between countries. (d) Population explosion, family welfare program. (e) Environment and human health. Cleanliness and disposal of domestic waste	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	6
Unit 3. Natural resources, Problems and Conservation	(a) Natural resource- Definition and classification (b) Water resources, Forest resources, Land resources, Food resources and its management (c) Energy resources- Classification and alternatives of conventional energy resources (Solar energy, geothermal energy, wind energy, nuclear energy, biomass and biogas energy)	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	6
Unit 4. Bio-diversity and its Protection	(a) Introduction- Genetic, species and ecosystem diversity. (b) Value of bio-diversity- Consumable use: Productive use, Social, Moral and Aesthetic uses. (c) India as a nation of mega bio-diversity center, bio-diversity at national and local levels. (d) Threats to bio-diversity – Loss of habitat, poaching of wildlife, man and wildlife conflicts.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	6
Unit 5. Disaster Management and Environmental Laws	(a) Concepts of hazard, Vulnerability, Risks, Natural disasters (earthquake, cyclone, floods, volcanoes), and man made disaster (Armed conflicts and civil strip, Technological disasters, Human settlement, Slow disasters (famine, draught, epidemics) and Rapid onset disasters(Air crash, tidal waves, Tsunami) (b) Disaster Management: Prevention, Preparedness and Mitigation (c) Environmental legislations in India: Air conservation act, water conservation act, wildlife conservation act, environment protection act. Role of information technology in protecting environment and health	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	6

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100		40	12	60	30
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	B. S. Chauhan Environmental Science 2008 First Richards T. Wright & Dorothy F. Boorse Environmental Science: Toward a Sustainable Future 2016 S. K. Dhameja Environmental Engg. & Management 2000
Articles	
References Books	Gilbert M. Masters Introduction to Environmental Engineering and Science 1991 Stanley Manahan & Stanley E. Manahan Environmental Chemistry 2009
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	1	-	-	-	-	-	-	-	-	-	-	-	-	2	-
CO4	1	-	-	-	-	-	-	-	-	-	-	-	-	2	3
CO5	1	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Calculus and Differential Equations
Course Code	BSMA0101[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Disciplinary Minor							
Pre-Requisite/s	calculus and differential equations include a strong foundation in algebra, trigonometry, pre-calculus, and analytical geometry. Understanding of functions, limits, and basic calculus concepts like derivatives and integrals is essential for success in these subjects.			**Co-Requisite/s**	calculus and differential equations often include concurrent enrollment in courses covering algebra, trigonometry, and pre-calculus. Additionally, a solid understanding of analytical geometry and basic calculus concepts such as limits, derivatives, and integrals is recommended for effective comprehension and application of these subjects.			
Course Outcomes & Bloom's Level	**CO1-** To get insight of fundamental knowledge of Differential, integration and differential equation.**(BL1-Remember)** **CO2-** To understand various techniques to solve real life problems through examples.**(BL2-Understand)** **CO3-** To apply notation of derivative in identifying increasing/ decreasing function, extreme values, concavity, convexity and also higher order derivatives which arise in all applied sciences.**(BL3-Apply)** **CO4-** To analyze behavior of curve through tracing and solution of ordinary differential equation.**(BL4-Analyze)** **CO5-** To evaluate Area, Quadrature, Rectification and Orthogonal trajectories of curves.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Successive differentiation, Leibnitz theorem, Maclaurin's and Taylor's series expansions, asymptotes.	Audio/Video clips, group discussion, lecture with ppt, quiz	8
2	Curvature, tests for concavity and convexity, Points of inflexion, Multiple points, Tracing of curves in Cartesian and polar coordinates.	Audio/Video clips, group discussion, lecture with ppt, Review Analysis	8
3	Integration of transcendental functions, Definite integrals, Reduction formulae, Quadrature, Rectification.	Audio/Video clips, group discussion, lecture with ppt, classroom presentations, Analysis	8
4	Linear differential equations and equations reducible to the linear form, Exact differential equations, First order and higher degree equations solvable for x, y and p, Clairaut's equation and singular solutions, Geometrical meaning of a differential equation, Orthogonal trajectories.	Audio/Video clips, group discussion, lecture with ppt, quiz	8
5	Linear differential equation with constant coefficients, Homogeneous linear ordinary differential equations, Linear differential equations of second order, Transformation of equations by changing the dependent variable independent variable, Method of variation of parameters.	Audio/Video clips, group discussion, lecture with ppt, quiz	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	G. F. Simmons Differential Equations Tata McGraw Hill, 1972.
Articles	
References Books	H. T. H. Piaggio Elementary Treatise on Differential Equations and their Application C.B.S. Publisher & Distributors, Delhi, 1985
MOOC Courses	https://onlinecourses.nptel.ac.in/noc24_ma12/preview https://onlinecourses.nptel.ac.in/noc24_ma37/preview
Videos	https://onlinecourses.nptel.ac.in/noc24_ma12/preview https://onlinecourses.nptel.ac.in/noc24_ma20/preview https://onlinecourses.nptel.ac.in/noc24_ma37/preview https://onlinecourses.nptel.ac.in/noc24_ma37/preview

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	2	-	1	-	-	-	-	1	-	1
CO2	3	3	1	3	3	2	-	1	-	1	-	-	2	-	2
CO3	3	2	-	1	3	-	-	-	-	-	-	-	1	3	2
CO4	3	2	-	2	-	-	-	-	-	-	-	-	-	3	1
CO5	2	2	-	1	-	-	-	-	-	-	-	-	-	2	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Abstract Algebra
Course Code	BSMA0201[T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Disciplinary Minor							
Pre-Requisite/s	Basic Knowledge of Set theory and Basic understanding of elementary mathematics.			**Co-Requisite/s**	Understanding of sets, subsets, operations on sets, and basic set operations such as union, intersection, and complement. Familiarity with fundamental algebraic structures such as groups, rings, and fields, including their definitions, properties, and basic examples.			
Course Outcomes & Bloom's Level	**CO1-** CO1: To remember the basic knowledge of the Groups, Subgroups, Normal Subgroups, Cyclic Groups, Homomorphism and Isomorphism of groups, Automorphisms, Ring and Field.**(BL1-Remember)** **CO2-** CO2: To understand the fundamental concept and properties of Groups, Rings, Fields and integral domains.**(BL2-Understand)** **CO3-** CO3: To apply the knowledge of groups, rings, fields and integral domains in all the fields of learning including higher research and extensions.**(BL3-Apply)** **CO4-** CO4: To analyze and solve the well-defined problems in mathematics related to the different groups, rings, and fields.**(BL4-Analyze)** **CO5-** CO5: To evaluate the studied problems from application point of view by using the results of the different theorems.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Definition and basic properties of groups, subgroups, Subgroups generated by a subset, Cyclic groups and simple properties.	Audio/Video clips, group discussion, lecture with ppt, quiz	8
2	Coset decomposition, Lagrange's theorem and its corollaries including Fermat's theorem, Normal subgroups and Quotient groups.	Audio/Video clips, group discussion, lecture with ppt, Review Analysis	9
3	Homomorphism and Isomorphism of groups, Fundamental theorem of homomorphism, Transformation and Permutation group, sn (Various subgroups of Sn n< 5 to be studied),Cayley's theorem.	Audio/Video clips, group discussion, lecture with ppt, classroom presentations, Analysis	10
4	Group Automorphisms, Inner Automorphism, Group of Automorphisms,Conjugacy relation and Centralizer,Normaliser, Counting principle and class equation of a finite group, Cauchy's theorem for finite abelian groups and non- abelian groups.	Audio/Video clips, group discussion, lecture with ppt, quiz	9
5	Definition and basic properties of rings, Ring homomorphism subrings, Ideals and Quotient rings, Polynomial rings & its properties, Integral domain and Field.	Audio/Video clips, group discussion, lecture with ppt, quiz	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	I. N. Herstein, Topics in Algebra Wiley Eastern Ltd. New Delhi,
Articles	
References Books	Shantinarayan A Text Book of Modern Abstract Algebra S. Chand and Company, New Delhi
MOOC Courses	https://onlinecourses.nptel.ac.in/noc24_ma06/preview
Videos	https://onlinecourses.nptel.ac.in/noc24_ma06/preview

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	3	-	-	-	-	1	-	-	-	-	-	-
CO2	1	-	-	2	-	-	-	-	1	-	-	-	-	-	-
CO3	-	2	-	-	1	-	-	-	-	2	-	-	-	-	-
CO4	2	-	1	-	-	-	-	2	-	-	-	-	-	-	-
CO5	1	-	-	2	-	-	-	2	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Vector Analysis & Linear Algebra
Course Code	BSMA0301[T]

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Disciplinary Minor							
Pre-Requisite/s	Basic knowledge of Matrix & vectors			**Co-Requisite/s**	Basic knowledge of LI, LD, dot and cross product			
Course Outcomes & Bloom's Level	**CO1-** CO1: To get insight of fundamental knowledge of matrix, group theory and transformations.and basic concept of vector analysis **(BL1-Remember)** **CO2-** CO2: To understand various techniques to solve real life problems through examples.**(BL2-Understand)** **CO3-** CO3: To apply the concepts of matrix, vector space, linear transformation and Gauss theorem , stock theorem , green theorem and other concept of vector analysis on many branches of Physics, Engineering, Social sciences and Mathematics **(BL3-Apply)** **CO4-** CO4To analyze the concept of Gauss theorem , stock theorem , green theorem and other concept of vector analysis .**(BL4-Analyze)** **CO5-** CO5: To evaluate gradient ,divergence ,curl andInverse, Eigen value and Eigen vector of matrix							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
Unit 1	Rank and Nullity of matrix, Solution of simultaneous equation by elementary transformation, consistency of equations, Eigen value and Eigen vectors, Calley Hamilton theorem, Inverse matrix, Digonlization.	Audio/Video clips, group discussion, lecture with PPTs, quiz	8
Unit 2	Definition and examples of vector spaces, subspaces, sum and direct sum of subspaces, Linear span, Linear dependence, Independence and their basic properties, Basis, Existence Theorem for basis, Extension theorem, Invariance of the number of elements of a basis, Dimension, Finite dimensional vector spaces, Existence of complementary subspaces of a subspace of a finite dimensional vector space, Dimension of sum of subspaces, Quotient space and its dimension.	Audio/Video clips, group discussion, lecture with PPTs, quiz	8
Unit 3	Linear transformations, Properties of linear transformation, Range and Kernel, The rank and nullity of linear transformations, Rank-Nullity theorem and its consequence, The matrix representation of a linear transformation, change of basic, dual space, bi-dual space and natural isomorphism, adjoint of a linear transformation.	Audio/Video clips, group discussion, lecture with PPTs, classroom presentations, Analysis	8
Unit 4	Scalar and vector product of three vectors, product of four vectors, Reciprocal vectors, vector differentiation, Gradient, Divergence and curl	Audio/Video clips, group discussion, lecture with PPTs, Quiz	8
Unit 5	Vector Integration, Greens Theorem, Stokes Theorems and Gauss divergence Theorem and problems based on them	Audio/Video clips, group discussion, lecture with PPTs, Quiz	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	1. K.B. Datta, Matrix and Linear Algebra, Pratice Hall of India Pvt. Ltd. New Delhi, 2000 2. K. Haffiman and R. Kunze, Linear Algebra, 2nd Edition. Prentice Hall Englewood Cliffs. New Jersey,1971 N. Saran and S. N. Nigam,Introduction to Vector Analysis,Pothishala Pvt. Ltd. Allahabad
Articles	
References Books	1. Marc Lipson and Seymour Lipschutz, Schaum'S Outline Of Linear Algebra, Key College Publishing (Springer – Verlag) 2001 2. S, Kumarsaran, Linear Algebra, A Bermetric Approach Prentice Hall of India, 2000 Shanti Narayan,A Text Book of Vector Calculus,S. Chand & Co. New Delhi
MOOC Courses	https://onlinecourses.nptel.ac.in/noc24_ma13/preview
Videos	https://onlinecourses.nptel.ac.in/noc24_ma04/preview https://onlinecourses.nptel.ac.in/noc24_ee48/preview https://onlinecourses.nptel.ac.in/noc24_ma11/preview

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	2	-	1	-	-	-	-	-	-	-
CO2	3	3	1	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	1	3	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	2	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	-	1	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Advance Calculus and Differential equations
Course Code	BSMA0401[T]

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Disciplinary Minor							
Pre-Requisite/s	Basics Differentiation , Integrations, , Continuity ,convergence and divergence of Sequence and Series ,partial differentiation			**Co-Requisite/s**	Function,, Limit , Sequence and Series and derivative			
Course Outcomes & Bloom's Level	**CO1-** To remember basic concept of Real Analysis ,Partial Differentiationwhich used in various problems of sciences. **(BL1-Remember)** **CO2-** To understand and identify the Convergence of sequences various test for convergence of sequences , limit ,continuity and differentiability of function partial differentiation, Envelops , maxima and minima , Double and Triple Integral volume and surface of solids.also**(BL2-Understand)** **CO3-** To apply the concept of limit continuity and differentiability partial differentiation ,Taylors theorem , LaGrange's method , double and triple integrals to solve various problems of physical and allied sciences**(BL3-Apply)** **CO4-** To analyze and draw connection among the ideas of LaGrange's theorem and Beta Gama function , volume and surface and there properties to solve various problems of physical and allied sciences also Analyze behavior of the solution of the well-defined problems of differentiation **(BL4-Analyze)** **CO5-** To evaluate Double and Triple integral , Partial differentiation , Convergence of series also identifying and provide the various applications related to them also **(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
UNIT01	Definition of a sequence, , Bounded and monotonic sequences, Theorems on limits of sequences, Cauchy's convergence criterion, series of non-negative terms, comparison test, Cauchy's integral test, Cauchy's root test, Ratio tests, Raabe's tests, Logarithmic tests, Alternating series, Leibnitz's test, Absolute and Conditional convergence	Audio/Video clips, group discussion, lecture with PPTs, quiz	10
UNIT02	imit and continuity of functions of two variables, Partial differentiation, Change of variables, Euler's theorem on homogeneous functions, Taylor's theorem for functions of two variables, Jacobins,, Maxima and Minima of functions of two variables	Audio/Video clips, group discussion, lecture with ppt	10
UNIT03	Beta and Gama function ,Double and triple integrals, Volumes and surfaces of solids of revolution, Change of order of integration in double integrals.	Audio/Video clips, group discussion, lecture with PPTs, classroom presentations, Analysis	10
UNIT04	Partial differential equations of the first order, Lagrange's solution, Some special types of equations which can be solved easily by methods other than the general method, Charpit's general method	Audio/Videoclips, group discussion, lecture with PPTs, Quiz	8
UNIT05	Partial differential equations of second and higher orders, Classification of partial differential equations of second order, Homogeneous and non-homogeneous equations with constant coefficients, Partial differential equations reducible to equations with constant coefficients.	Audio/Video clips, group discussion, lecture with PPTs, Quiz	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	R. R. Goldbeg,Real Analysis,Oxford & I. B. H. Publishing Co. New Delhi Sharma and Gupta ,Integral Transform,Pragati, Prakashan Meerut
Articles	
References Books	D. Soma Sundaram and B. Choudhary,A first Course in Mathematical Analysis,Narosa Publishing House, New Delhi, 1997 D. A. Murray,Introductory Course in Differential Equation,Orient Longman, India, 1967.
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	2	2	-	2	-	-	-	-	1	-	1
CO2	3	3	1	3	3	2	-	1	-	1	-	-	2	-	2
CO3	3	2	-	1	3	-	-	-	-	-	-	-	1	3	2
CO4	3	2	-	2	-	-	-	-	-	-	-	-	-	3	1
CO5	2	1	-	1	-	-	-	-	-	-	-	-	-	2	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Computer Oriented Statistical Methods
Course Code	BSMA0501[T]

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Disciplinary Minor							
Pre-Requisite/s	Understanding of algebra, basic calculus, and probability theory. Familiarity with descriptive statistics, such as measures of central tendency and dispersion, is necessary. Basic computer skills are helpful for using statistical software like R or Python. Critical thinking, problem-solving, and logical reasoning skills are essential for analyzing data and drawing valid conclusions. Continuous learning and practice are crucial in statistics due to its dynamic nature.			**Co-Requisite/s**	Concurrent study of experimental design, to understand how data is collected and its impact on analysis. Familiarity with a programming language such as Python or R is beneficial for data manipulation and analysis. Basic knowledge of probability theory, calculus, and algebra supports a deeper understanding of statistical concepts. An understanding of research methods aids in interpreting statistical results within context. Additionally, critical thinking skills are essential for evaluating the validity of statistical methods and conclusions. Practical experience applying statistical techniques to real-world problems enhances understanding and proficiency.			
Course Outcomes & Bloom's Level	**CO1-** To remember the data collection plans and basic tools of descriptive statistics **(BL1-Remember)** **CO2-** To analyze the relationship between two variables using scatter plot and Interpret a simple correlation. **(BL4-Analyze)** **CO3-** To apply the concept of sampling distribution of a statistic and hypothesis**(BL3-Apply)** **CO4-** TO Understand the concept of sampling distribution of a statistic and its properties, difference between parameter and statistic**(BL2-Understand)** **CO5-** To evaluate the correlation and regression analysis and measure of central tendency**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction: Frequency distribution and Frequency charts, Histogram, Frequency polygons, Frequency curves and Cumulative frequency distribution. Measures of Central Tendency: Arithmetic mean median, mode.	Audio/Video clips, group discussion, lecture with ppt, quiz	8
2	Measures of Dispersion: Moments, Skewness and kurtosis, Range, mean deviation, standard deviation, coefficient of variation	Audio/Video clips, group discussion, lecture with ppt, Review Analysis	10
3	Combinatorics: Permutation and Combination, Repetition and Constrained Repetition, Binomial Coefficients, Binomial Theorem. Elementary Probability Theory: Sample space, events, classical definition of probability, theorems on total and compound probability, independent and dependent events, mutually exclusive events	Audio/Video clips, group discussion, lecture with ppt, classroom presentations, Analysis	8
4	Regression and Correlation: Coefficient of correlation, rank Correlation, Regression analysis, Curve fitting: Method of Least square	Audio/Video clips, group discussion, lecture with ppt, quiz	8
5	Testing of Hypotheses: Simple and composite hypothesis, errors of kind-I and kind-II, critical region, level of significance. Tests of Significance: Tests for simple hypotheses, Student's t test, F-test and applications.	Audio/Video clips, group discussion, lecture with ppt, quiz	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	H. C. Saxena and J. N. Kapoor Mathematical Statistics S. Chand and sons Co.
Articles	
References Books	M. Ray Statistical Methods Ram Prasad Publication
MOOC Courses	https://onlinecourses.nptel.ac.in/noc24_ec03/preview
Videos	https://onlinecourses.nptel.ac.in/noc24_ec03/preview

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	2	-	-	-	-	-	-	1	-	1
CO2	3	3	1	3	3	2	-	-	-	1	-	-	2	-	2
CO3	3	2	-	1	3	-	-	-	-	-	-	-	1	3	2
CO4	3	2	-	2	-	-	-	-	-	-	-	-	-	3	1
CO5	2	2	-	1	-	-	-	-	-	-	-	-	-	2	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Mechanics
Course Code	BSPH0101[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Knoeledge of Physics upto Class 12			**Co-Requisite/s**	Knoeledge of Physics upto Class 12			
Course Outcomes & Bloom's Level	**CO1-** To remember the basic laws of mechanics**(BL1-Remember)** **CO2-** Understand the basic concepts of Newtonian Mechanics,**(BL2-Understand)** **CO3-** To enable students to apply the Laws of mechanics to various mechanical systems**(BL3-Apply)** **CO4-** To analyze the applications of Laws of mechanics to various mechanical systems.**(BL4-Analyze)** **CO5-** To evaluate the laws of mechanics and its application to various mechanical systems.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Mathematical Physics Addition, subtraction and product of two vectors; Polar and axial vectors and their examples from physics; Triple and quadruple product (without geometrical applications); Scalar and vector fields; Differentiation of a vector; Repeated integral of a function of more than one variable; Unit tangent vector and unit normal vector; Gradient, Divergence and Curl; Laplacian operator; Idea of line, surface and volume integrals; Gauss', Stokes' and Green's Theorems	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
2	Unit-II Newton's laws and Conservation principle Position, Velocity and Acceleration Vector, Components of velocity and acceleration in different coordinate systems. Newton's Laws of motion and its explanation with problems,and various types of forces in nature (explanation), Conservation of energy and momentum Elastic and inelastic collisions	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
3	Unit-III Rigid Body Dynamics Concept of rigid body, System of particles, Translational and Rotational motion, Moment of Inertia and their Product, Principal moments and axes, Calculation of moment of inertia lamina, disc, solid cylinder and sphere, Motion of Rigid Body, Euler's equation, Centre of mass and reduced Mass. Pseudo Forces (e.g. Centrifugal Force), Coriolis force and its applications	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
4	Unit-IV Central forces and Oscillations Motion under a central force, Derivation of Kepler's laws. Gravitational law and field, Potential due to a spherical body. Gauss & Poisson's equation of Gravitational self-energy. Concept of Simple, Periodic & Harmonic Oscillation with illustrations; Differential equation of harmonic oscillator; Kinetic and potential energy of Harmonic Oscillator; Oscillations of two masses connected by a spring;	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
5	Unit-VRelativistic Mechanics Michelson-Morley experiment and its outcome; Postulates of Special Theory of Relativity; Lorentz Transformations. Simultaneity and order of events; Lorentz contraction; Time dilation; Relativistic transformation of velocity ,frequency and wave number; Relativistic addition of velocities; Variation of mass with velocity	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	To verify Parallel and Perpendicular Axis theorem	Experiments	BL3-Apply	3
2	To find out moment of inertia fly whee	Experiments	BL3-Apply	3
3	To verify the forces in different members of jib crane	Experiments	BL4-Analyze	3
4	To verify parallelograms law using Gravesend Apparatus	Experiments	BL4-Analyze	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	University Physics by Sears and Zeemansky
Articles	
References Books	Mechanics by D.S. Mathur
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	3	3	2	-	1	1	-	-	-	-	-
CO2	2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	-	-	3	-	2	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Properties of Matter
Course Code	BSPH0102[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Disciplinary Major							
Pre-Requisite/s	Knowledge of Physics upto Class 12			**Co-Requisite/s**	Knowledge of Mathematics upto Class 12			
Course Outcomes & Bloom's Level	**CO1-** To remember the basic laws of Properties of Matter. **(BL1-Remember)** **CO2-** Understand the basic concepts of Properties of Matter **(BL2-Understand)** **CO3-** To enable students to apply the Laws of Properties of Matter **(BL3-Apply)** **CO4-** To analyze the applications of Laws of Properties of Matter**(BL4-Analyze)** **CO5-** To evaluate the laws of Properties of Matter and its application to various mechanical systems.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Unit-I Elasticity Elasticity, Effect of Temperature and Impurities, Hooks law and Stress strain curve, Young Modulus, Bulk Modulus, and Modulus of rigidity, Poisson's ratio, relation among various Elastic moduli, Determination of Young Modulus	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
2	Unit II Rigidity and bending Torsion of Cylindrical rod and Torsional rigidity, Torsion pendulum, Determination of Modulus of Rigidity by Torsional oscillations, Bending of beams, Cantilever loaded at free end, Cantilever supported at end loaded in the middle, determination of Y by bending od beam	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
3	Unit III Surface tension Surface Tension: Surface Tension, Angle of Contact, Capillary Rise Method; Energy required to raise a liquid in the capillary tube; Factors affecting surface tension; Jaeger's method for Determination of surface tension; Applications of Surface Tension.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
4	Unit-IV Viscosity Concept of Viscous Forces and Viscosity; Steady and Turbulent Flow, Reynolds's number; Equation of Continuity; Bernoulli's Principle; Application of Bernoulli's equation - (i) Speed of Efflux (ii) Venturi meter (iii) Aspirator Pump(iv) Change of plane of motion of a spinning ball.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
5	Unit-V Ultrasonic and Acoustics Ultrasonic waves, production of ultrasonic waves, Detection and application of ultrasonic, Acoustics- Reverberation time and its measurement- Sabine's formulaAbsorption coefficient and its determination- Factors affecting architectural acoustics and their remedy, Sound absorbing materials.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	University Physics by Sears and Zeemansky
Articles	
References Books	General Properties of matter by D S Mathur
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	3	3	2	-	1	1	-	-	-	-	-
CO2	2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	-	-	3	-	2	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Statistical physics
Course Code	BSPH0202[T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Disciplinary Major							
Pre-Requisite/s	Knowledge of Physics upto Class 12			**Co-Requisite/s**	Knowledge of Mathematics upto Class 12			
Course Outcomes & Bloom's Level	**CO1-** To remember the basic laws of Statistical Physics**(BL1-Remember)** **CO2-** Understand the basic concepts of Statistical Physics**(BL2-Understand)** **CO3-** To apply the concepts of Statistical Physics to different system.**(BL3-Apply)** **CO4-** To Analyze the laws of Statistical Physics**(BL4-Analyze)** **CO5-** To evaluate the laws of Statistical Physics**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Statistical Physics-I Description of a system: (Significance of statistical approach, Particle-states, System-states, Microstates and Macro-states of a system, Equilibrium states, Fluctuations,) Classical &Statistical Probability, the probability of a distribution, the most probable distribution and its narrowing with increase in number of particles The equal-probability postulate,	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
2	Unit-II Statistical Physics-II Phase space, Statistical ensemble, Number of states Accessible to a system, Phase space. Micro Canonical Ensemble, Canonical Ensemble, Partition Function, Relation between Partition Function and Entropy Constraints of accessible and inaccessible states.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
3	Unit-III Maxwell-Boltzmann Statistics Maxwell-Boltzmann statistics, Most Probable distribution in discrete energy levels (MB distribution) Molecular speeds, Distribution and mean, r.m.s. and most probable velocity,	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
4	Unit-IV Bose Einstein Statistics Bose-Einstein statistics, Ideal Bose Einstein gas Black□body radiation, The Rayleigh-Jeans formula, The Planck radiation formula	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
5	Unit-V Fermi Dirac Statistics Fermi-Dirac statistics, Ideal Fermi Dirac gas Thermionic emission, Photoelectric effect White Dwarf Star, Concept of Phase transitions	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Thermal Physics by Garg, Bansal and Ghosh
Articles	
References Books	Thermodynamics, Kinetic theory of gase and statistical thermodynamic by Sears and Salinger
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	2	1	-	-	-	-	-	-	-	-
CO2	1	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	1	3	-	2	2	-	-	-	-	-	-	-	-	-	-
CO4	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	-	-	3	-	2	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Optics
Course Code	BSPH0301[T]

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Knowledge of Physics upto BSc first Year(Second semester)			**Co-Requisite/s**	Knowledge of Mathematics upto BSc first Year(Second semester)			
Course Outcomes & Bloom's Level	**CO1-** To remember the basic laws of Optics**(BL1-Remember)** **CO2-** Understand the basic concepts of Optics**(BL2-Understand)** **CO3-** To apply the concepts of Optics to different system. **(BL3-Apply)** **CO4-** To Analyze the laws of Optics**(BL4-Analyze)** **CO5-** To evaluate the laws of Optics**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Unit-I Geometric Optics and its applications: Ray optics, Plane and spherical Mirrors, Lens, image formation, Lens formula, combination of thin lenses and equivalent focal length. Dispersion and dispersive power, chromatic and achromatic aberration, need of multiple lenses in eyepieces, Ramsdens and Huygens eye-piece	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
2	Unit-II Interference: Principle of Superposition, Conditions for sustained interference, Theory of interference, Lloyd's mirror, Achromatic fringes. Interference in parallel and wedge shaped films, Colour of thin films. Newton's rings and Michelson interferometer and their applications. Multiple beam interference in parallel film and Fabry-Perot interferometer.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
3	Unit-III Diffraction: Frenel's diffraction, Zone plate, diffraction due to straight edge. Fraunhoffer diffraction due to single and double slits, plane transmission grating, Resolving power of grating, telescope and Microscope Diffraction Grating: Diffraction at N-parallel slits Intensity distribution, Plane diffraction grating, Concave grating and its mountings. Resolving power of a grating and comparison with resolving power of prism and of a Fabry Parot etalon.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
4	Unit-IV Polarization: Transverse nature of light waves, Polarization of electromagnetic waves, Plane polarized light – production and analysis, Description of Linear, circular and elliptical polarization. Propagation of em waves in anisotropic media, uniaxial and biaxial crystals, symmetric nature of dielectric tensor, Double refraction, Hygen's principle, Ordinary and extraordinary refractive indices, Fresnel's formula, light propagation in uniaxial crystal, Nicol prism, Production of circularly and elliptically polarized light, Babinet compensator and applications, Optical rotation, Optical rotation in liquids and its measurement through Polari meter.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
5	Unit-V Lasers and Photo Sensors A brief history of lasers, characteristics of laser light, Einstein prediction, Relationship between Einstein's coefficients (qualitative discussion only), Pumping schemes, Resonators, Ruby laser, He-Ne laser, Applications of lasers, Principle of Holography	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	To find out the Focal length of combination of lenses with Nodal slide experiments	Experiments	BL3-Apply	3
2	To determine the wavelength of Sodium light by using Newtons ring experiments	Experiments	BL4-Analyze	3
3	To determine the wavelength of Laser light by using diffraction grating	Experiments	BL3-Apply	3
4	To determine the specific rotation of Sugar solution by using polarimeter	Experiments	BL3-Apply	3
5	To find the numerical aperture of given fiber	Experiments	BL3-Apply	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Fundamental of Optics by N Subramanyam and Brijlal.
Articles	
References Books	(i) Principles of Optics by BK Mathur, (ii) Optics by Ajay Ghatak
MOOC Courses	(i) https://nptel.ac.in/courses/115107131 (ii)https://nptel.ac.in/courses/115107131 (iii) https://nptel.ac.in/courses/115107095
Videos	(i) https://nptel.ac.in/courses/115107131 (ii)https://nptel.ac.in/courses/115107131 (iii) https://nptel.ac.in/courses/115107095

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	1	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	3	2	2	-	-	-	-	-	-	-	-	-	-
CO4	1	2	3	2	2	-	-	-	-	-	-	-	-	-	-
CO5	2	1	3	2	2	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Electricity and Magnetism
Course Code	BSPH0401{T]

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Knowledge of Physics upto III Semester			**Co-Requisite/s**	Knowledge of Calculus			
Course Outcomes & Bloom's Level	**CO1-** To remember the basic laws of Electricity and Magnetism**(BL1-Remember)** **CO2-** Understand the basic concepts of Electricity and Magnetism**(BL2-Understand)** **CO3-** To apply the concepts of Electricity and Magnetism to different system. **(BL3-Apply)** **CO4-** To Analyze the laws of Electricity and Magnetism**(BL4-Analyze)** **CO5-** To evaluate the laws of Electricity and Magnetism**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Unit-I Vector Calculus : Differentiation of vectors, scalar and vector fields, conservative fields and potentials, line integrals, gradient of a scalar field, divergence of a vector field and divergence theorem, curl of a vector field and its physical significance, Stokes' theorem, combination of grad, div and curl	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
2	Unit- II Electric Field and Electric Potential: Electric field, electric field lines electric flux Gauss law with applications to charge distributions with Spherical, Cylindrical and Planer symmetry. Conservative nature of electrostatic field, electrostatic Potential, Potential and electric field of a dipole Force and Torque on a diploe	Audio/Video clips, group discussion, lecture with ppt, on white board	8
3	Unit-III Electrostatic energy and Capacitance of a System Electrostatic energy of system of charges, Electrostatic energy of a charged sphere, Conductors in an electrostatic field, Surface charge and force on a conductor, Capacitance of a System of charged conductors, Parallel plate capacitor	Audio/Video clips, group discussion, lecture with ppt, on white board	8
4	Unit-IV Magnetic Field Magnetic force between current elements and definition of magnetic field B Biot Savart's Law and its application to straight wire and circular loop. Dipole Moment and its analogy with electric dipole Ampere's Circuital law and its application to Solenoid.	Audio/Video clips, group discussion, lecture with ppt, on white board	8
5	Unit-V Electromagnetic Induction and Electrical Circuits Faraday's Law, Lenz's law, Self and Mutual Inductances Introduction to Maxwell equation charge conservation and displacement current. Electrical Circuits: Kirchhoff's law Complex reactance and impedance series and parallel LCR Circuit:: (1) Resonance (2) Power dissipation (3) Quality factor and (4) Band width	Audio/Video clips, group discussion, lecture with ppt, on white board	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Series Resonance for Different values of resistances, capacitances, Inductances and plotting of resonance curves and Q factor.	Experiments	BL4-Analyze	3
2	Measurement of Q factor for both Parallel resonances.	Experiments	BL2-Understand	3
3	To verify Kirchoff's Current and Voltage Law for D.C. Circuit	Experiments	BL2-Understand	3
4	To determination the resistance per unit length using Carey Foster's bridge wire.	Experiments	BL4-Analyze	3
5	To determine the value of unknown resistance using post office box.	Experiments	BL2-Understand	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Electricity and Magnetism and Electromagnetic Theory by S Mahajan and Choudhury
Articles	
References Books	Introduction to Electrodynamics by D J Griffith
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	2	2	-	2	-	-	-	-	-	-	-	-
CO2	2	3	2	2	2	-	-	-	-	-	-	-	-	-	-
CO3	2	2	2	3	1	-	1	-	-	-	-	-	-	-	-
CO4	1	1	3	2	3	-	-	-	-	-	-	-	-	-	-
CO5	3	2	1	1	1	-	3	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Electromgnetic Theory
Course Code	BSPH0404[T]

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Disciplinary Major							
Pre-Requisite/s	Knowledge of Physics upto BSc III Semester			**Co-Requisite/s**	Knowledge of Vector Calculus			
Course Outcomes & Bloom's Level	**CO1-** To remember the basic laws of Electrodynamics**(BL1-Remember)** **CO2-** Understand the basic concepts of Electromagnetic theory**(BL2-Understand)** **CO3-** To apply the concepts of Electrodynamics to different system. **(BL3-Apply)** **CO4-** To Analyze the laws of Electromagnetic theory**(BL4-Analyze)** **CO5-** To evaluate the laws of Electrostatics and Magneto statics **(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Unit-I Maxwell Equations: Review of Maxwell's equations. Displacement Current. Vector and Scalar Potentials. Gauge Transformations: Lorentz and Coulomb Gauge. Wave Equations. Plane Waves in Dielectric Media.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
2	Unit-II EM Energy Density: Poynting Theorem and Poynting Vector. Electromagnetic (EM) Energy Density. Physical Concept of Electromagnetic Field Energy Density. Momentum Density and Angular Momentum Density	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
3	Unit-III Electromagnetic waves: E. M. waves in vacuum, linear and circular polarization, Poynting vector, refraction and reflection of EM waves at interface between two dielectrics, normal and oblique incidence, Brewster angle, total reflection, numerical problems.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
4	Unit-IV Electromagnetic waves in a conducting medium, Complex refractive index, Boundary value problems in presence of metallic interface: reflection and refraction from metallic surface	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
5	Unit-V Wave Guides: Planar optical wave guides. Planar dielectric wave guide. Condition of continuity at interface. Phase shift on total reflection. Eigenvalue equations. Phase and group velocity of guided waves. Field energy and Power transmission	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Introduction to Electrodynamics by D.J. Griffiths
Articles	
References Books	Classical Electrodynamics by J D Jakson
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3	1	1	-	-	-	-	-	-	-	-	-	-
CO2	1	2	2	2	2	-	-	-	-	-	-	-	-	-	-
CO3	2	3	1	2	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	3	1	-	-	-	-	-	-	-	-	-	-
CO5	1	1	1	1	2	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Atomic and Nuclear Physics
Course Code	BSPH0501[T]

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Knowledge of Classical Physics			**Co-Requisite/s**	Knowledge of Mathematics upto BSc IV Semester			
Course Outcomes & Bloom's Level	**CO1-** To remember the basic laws of Atomic and Nuclear Physics**(BL1-Remember)** **CO2-** Understand the basic concepts of Atomic and Nuclear Physics**(BL2-Understand)** **CO3-** To apply the concepts of Atomic and Nuclear Physics to different system. **(BL3-Apply)** **CO4-** To Analyze the laws of Atomic and Nuclear Physics**(BL4-Analyze)** **CO5-** To evaluate the laws of Atomic and Nuclear Physics**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Unit-I Atomic Physics: Brief review of Bohr and Somerfield model of atom. Effect of finite nuclear mass in relation to Rydberg constant. Idea of discrete energy levels and electron spin: Fanck – Hertz and Stern – Gerlach experiments Significance of four quantum numbers and concept of atomic orbitals.	Audio/Video clips, lecture with ppt, on white board, quiz	8
2	Unit-II One valence electron atom: Orbital magnetic dipole moment, Orbital, spin and total angular momenta, Larmor precession, Paulis exclusion principle, Vector model of atom, Many particles in one dimensional box, Electronic configuration and atomic states, Spin-orbit interaction and fine structure, Intensity of spectral lines, General selection rules.	Audio/Video clips, lecture with ppt, on white board, quiz,	8
3	Unit-III Many electron atom Zeeman Effect and Paschen Bach effect. Two valence electron atoms: LS and JJ coupling schemes and resulting spectra. Idea of normal and inverted doublet. Basics of Stark effect. Doublet structure of alkali spectra.	Audio/Video clips, lecture with ppt, on white board, quiz,	8
4	Unit-IV General Properties of Nuclei and Nuclear Modals: Basic properties of nucleus: Shape, Size, Mass and Charge of the nucleus. Stability of the nucleus and Binding energy. Liquid-Drop Model, Shell Model, Meson Theory of Nuclear Forces.	Audio/Video clips, lecture with ppt, on white board, quiz,	8
5	Unit-V Radioactivity decay and Nuclear Reaction: Alpha particle spectra – velocity and energy of alpha particles. Geiger-Nuttal law. Nature of beta ray spectra. The neutrino hypothesis. Energy levels and decay schemes. Positron emission and electron capture. Nuclear reactions, Q-values and threshold of nuclear reactions. Cross-sections. Nuclear Fission, Nuclear Reactors, Nuclear Fusion in Stars.	Audio/Video clips, lecture with ppt, on white board, quiz,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	e/m by Thomson method	Experiments	BL2-Understand	3
2	To study the characteristics of the GM Counter and hence determine the operating voltage	Experiments	BL2-Understand	3
3	Planck Constant using LEDs by observing reverse photo electric effect	Experiments	BL3-Apply	3
4	To determine the excitation potential of gas (Argon) by Franck- Hertz experiment	Experiments	BL2-Understand	3
5	To draw the Hysteresis loop of a given ferromagnetic substance	Experiments	BL2-Understand	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Concepts of Modern Physics by Arthur Beiser
Articles	
References Books	1 Physics of Atoms & molecules by B.H. Bransden & C.J.Joachain 2 Nuclear Physics by Kaplan
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	2	2	-	-	-	-	-	-	-	-	-	-
CO2	2	-	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	2	-	2	-	-	-	-	-	-	-	-	-	-
CO5	1	2	-	3	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Elementry quantum mechanics
Course Code	BSPH0502[T]

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	Student must have knowledge about classical mechanics, black body radiation, photo electric effect and Compton effect etc.			**Co-Requisite/s**	After the completion of the course, student developed the basic concept quantum mechanics such as wave function, probability density, wave-particle duality, Schrodinger equation etc. They have also clearly differentiate between classical and quantum mechanics.			
Course Outcomes & Bloom's Level	**CO1-** To remember the basic laws of Quantum Mechanics**(BL1-Remember)** **CO2-** To understand the basic concepts of Quantum Mechanics**(BL2-Understand)** **CO3-** To apply the concepts of Quantum Mechanics to different system. **(BL3-Apply)** **CO4-** To Analyze the laws/postulates of Quantum Mechanics**(BL4-Analyze)** **CO5-** To evaluate the laws/postulates of Quantum Mechanics**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	ORIGIN OF QUANTUM MECHANICS Particles and Waves: Photoelectric effect. Black body radiation. Compton effect. De Broglie hypothesis. Wave particle duality. Davisson-Germer experiment. Wave packets. Concept of phase and group velocity. Two slit experiment with electrons. Probability. Wave amplitude and wave functions. Heisenberg's uncertainty principle with illustrations.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
2	WAVE MECHANICS Wave Packet - Schrodinger Wave Equation- Interpretation of the Wave Function, Probability Interpretation, Probability Current Density and Equation of Continuity- Ehrenfest theorem-Time Independent Schrodinger Wave Equation-Stationary States	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
3	ONE DIMENSIONAL UNBOUND STATES One dimensional potential Step and barrier, Reflection and transmission coefficients for a rectangular barrier in one dimension. Explanation of alpha decay. Quantum phenomenon of tunneling. Free particle in one-dimensional box, Eigen functions and Eigen values of a free particle	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
4	ONE DIMENSIONAL BOUND STATES One dimensional potential well, Boundary conditions. Bound states. Infinite Square Well Potential, Finite Square Well Potential One-dimensional simple harmonic oscillator, energy Eigen values from Hermite differential equation, wave function for ground state	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
5	Unit-V THREE-DIMENSIONAL BOUND STATES Particle Moving in a Spherically Symmetric Potential – Radial and Angular Part of Schrodinger Equation - System of Two Interacting Particles -Rigid Rotator – Hydrogen Atom- Radial Equation –Solution to Radial Equation- Energy Eigen Values and Eigen Functions	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	18
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Introduction to Quantum Mechanics by David Griffith Quantum Mechanics: Concept and Applications by Nouredine Zettili Concept of Modern Physics by Aurther Beiser
Articles	
References Books	Introduction to Quantum Mechanics by David Griffith Quantum Mechanics: Concept and Applications by Nouredine Zettili Concept of Modern Physics by Aurther Beiser
MOOC Courses	https://nptel.ac.in/courses/115101010 https://nptel.ac.in/courses/115102023 https://nptel.ac.in/courses/115104096 https://nptel.ac.in/courses/115104096
Videos	https://nptel.ac.in/courses/115101010 https://nptel.ac.in/courses/115102023 https://nptel.ac.in/courses/115104096 https://nptel.ac.in/courses/115104096

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	1	1	-	-	-	-	-	-	-	1	1	2
CO2	2	1	3	1	2	-	-	-	-	-	-	-	1	2	1
CO3	1	2	3	1	2	-	-	-	-	-	-	-	1	1	-
CO4	1	3	2	1	1	-	-	-	-	-	-	-	2	1	2
CO5	1	2	3	2	1	-	-	-	-	-	-	-	1	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Classical Mechanics
Course Code	BSPH0601[T]

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	Student must have basic knowledge related to vector calculus, coordinate system (such as cartesian, spherical and cylindrical) and mathematics knowledge up to 12th class.			**Co-Requisite/s**	After the completion of the course, students are able to know about the Langrangian formulation, connection between Langrangian and Hamiltonian system etc.			
Course Outcomes & Bloom's Level	**CO1-** To remember the various formulations of classical mechanics like Lagrangian, Hamiltonian and Hamilton-Jacobi**(BL1-Remember)** **CO2-** To understand the dynamical system; and its relation to dynamical variables like energy and momentum**(BL2-Understand)** **CO3-** To enable students to apply the various dynamical systems.**(BL3-Apply)** **CO4-** To analyze the applications of dynamical system in various fields such as research and trajectories of celestial bodies**(BL4-Analyze)** **CO5-** To evaluate understanding of various formulations in time evaluation of dynamical systems**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Langrangian Formulation of Mechanics Constrain and their classification examples of constrain, Degree of freedom, Generalized Co-ordinates, Dynamical systems , Phase space dynamics , Some techniques of calculus of variation, Hamilton's Principle, Langrangian equation of motion from Hamilton's principle, Conservation theorems and symmetry properties. Invariance and Neother's Theorem	Tutorials, Collaborative, Demonstrations, Video lectures, PBL	8
2	Hamiltonian formulation of Mechanics Hamiltonian and its physical significance, Hamilton's equations, Examples: Harmonic oscillator, motion of a particle in central force field, charged particle in an electromagnetic field, canonical transformation (C.T.), Generating function, properties of C.T, Poisson Bracket (PB), elementary PB, angular momentum and Poisson brackets , Poisson brackets and canonical transformations. Hamilton Jacobi theory and it's connection with canonical transformation.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
3	Reduction to the equivalent one-body problem, the Equation of motion and first integral, the equivalent one- dimensional problem and classification of orbit, Planetary motion – Kepler's Law, Stability analysis, scattering in a central force field, Transformation of the scattering problem to lab co-ordinate	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
4	Rigid body Dynamics Rotating Co-ordinate System, Coriolis & centrifugal force, simple planer motion, inertia tensor Angular momentum Eulerian angle, Euler's equation of motion of Rigid bodies, Torque free motion of rigid bodies	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
5	Small oscillation Two coupled harmonic oscillations, general problem of coupled oscillation, orthogonality of Eigen vectors, Normal Co-ordinates, Molecular vibration. . Forced vibrations and the effect of dissipative forces.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	18
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Concepts of Modern Physics by Aurther beiser Classical Mechanics by J.C. Upadhyaya Classical Mechanics by Herbert Goldstein Classical mechanics by gupta kumar sharma
Articles	
References Books	Concepts of Modern Physics by Aurther beiser Classical Mechanics by J.C. Upadhyaya Classical Mechanics by Herbert Goldstein Classical mechanics by gupta kumar sharma
MOOC Courses	https://nptel.ac.in/courses/115105098 https://nptel.ac.in/courses/115106068 https://nptel.ac.in/courses/115106123 https://nptel.ac.in/courses/115106068 https://nptel.ac.in/courses/115106058
Videos	https://nptel.ac.in/courses/115105098 https://nptel.ac.in/courses/115106068 https://nptel.ac.in/courses/115106123 https://nptel.ac.in/courses/115106068 https://nptel.ac.in/courses/115106058

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	1	1	-	-	-	-	-	-	-	1	1	2
CO2	1	2	3	1	2	-	-	-	-	-	-	-	1	2	1
CO3	1	2	3	1	2	-	-	-	-	-	-	-	1	2	3
CO4	1	3	2	1	1	-	-	-	-	-	-	-	2	1	2
CO5	1	2	3	2	1	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Mathematical Physics
Course Code	BSPH0602[T]

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	Student must have basic knowledge about mathematics (such as vector calculus, derivative, and integration) un to 12th class			**Co-Requisite/s**	After completion of the course, student developed the critical thinking related to Linear algebra, complex variable, Fourier series. Laplace transform and applied those concept in different area of subject.			
Course Outcomes & Bloom's Level	**CO1-** To remember the various formulae of linear algebra, complex analysis, Fourier and Laplace transformation, differential equation and tensor.**(BL1-Remember)** **CO2-** To understand the theorems in linear algebra, complex analysis and tensor**(BL2-Understand)** **CO3-** To apply complex analysis, Fourier and Laplace transformation, differential equation and tensor in Mechanics and others branches of physics.**(BL3-Apply)** **CO4-** To build analysis capacity of using linear algebra, complex analysis, Fourier and Laplace transformation, differential equation and tensor**(BL4-Analyze)** **CO5-** To evaluate given physical problems using linear algebra, complex analysis, Fourier and Laplace transformation, differential equation and tensor**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Linear Algebra Linear Vector Space: dual space and vectors, definition of real and complex vector spaces, linear operator, subspace; Span and linear independence:; Basis and Dimension, Linear Transformation: image, kernel, rank, change of basis, transition matrix, isomorphism, similarity transformation, orthonormality, Gram-Schmidt procedure, eigenvalues and eigenvectors	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
2	Complex Analysis Recapitulation: Complex number, Triangular inequalities, Schwarz inequality, function of complex variable – single and multiple- value function, limit and continuity, Differentiation –Cauchy –Riemann equation and their Application, Complex integrals, Cauchy's theorem , Series- Taylor and Laurent expansion, Classification of singularities, Branch point and branch cut, Residue theorem.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
3	Fourier and Laplace Transformation Fourier series of periodic functions, even and odd functions, half range expansions and different wave forms, complex form of Fourier series and practical harmonic analysis. Fourier transforms of various standard functions. Laplace transforms of various standard functions, properties of Laplace transforms and inverse Laplace transforms.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
4	Special function Singularity structure of a general second order homogeneous differential equation : ordinary points, regular and irregular points, indicial equation, the point at infinity, Series expansion method for solving differential equations, series solutions, Generating function and recurrence relations and Orthogonality of Bessel, Legendre and Hermite polynomials	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
5	Tensor Cartesian tensor, vector component, covariant, contravariant & mixed tensor, Direct product of two or more tensor, tensor of second & higher rank, symmetric & anti-symmetric, Illustrative applications of tensor in physics	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	18
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Applied Mathematical for engineers and physicist by Pipes Mathematical Methods by Arfken Mathematical Physics by H.K. Dass Advanced Engineering Mathematics– Erwin Kreyszig Schaum Series for transforms, Complex Variables and Tensors by Spiegel
Articles	
References Books	Applied Mathematical for engineers and physicist by Pipes Mathematical Methods by Arfken Mathematical Physics by H.K. Dass Advanced Engineering Mathematics– Erwin Kreyszig Schaum Series for transforms, Complex Variables and Tensors by Spiegel
MOOC Courses	https://nptel.ac.in/courses/115103036 https://nptel.ac.in/courses/115106086
Videos	https://nptel.ac.in/courses/115103036 https://nptel.ac.in/courses/115106086

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	1	-	-	-	-	-	-	-	-	1	1	2
CO2	1	2	3	1	-	-	-	-	-	-	-	-	1	2	1
CO3	1	2	3	1	-	-	-	-	-	-	-	-	1	1	-
CO4	1	3	2	1	-	-	-	-	-	-	-	-	2	1	2
CO5	1	2	3	2	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Electronics
Course Code	DSE1[T]

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					2	0	1	3
Course Type	Embedded theory and lab							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	Knowledge of basic Circuit Analysis			**Co-Requisite/s**	Know,edge of basic electricity			
Course Outcomes & Bloom's Level	**CO1-** To remember the different biasing technique, amplification, transformation of waves, oscillation, basic of differential and operational amplifier**(BL1-Remember)** **CO2-** To understand the continuity equation, pn junction and operating point and different amplifier circuit**(BL2-Understand)** **CO3-** To apply in designing the new circuit for amplifier using RC, OPAM, wave shaping and oscillation.**(BL3-Apply)** **CO4-** To analysis amplification by a circuit, wave shaping, basic oscillation circuit and its conditions, differential and operational amplifier**(BL4-Analyze)** **CO5-** To evaluate the operating point of diode and transistor, gain in various amplifier circuits, wave shaping circuit, class A, class B and class C amplifiers**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕			**SDG (Goals)**	SDG4(Quality education)			

Part B

Modules	Contents	Pedagogy	Hours
1	Biasing techniques and linear amplifier Continuity equation and its application to p-n junction under forward and reverse bias, Solution of Continuity equation for reversed and forward biased abrupt p-n junctions, Load line for a transistor, Location of Q-point for the bipolar transistor, variation of bias current, RC coupled CE amplifier, its frequency response and gain frequency plot, Gain band product, cascading of amplifiers.	Audio/Video clips, lecture with ppt, on white board, quiz	8
2	Power Amplifier and Oscillators Operating conditions for power amplifier, power relations, the ideal transformer, voltage limitations of eh transformer, non-linear distortion, idea of intermodulation distortion. The class A power amplifier, The push-pull amplifier, Feedback requirements of oscillations, Basic oscillator analysis, Hartley and Compitt oscillators, Piezo-electric, frequency control, RC oscillators.	Audio/Video clips, lecture with ppt, on white board, quiz,	8
3	Wave Shaping Circuits Linear wave shaping, High pass RC Circuit, High pass RC circuit as a differentiator, Low pass RC circuit, Low pass RC circuit as a integrator, Non- linear wave shaping, Shunt diode clipper and series diode clippers, Double ended p-n junction and Zener diode clipper circuits, Clamping circuits, Zero level and given level clamping, Fundamentals of voltage and current sweep generates, sweep wave forms, Miller integrating sweep circuits, Blocking and Triggered transistor blocking oscillator	Audio/Video clips, lecture with ppt, on white board, quiz,	8
4	Basic of Differential and Operational Amplifiers Differential amplifier, Differential amplifier circuit configuration, Dual input balanced output differential amplifier, Voltage gain, differential input resistance, inverting and non-inverting inputs. Common mode rejection ratio, Operational amplifier, input offset voltage supply, rejection ratio, Ideal OPAmp, equivalent circuit of an OP Amp, ideal voltage transfer curve, inverting,dual and non-inverting amplifier, measurement of OP Amp parameters, frequency response.	Audio/Video clips, lecture with ppt, on white board, quiz,	8
5	Application of Operational Amplifier Use of OP Amp as sign changer, scale changer, phase shifter, voltage to current converter differential dc amplifier, bridge amplifier, ac voltage follower, analog integration and differentiation, electronic analog computation, Non-linear function generator , series and shunt regulator.	Audio/Video clips, lecture with ppt, on white board, quiz,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Functions of CRO	Experiments	BL2-Understand	3
2	Half Wave Rectifier	Experiments	BL4-Analyze	3
3	Full Wave Rectifier	Experiments	BL4-Analyze	3
4	PNP Transistor CB Mode	Experiments	BL2-Understand	3
5	Transistor as an amplifier	Experiments	BL4-Analyze	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Integrated Electronics- Analog and Digital Circuit and Systems by Millman
Articles	
References Books	Electronic Devices and Circui by ROBERT L BOYLESTAD and LOUIS NASHELSKY
MOOC Courses	https://onlinecourses.nptel.ac.in/noc21_ee55/preview by Prof. M.B. Patil of IIT Bombay
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	1	3	2	2	-	-	-	-	-	-	-	-	-	-
CO3	2	1	2	1	2	-	-	-	-	-	-	-	-	-	-
CO4	1	2	1	3	1	-	-	-	-	-	-	-	-	-	-
CO5	2	1	3	2	2	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Condence Matter Physics
Course Code	DSPH0601[T]

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					2	0	1	3
Course Type	Embedded theory and lab							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	Student must have basis knowledge about the crystal structure such as Crystalline and amorphous, lattice point, unit cell etc.			**Co-Requisite/s**	After the completion of the course, student are able to developed a comprehensive idea related to crystal structure, lattice dynamics and thermal properties (such as lattice specific heat at constant pressure and volume) and also band theory of solid.			
Course Outcomes & Bloom's Level	**CO1-** To remember different crystal structure, symmetry elements, Bragg's Law, thermal and electronic properties of solid**(BL1-Remember)** **CO2-** To understand the origin of specific heat, energy band gap, formation of semiconductor junction, formation of defects in crystal**(BL2-Understand)** **CO3-** To apply knowledge of crystal structure, electronic and thermal properties on a given compound**(BL3-Apply)** **CO4-** To analysis difference between specific heat, conductivity in semiconductors and density of states**(BL4-Analyze)** **CO5-** To evaluate the different formation crystal by nature, thermal and electrical conductivity, electronic properties of conductors and semiconductors(**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Crystal Structure Space and crystal lattice, Primitive vectors and cells, symmetry elements, Miller indices for plane and axis, Space groups and point groups, Braggs Law, Construction of reciprocal lattice, reciprocal lattice vectors, Brillion zones, Reciprocal Lattice of SC, BCC and FCC, structural and atomic factors	Audio/Video clips, lecture with ppt, on white board, quiz	8
2	Lattice Dynamic and Thermal Properties Audio/Video clips, group discussion, lecture with ppt, on white board, quiz, Review Paper Analysis Vibration of one dimensional monatomic and diatomic lattices. Quantization of lattice vibration, Phonon momentum, Quantitative description of phonons in three dimensional lattice, phonon density of states, Einstein and Debye models of lattice specific heat, an harmonic effect in crystals, thermal expansion of solids, equation of states of solids, Photon phonon interaction and thermal conductivity.	Audio/Video clips, lecture with ppt, on white board, quiz,	8
3	Electronic Energy Bands Free electron gas, Hall effect and quantized Hall effect, The Periodic potentials Bloch thoerem and Born –von Kramer boundary conditions, Fermi surface, Electron density of states, Kroning –Penny model, Equation for electron wave in a periodic potential, solution of central equation, approximate solution near zone boundary, Construction of Fermi surface, tight binding approximation for band structure, effective mass in solids	Audio/Video clips, lecture with ppt, on white board, quiz,	8
4	Elements of Semiconductor Physics Band structure of semiconductors, Number of carriers in thermal equilibrium, intrinsic(non□degenerate) semiconductors, Extrinsic semiconductors, Effect of doping, impurity levels, Population of impurity level, Field and carrier densities in equilibrium, p-n junction, Elementary picture of rectification by pn junction.	Audio/Video clips, lecture with ppt, on white board, quiz,	8
5	Point defects Lattice vacancies, Interstials and their thermo dynamical calculation, features of point defects, color centers, formation of Alloys, Order disorder transformation, Elementary theory of order	Audio/Video clips, lecture with ppt, on white board, quiz,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	To determination of Miller Indices of crystal Lattice Structure	Experiments	BL2-Understand	3
2	To determine the Specific heat capacity of a given substance with help of electric kettle	Experiments	BL3-Apply	3
3	Hall Effect Experiment and its calculation of the Hall Coefficient.	Experiments	BL5-Evaluate	3
4	Then measure the energy band gap and resistivity of a thin sample using Four probes	Experiments	BL4-Analyze	3
5	To draw the characteristic curve of a forward & reverse Biased P-N Junction diode and to determine the static resistance of the given diode	Experiments	BL4-Analyze	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	1 Introduction to solid state Physics by Charles Kittle (Eight edition) 2 Solid State Physics by Dekkar
Articles	
References Books	Solid State Physics by Asheroff and Mermin
MOOC Courses	https://nptel.ac.in/courses/115106061
Videos	https://nptel.ac.in/courses/115106061

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	1	1	-	-	-	-	-	-	-	1	1	2
CO2	1	2	3	1	2	-	-	-	-	-	-	-	1	2	1
CO3	2	3	2	2	2	-	-	-	-	-	-	-	1	1	3
CO4	1	2	1	1	1	-	-	-	-	-	-	-	2	1	2
CO5	1	2	2	3	1	-	-	-	-	-	-	-	1	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Atomic and Molecular Physics
Course Code	DSPH0602[T]

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	Knowledge of elementry Quantum Mechanics			**Co-Requisite/s**	Knowledge of Mathematics upto BSc V semestger			
Course Outcomes & Bloom's Level	**CO1-** To Rember basics of atomic and molecular spectroscopy**(BL1-Remember)** **CO2-** To understand the mechanisms of various spectroscop**(BL2-Understand)** **CO3-** To apply selection rules, laws to understand the atoms and molecule**(BL3-Apply)** **CO4-** To analyze the process of molecule formation and luminescence**(BL4-Analyze)** **CO5-** To evaluate and apply the concepts for laser applications**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Unit-I Atomic Physics Quantum states of one electron atom, atomic orbitals, Hydrogen spectrum, spectra of helium and alkali elements, spin orbit interaction and fine structure of alkali spectra, normal and anomalous Zeeman effect, Pschenback effect, Startk effect, two electron system, equivalent and non equivalent electrons, Pauli's elclusion principle, interaction energy, L-S and J-J coupling, Hyperfine structure and isotopic shift, line broadening mechanisms.	Audio/Video clips, lecture with ppt, on white board, quiz	8
2	Unit-II Rotational Spectra Type of molecules: Linear, non-linear, symmetric top, asymmetric top, spherical top; rotational spectra of diatomic molecules as a rigid rotator, energy level diagram and spectra, rotational spectra of non rigid rotator, energy level diagram and spectra, intensity of rotational lines, applications of rotational spectra and pure rotational Raman spectra	Audio/Video clips, lecture with ppt, on white board, quiz,	8
3	Unit-III Vibrational and Vibrational- rotational Spectra Vibrational energy of diatomic molecules, diatomic molecule as simple oscillator, its energy lelvel diagram and spectrum, Born-Oppenheimer approximation. Morse potential energy curve, molecules as vibrating rotator, vibration spectrum of diatomic molecules, PQR branches, infrared spectrometry, vibrational Raman spectroscopy, structure determination form Raman and IR spectroscopy	Audio/Video clips, lecture with ppt, on white board, quiz,	8
4	Unit-IV Fluorescence Spectroscopy Vibronic interaction, Herzberg Tellor theory, Frank-Condon principle.fluorescence spectroscopy, Kasha's rule, Quantum Yield, non radiative transition, Jablonski diagram, Time resolved fluorescence and determination of excited state if life time.	Audio/Video clips, lecture with ppt, on white board, quiz,	8
5	Unit-V Elements of Laser Physics Spontaneous and stimulated emission, Einstein A & B coefficients. Optical pumping, population inversion, rate equation. Modes of resonators and coherence length, four and three level pumping schemes, Examples of laser amplifiers, Characteristics of the laser output: Power, Spectral distribution, Spatial distribution and polarization, Gas lasers-CO2 and N2 Lasers, Solid state lasers- Nd-YAG laser, Semiconductor laser	Audio/Video clips, lecture with ppt, on white board, quiz,	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	1 Fundamentals of Molecular spectroscopy: by C.N. Banwell and E.M. McCash 2Principles of Fluorescence Spectroscopy: Joseph R. Lakowicz, Springer
Articles	
References Books	1 Spectra of diatomic molecules: Herzber 2 Spectroscopy Vol. I&II: Walker and Straughen
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	2	2	-	-	-	-	-	-	-	-	-	-
CO2	2	2	3	3	1	-	-	-	-	-	-	-	-	-	-
CO3	2	2	2	1	1	-	-	-	-	-	-	-	-	-	-
CO4	1	3	1	2	2	-	-	-	-	-	-	-	-	-	-
CO5	3	1	2	1	3	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	Nano-1
Course Code	DSPH0603[T]

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					2	0	1	3
Course Type	Embedded theory and lab							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	Knowledge of Physics upto BSc Level			**Co-Requisite/s**	Knowledge of Chemistry Lab how to handle Chemicals etc.			
Course Outcomes & Bloom's Level	**CO1-** To Learn basics of nanotechnology, size effect, properties, significance**(BL1-Remember)** **CO2-** To understand the nucleation and growth of particles in homogeneous and heterogeneous route and characterization process**(BL2-Understand)** **CO3-** To apply synthesis characterization routes for nano particle growth**(BL3-Apply)** **CO4-** To analyze the process of growth and characterization and various factors influence the properties of Nanomaterials,**(BL4-Analyze)** **CO5-** To evaluate and optimize the procedures, and implementations to the new designs**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Unit-I Introduction of Nanomaterials Emergence of Nanotechnology: Bottom-Up and Top-Down Approaches, Physical Chemistry of Solid Surfaces: Surface Energy, Chemical Potential as a Function of Surface Curvature, Electrostatic Stabilization, Steric Stabilization, Elementary Consequences of Small Particle Size, Surface of Nanoparticles, Thermal Phenomena, Diffusion Scaling Law , Surfaces in Nanomaterials, Consequences of Surface Energy	Audio/Video clips, lecture with ppt, on white board, quiz	8
2	Unit-II Synthesis of Nano materials I Nano particles: Through Homogeneous Nucleation: Growth of nuclei controlled by diffusion and surface process, Synthesis of metallic, semiconductor and oxide nano particles, sol-gel processing, Forced hydrolysis, Vapor phase reactions, Solid state phase segregation, Through Heterogeneous Nucleation, Kinetically Confined Synthesis, Aerosol synthesis, Spray pyro , Template-based synthesis, Hydrothermal and Solvo thermal Methods	Audio/Video clips, lecture with ppt, on white board, quiz,	8
3	Unit-III Synthesis of Nano materials II Nano wires and Nano rods: Spontaneous Growth Evaporation (dissolution)-condensation growth, Vapor (or solution)-liquid-solid (VLS or SLS) growth, Stress-induced recrystallization, Template-Based Synthesis, Electrospinning, Lithography Thin Films: Fundamentals of Film Growth, Physical Vapor Deposition (PVD): Evaporation, Molecular beam epitaxy (MBE), Sputtering, Chemical Vapor Deposition: chemical reactions, Transport phenomena, Atomic Layer Deposition (ALD), Super lattice. Self-Assembly, Langmuir-Blodgett Films, Electrochemical Deposition, Sol-Gel Films	Audio/Video clips, lecture with ppt, on white board, quiz,	8
4	Unit-IV Characterization of Nanomaterials I Structural Characterization: X-ray diffraction (XRD), Small angle X-ray scattering (SAXS)Morphological: Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), AFM (contact and non contact)	Audio/Video clips, lecture with ppt, on white board, quiz,	8
5	Unit-V Characterization of Nanomaterials II Melting points and lattice constants, Surface Plasmon resonance, Thermo gravimetric analysis (TGA), UV Vis Spectrophotometers, FTIR, Photoluminescence, electro luminescence and thermo luminescence	Audio/Video clips, lecture with ppt, on white board, quiz,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Syenthesis of ZnO nanoparticals through Sol gel Method	Experiments	BL2-Understand	3
2	To synthesize the Lead iodide and Lead acetate thin film by using spin coating technique	Experiments	BL3-Apply	3
3	Synthesize the CdS thin film by using dip-coating method	PBL	BL3-Apply	3
4	Synthesize the ZnS thin film by using spin coating technique and obtain the energy band gap by using UV-VIS spectrophotometer	Experiments	BL5-Evaluate	3
5	To synthesize the ZnS thyin film by using spin coating technique and detemine the vibration frequency mode usinf Fourier transform infrared spectroscopy (FTIR)	Case Study	BL4-Analyze	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	1 Nanostructures &Nanomaterials, Synthesis, Properties Applications by G Cao, Imperial College Press 2 Nanomaterials by Dieter Vollath, Wiley VCH
Articles	
References Books	1 Chemistry of Nanomaterials: Synthesis, Properties and Applications. Edited by C. N. R. Rao, A. Muler, A. K. Cheetham WILEY. 2 Introduction to Nanoscience S M Lindsey
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	2	2	3	2	1	-	-	-	-	-	-	-	-	-	-
CO3	2	3	2	1	3	-	-	-	-	-	-	-	-	-	-
CO4	1	2	1	2	2	-	-	-	-	-	-	-	-	-	-
CO5	3	1	3	3	1	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	NCC
Course Code	NCC0101

Part A

					L	T	P	C
Year	1st	**Semester**	1st	**Credits**	2	0	2	4
Course Type	Theory only							
Course Category	Generic Elective							
Pre-Requisite/s	Should be acquainted with the basics knowledge of General Awareness about Leadership Quality, Personality Development, Defense system etc			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Develop the qualities of social skills.**()** **CO2-** Imbibe leadership qualities. **()** **CO3-** Be motivated to serve the nation by joining Armed forces. **()** **CO4-** Contribute in environmental awareness and conservation activities**()** **CO5-** Keep abreast of current affairs & general awareness.**()** **CO6-** Effectively contribute in managing disaster relief tasks**()**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG6(Clean water and sanitation) SDG13(Climate action) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours
Unit 1. Personality Development	Group Discussions – Social Skills & Time management.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 2. Leadership Development	Case Studies – Case Studies – Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965 war.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 3. Disaster management	(i) Initiative Trg, Organising Skills. (ii) Dos and Don'ts. (iii) Natural Disasters. (iv) Man Made Disasters. (v) Fire Services and Fire Fighting.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit-4.Environmental Awareness	Adventure Environmental Awareness and Conservation, Local and global approaches to conserve nature.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 5. General Awareness & Armed Forces	General Awareness, Army, Navy, Air Force and Central Armed Police Forces.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	R Gupta ; NCC National Cadet Corps A, B & C Certificate Examination Book; Ramesh Publishing House, 2018.
Articles	https://indiancc.mygov.in/
References Books	Singh, Neeraj; A Hand Book of NCC; Kanti Prakashan Publisher Cadet training hand book specialised subjects (2017)
MOOC Courses	
Videos	https://www.youtube.com/watch?v=eBA5t4iepAA

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	NCC (optional)
Course Code	NCC0201[T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					2	0	1	3
Course Type	Theory only							
Course Category	Generic Elective							
Pre-Requisite/s	Should be acquainted with the basics knowledge of General Awareness about Leadership Quality, Personality Development, Defense system etc			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Develop the qualities of social skills.**()** **CO2-** Imbibe leadership qualities. **()** **CO3-** Be motivated to serve the nation by joining Armed forces. **()** **CO4-** Contribute in environmental awareness and conservation activities**()** **CO5-** Keep abreast of current affairs & general awareness.**()** **CO6-** Effectively contribute in managing disaster relief tasks**()**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG6(Clean water and sanitation) SDG13(Climate action) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours
Unit 1. Personality Development	Group Discussions – Social Skills & Time management.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 2. Leadership Development	Case Studies – Case Studies – Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965 war.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 3. Disaster management	(i) Initiative Trg, Organising Skills. (ii) Dos and Don'ts. (iii) Natural Disasters. (iv) Man Made Disasters. (v) Fire Services and Fire Fighting.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit-4.Environmental Awareness	Adventure Environmental Awareness and Conservation, Local and global approaches to conserve nature.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5
Unit 5. General Awareness & Armed Forces	General Awareness, Army, Navy, Air Force and Central Armed Police Forces.	Lecture, Tutorials, Group discussion, Collaborative work, self-study, Seminar presentations by students, individual and group drills, group and individual field-based assignments, Educational Excursion	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	R Gupta ; NCC National Cadet Corps A, B & C Certificate Examination Book; Ramesh Publishing House, 2018.
Articles	https://indiancc.mygov.in/
References Books	Singh, Neeraj; A Hand Book of NCC; Kanti Prakashan Publisher Cadet training hand book specialised subjects (2017)
MOOC Courses	
Videos	https://www.youtube.com/watch?v=eBA5t4iepAA

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_PCM

Title of the Course	India in 21st centuary
Course Code	VAC0101[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					2	00	00	2
Course Type	Theory only							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	1. *Understanding of Sociological Concepts*: A foundational knowledge of sociological concepts is essential to grasp the composition of Indian society discussed in Unit I. This includes understanding social institutions, cultural environments, and threats to national integration. 2. *Historical Background*: Familiarity with the history of India, particularly the Indian Freedom Movement, is crucial for comprehending Unit II. Knowledge of events such as the Revolt of 1857, the emergence of nationalism, and the various phases of the freedom struggle provides context for understanding the birth of the Indian nation-state. 3. *Awareness of Political Movements*: A basic understanding of political movements in India, particularly those led by figures like Gandhi, is necessary for Unit III. Familiarity with concepts like non-cooperation, civil disobedience, and the Quit India movement aids in analyzing the dynamics of Indian freedom and partition. 4. *Knowledge of Post-Independence Era*: Understanding the phases of nation-building since independence is vital for Unit IV. This includes awareness of the planned progress era, populist policies, and the paradigm shift towards liberalization and globalization. Knowledge of responses from different societal groups and regions enriches the understanding of India's post-independence journey. 5. *Global Awareness*: Unit V delves into global concerns such as environmental issues, globalization, and movements for democracy and sustainability. A broad understanding of global trends and their impact on nations is necessary to engage with this content effectively.			**Co-Requisite/s**	1. *Foundational Understanding of Sociological Concepts*: - Understanding social institutions, cultural environments, and threats to national integration is fundamental. - Familiarity with sociological theories such as functionalism, conflict theory, and symbolic interactionism can provide a deeper comprehension of societal dynamics. 2. *Historical Context of India*: - Knowledge of Indian history, including the colonial period, the struggle for independence, and post-independence developments, offers context for understanding the evolution of Indian society. - Understanding the socio-economic impacts of colonial rule and the transition to independence enhances insight into contemporary social issues. 3. *Understanding of Political Movements in India*: - Knowledge of key figures, ideologies, and strategies of political movements in India, including those led by Gandhi, Nehru, and other prominent leaders, is essential. - Awareness of the socio-political context of colonial India and the role of various stakeholders in the struggle for independence enriches understanding. 4. *Familiarity with Post-Independence Developments*: - Understanding the socio-economic and political changes in post-independence India, including the Nehruvian era, economic reforms, and social movements, is crucial. - Awareness of key policies, such as the Green Revolution, reservation system, and economic liberalization, provides insights into contemporary Indian society. 5. *Global Perspective and Awareness*: - Knowledge of global trends in areas such as technology, economics, environment, and geopolitics enhances understanding of India's position in the global context. - Understanding global issues like climate change, international trade, and human rights movements enables students to analyze their impact on India and vice versa.		
Course Outcomes & Bloom's Level	**CO1-** 1. Students are able to define, identify and explain the process of Indian Freedom movement and development of political Institutions.**(BL1-Remember)** **CO2-** 2. Students are able to summarize and extract the time before Independence and after Independence India.**(BL2-Understand)** **CO3-** 3. Students are able to evaluate India society, Its nature and agencies of social change with reference to modernization.**(BL5-Evaluate)** **CO4-** 4. Students are able to write the historical accounts that shaped the very nature and character of 20 and 21 st century India with reference to Nation Building and constitution**(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✓ Gender ✓ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG5(Gender equality) SDG10(Reduced inequalities) SDG12(Responsible consuption and production) SDG13(Climate action)				

Part B

Modules	Contents	Pedagogy	Hours
1	1. Composition of Indian Society Society. (a) Introduction of Nature of India society and Indian nation state. (b) Major Social Institutions and Organization and threats to national integration (c) Social and Cultural Environment of India Society in 19th ,20th and 21st century.	● Lectures and visual PowerPoint slides ● Students read text and commentary on assigned topics as well as published research articles before the lectures ● Students read cases discussed in the text-books, as well as more detailed articles. ● Students participate in class discussions to crystallize the concepts	5
2	Unit II Indian Freedom Movement- emergence. 5 1) Revolt of 1857 , Rise of nationalism & Birth of Congress 2). Partition of Bengal & swadeshi movement, Home rule movement Round table conferences 3) Revolutionary movements, Gandhian movements (i) Non-Cooperation (ii) Civil Disobedience (iii) Quit India movement	Lectures and visual PowerPoint slides ● Students read text and commentary on assigned topics as well as published research articles before the lectures ● Students read cases discussed in the text-books, as well as more detailed articles. ● Students participate in class discussions to crystallize the concepts	5
3	Unit 3 Indian freedom and Partition 5 1.) Communalism – Rise & spread (11.) Muslim league & its politics , Hindu communalism . 111.) India's partition & independence References	Lectures and visual PowerPoint slides ● Students read text and commentary on assigned topics as well as published research articles before the lectures ● Students read cases discussed in the text-books, as well as more detailed articles. ● Students participate in class discussions to crystallize the concepts	5
4	UNIT IV Nation building Since Independence 5 3 stages of making of the Indian Nation state: - 3 . Era of planned progress. (1951-1971) Period of Populist policies and programmes (1971 to 1992) Period of paradigm shift towards liberalization and globalization (since 1992). Responses of various classes, communities and regions.	Lectures and visual PowerPoint slides ● Students read text and commentary on assigned topics as well as published research articles before the lectures ● Students read cases discussed in the text-books, as well as more detailed articles. ● Students participate in class discussions to crystallize the concepts	5
5	Unit V Nation Building and Global Concern 5 a. Environmental concerns in 21st century b. Question of Globalization and its Impact c. Global Movement for Democracy and sustainability	Lectures and visual PowerPoint slides ● Students read text and commentary on assigned topics as well as published research articles before the lectures ● Students read cases discussed in the text-books, as well as more detailed articles. ● Students participate in class discussions to crystallize the concepts	4

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	28
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
00	00	00		00	

Part E

Books	1. Bose, N.K. 1967, Culture and Society in India. Bombay: Asia Publishing House 2. Dube, S.C. 1990, Indian village.(New Delhi: National Book Trust.) 3. Percival Spear : History of Indian Society , Penguin , 1966. 4. Uberoi, Patrica : Family , kinship and Marriage , New Delhi : oxford University Press , 1995 , PP 50 to 73 , 416 to 451 5. Gandhi , M K : Removal of Untouchability , Navjeevan Publishing House , Ahmadabad , 1954
Articles	
References Books	1. A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
MOOC Courses	
Videos	1.https://www.youtube.com/watch?v=i8N6YRTJsDk 2. https://youtu.be/MWsT7x3qd3E 3.https://www.youtube.com/watch?v=pQghqJSUAK4&list= 4.https://youtu.be/9BEU8A_JZPU 5.https://youtu.be/pPsKQwaZ4dg

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
CO2	-	-	-	-	-	1	-	-	2	-	-	-	1	1	1
CO3	-	-	-	-	-	2	2	-	-	-	-	-	2	1	1
CO4	-	-	-	-	-	1	-	-	-	-	-	-	2	1	2
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	Cellular Metabolism
Course Code	BT 105 (T)

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	Knowledge about basics of biomolecules			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To impart knowledge on structural, functional and dynamic aspects of biological components.**(BL1-Remember)** **CO2-** To comprehend the understanding of the metabolic pathways involving the four major metabolic compounds:**(BL2-Understand)** **CO3-** To estimate the relation of biological material to living matter and elaborate the structure and functions of different biomolecules.**(BL3-Apply)** **CO4-** To analyze the various biomolecules in biological samples**(BL4-Analyze)** **CO5-** To evaluate the applications of biomolecules in various fields **(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Basic Concepts of Intermediary metabolism, Carbohydrate metabolism: Glycolysis, Kreb's Cycle, glycogenolysis, glycogenesis, pentose phosphate pathway, gluconeogenesis, glyoxolate pathway, Cori cycle. Metabolic disorders	Tutorials, Collaborative Demonstrations, Project methods Experiments,	7
2	Biosynthesis and degradation of fatty acids, Biosynthesis of lipids, Degradation of lipids, Regulation of lipid metabolism. Formation of ketone bodies Ketosis. Metabolic disorders	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	7
3	Transamination, Oxidative deamination, decarboxylation, Biosynthesis of amino acids, Degradation of amino acids, Regulation of amino acids metabolism. Nitrogen Metabolism - Assimilation of inorganic Nitrogen sources; Urea cycle	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	7
4	Biosynthesis and degradation of purine nucleotides, Biosynthesis and Degradation of Pyrimidine nucleotide, regulation of purine and pyrimidine metabolism.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lectures	10
5	Photosynthetic microorganisms, photosynthetic pigments, and generation of reducing power by cyclic and non-cyclic photophosphorylation, Electron transport chain in photosynthetic bacteria. Carbon dioxide fixation pathways. Respiration : Components of electron transport chain, free energy changes and electron transport, oxidative phosphorylation, ATP synthase and theories of ATP formation.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Estimation of Blood Glucose by Coupled Enzyme Assay	Experiments	BL4-Analyze	3
II	Sugar Fermentation by Microorganisms	PBL	BL3-Apply	3 DAYS
III	Demonstration of Starch Digestion by Salivary Amylase	Simulation	BL2-Understand	3
IV	Isolation and Fractionation of Egg Lipids by TLC and their Estimation	PBL	BL5-Evaluate	6

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	28
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	David L. Nelson, Michael M. Cox, W. H. Freeman;Lehninger Principles of Biochemistry, Fifth Edition, , 2008, th Edition
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7545035/
References Books	G.Zubay Biochemistry 3 rd Edition Stryer Biochemistry 9 th Edition DVoet and JG. Voet , J Wiley and Sons. Biochemistry 5 th Edition David Plummer Practical Biochemistry Volume 3 Company.S;Philadelphia, Stipanuk.PA. (4th edition) (2019) Biochemical, physiological, and molecular aspects of human nutrition. Second Edition, Murray, R., Mayes, P., Rodwell, V., Granner, D (2006) Harper's illustrated biochemistry. 26th edition, McGraw-Hill Companies, Columbus, OH.
MOOC Courses	https://nptel.ac.in/courses/104105139
Videos	https://nptel.ac.in/courses/104105139

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	2	-	-	-	2	-	-	1	-	1
CO2	2	3	2	2	2	1	-	-	-	2	-	-	1	-	3
CO3	3	1	1	2	1	-	-	-	-	-	-	-	3	2	3
CO4	3	2	1	1	1	-	-	-	-	2	-	-	2	3	2
CO5	2	1	1	2	1	-	-	-	-	2	-	-	2	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	Enzyme Technology
Course Code	BT 202 (T)

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Disciplinary Major							
Pre-Requisite/s	To acquire fundamental knowledge on enzymes and their importance in biological reactions.			**Co-Requisite/s**	To analyse methods for production, purification, characterization and immobilization of enzymes			
Course Outcomes & Bloom's Level	**CO1-** To acquire fundamental knowledge on enzymes and their importance in biological reactions**(BL1-Remember)** **CO2-** To understand and ability to difference between a chemical catalyst and bio catalyst.**(BL2-Understand)** **CO3-** to apply the role of enzymes in clinical diagnosis and industries.**(BL2-Understand)** **CO4-** analyze methods for production, purification, characterization and immobilization of enzymes**(BL2-Understand)** **CO5-** To evaluate the current and future trends of applying enzyme technology**(BL3-Apply)** **CO6-** To develop biotechnological products for the commercialization purpose.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Historical aspects, Classification and Nomenclature, Enzyme commission system of Classification; EC Number, Mechanism of enzyme action and specificity, Mechanism of enzyme catalysis and their type	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Enzyme activity: Effects of substrate, temperature, pH and pressure on enzyme activity. Steady state kinetics: Estimation of rate of enzyme catalyzed reaction. Relationship between initial velocity and substrate concentration	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Enzyme assay: Continuous and Sampling techniques coupled kinetic assays; turn over number and specific activity. Enzyme Inhibition: Competitive, Un-competitive and noncompetitive inhibition effect to inhibitors on enzyme kinetics	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
4	Enzyme Immobilization: Methods of immobilization of the enzyme. Properties of immobilized enzymes. Advantages and disadvantages of immobilized enzymes. Enzyme Purification techniques: Isolation, purification and, Large-scale production of enzymes.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lectures	8
5	Uses of enzyme in Industries; textiles, leather and food. Therapeutics uses of enzyme. Uses of Enzymes in diagnostics. Enzymes as Biosensors.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lectures	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	To quantitative analysis of protease	Experiments	BL3-Apply	3
2	To quantitative and quantitative analysis of protease	Experiments	BL3-Apply	3
3	To quantitative analysis of Urease	Experiments	BL3-Apply	3
4	To quantitative and quantitative analysis of Urease	Experiments	BL3-Apply	3
5	Determination of Km and Vmax of Urease	Experiments	BL4-Analyze	3
6	Determination half life of enzyme	PBL	BL4-Analyze	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	

Part E

Books	David L. Nelson & Michael M. Cox-Lehninger Principles of Biochemistry-3rd Edition
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3962110/
References Books	Palmer T and P L Bonner-Enzymes: Biochemistry Biotechnology, Clinical Chemistry-2nd Edition
MOOC Courses	https://nptel.ac.in/courses/102103097
Videos	https://nptel.ac.in/courses/102103097

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	3	3	1	3	2	1	1	1	3	3	1	3	2
CO2	2	1	2	2	1	3	3	1	1	1	3	1	2	2	3
CO3	2	3	1	1	3	3	2	1	3	3	1	2	3	1	2
CO4	2	3	2	3	3	1	1	1	2	1	1	2	1	1	2
CO5	3	1	3	2	1	3	3	1	1	1	1	2	2	1	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	Molecular Biology
Course Code	BT 203(T)

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	Basic knowledge of macromolecules and micro molecules			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To observe and understand the types of DNA and its replication among prokaryotes & eukaryotes. **(BL1-Remember)** **CO2-** To understand the transcription process in prokaryotes and eukaryotes. **(BL2-Understand)** **CO3-** To compare and distinguish the functions of various enzymes involves in transcription process of prokaryotes as well as eukaryotes.**(BL3-Apply)** **CO4-** To describe and summarize the RNA modifications in eukaryotes.**(BL4-Analyze)** **CO5-** To study and conclude the genetic behavior based on the genetic code in a particular organism.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Chemical structure and base composition of nucleic acids, A, B and Z- DNA, Factors and forces stabilizing nucleic acid structure, super coiled DNA, properties of DNA, Denaturation Kinetics. DNA replication: Replication initiation, elongation and termination in prokaryotes and eukaryotes, Types of DNA replications; Theta Shaped, Rolling circle. DNA damage and DNA repair, SOS repair.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
2	Prokaryotic transcription; RNA polymerase, transcription unit, promoters: constitutive and inducible, initiation, Types of termination-(rho dependent and factor independent). Eukaryotic transcription: Eukaryotic transcription unit, structure and design of Promoters for RNA polymerase I, II and III, mechanism of transcription and its regulation, Basal transcription factors.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
3	Post-transcriptional modifications: 5□cap formation, 3□-end processing, polyadenylation Organization and structure□function of ribonucleoprotein: Splicesome. Splicing, Processing of hnRNA, Processing of rRNA and Processing of tRNA.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lectures	9
4	Genetic code and their properties, Deciphering the genetic codes, wobble hypothesis, Prokaryotic and eukaryotic translation: the translation machinery, adaptor molecules, mechanism of initiation, elongation and termination	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lectures	8
5	Regulation of gene expression in prokaryotes: Operon concept; lac, trp and ara operons, Regulation of gene expression in eukaryotes: hormonal. Molecular markers RAPD, AFLP, SSLP markers, STS, Satellites DNA, RFLP maps, linkage analysis, Application of molecular Markers in forensic and disease prognosis. PCR and its variants	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	9

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Isolation of DNA from the different plant sample	PBL	BL3-Apply	4
II	DNA isolation from various sample	PBL		6

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	30	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	David Frei Felder Molecular Biology 4 th Edition
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9573682/
References Books	Watson, Baker & Bell Molecular Biology of Gene 7 th Edition Albert Molecular Biology of the Cell 5 th Edition Lewin and Benjamin Genes 12th Edition
MOOC Courses	https://nptel.ac.in/courses/102103341
Videos	https://nptel.ac.in/courses/102103341

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	2	-	-	-	2	-	-	1	-	1
CO2	2	3	2	2	2	2	-	-	-	2	-	-	1	-	3
CO3	3	1	1	2	1	-	-	-	-	-	-	-	3	2	3
CO4	3	2	1	1	1	-	-	-	-	2	-	-	2	3	2
CO5	2	1	1	1	1	-	-	-	-	2	-	-	2	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	Immunotechnology
Course Code	BT 204 (T)

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Understand basic and advanced concepts of Immunology and body's defense system.			**Co-Requisite/s**	This course will introduce to the applied aspects of immunology in disease detection and diagnosis			
Course Outcomes & Bloom's Level	**CO1-** To remember the structure of various Immunological Barriers of the body**(BL1-Remember)** **CO2-** To understand the Different cells & proteins involved in Immune system**(BL2-Understand)** **CO3-** To understand the connection of immune system failure & disorders**(BL2-Understand)** **CO4-** To apply the use of Proteins & receptors in antibody formation**(BL3-Apply)** **CO5-** To evaluate the applications of Antigens & Antibodies in Diagnostic & Medical Research**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to the immune system, innate and adaptive immune response, Lymphatic tissues and migration of immune cells .Physiological and anatomical barriers in immune system.Cells and organs of the immune system, Hematopoietic development and mediators of the process and regulation . Humoral and cell mediated immune response.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Inflammation: sign & Symptoms, cell incolved in inflammation, leucocyte extravasation,TOLL receptors :types and mechanism of action. Antigens and Immunogens its properties, Super antigens Adjuvants, haptanes.epitopes . active and passive immunity, Structure, classification and functions of Antibody, CDRS and there function., Organization and expression of Immunoglobulin genes and Class switching.Mechanism of antibody diversity	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	7
3	Major histocompatibility complex (MHC), Types of MHC and Display of antigenic peptide, Role of MHC in antigen processing and presentation. Complement system: component, activation pathway , complement deficiency diseases.Activation, maturation and diffrenciation of B and T cells, B cell receptor complex, T cell receptor complex	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments ABL	8
4	CTLs: activation and mechanism of action, NK cells and target cell destruction, Cytokines : Properties, mode of action, cytokine families and JAK-STAT pathway, Hypersenstivity: type 1,2,3,4, Immunodefieciency: primary and secondary, Autoimmunity: Organ specific and systemic diseases	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lectures	7
5	Antigen antibody interaction: precipitation, agglutination reaction, RIA,ELISA, Western blotting, Immunofluroscence, CFT. Monoclonal antibody: Hybridoma Technology and there applications, Antibody engineering. Immunization: active and passive immunization, types of vaccines and their production strategy.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Anatomical view of mammalian thymus and various immune organs	Experiments	BL2-Understand	3
2	Precipitation reaction.	Experiments	BL2-Understand	3
3	Haemoglobin detection by given Blood Sample	Experiments	BL3-Apply	3
4	Double immunodiffusion	Experiments	BL3-Apply	3
5	Radial immuno diffusion	Experiments	BL4-Analyze	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	09
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	20

Part E

Books	Kuby Immunology by T. Kindst, R.A. Goldsby and B.A. Osborne 2. Essential Immunology by Ivan Roitt
Articles	https://medcraveonline.com/MOJI/cytokines-and-their-role-in-health-and-disease-a-brief-overview.html
References Books	Immunology understanding the immune system by Klaus D. Elgert 4. Immunology by I. Roit J. Brostoff and D. Male
MOOC Courses	https://nptel.ac.in/courses/102105083
Videos	https://nptel.ac.in/courses/102105083

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	3	1	3	1	2	3	1	2	3	1	1	2
CO2	1	1	2	1	3	2	3	2	3	1	2	3	1	2	3
CO3	1	2	2	3	4	3	3	1	3	1	2	2	1	2	1
CO4	2	2	1	2	2	2	2	3	2	2	1	1	2	2	1
CO5	2	3	3	1	1	3	1	3	1	3	3	1	3	1	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	Open Elective 1 : Bioinformatics
Course Code	BT 205 (T)

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Embedded theory and lab							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	Should be familiar with the basics of bioinformatics, its databases and search tools, types of sequence alignment, comparative modeling, evolutionary prediction of sequences and basics of drug designing			**Co-Requisite/s**	Basic concepts of computational tools, their applications and their uses in industry and research along with basic understanding of proteomics and genomics and genomics			
Course Outcomes & Bloom's Level	**CO1-** The course prepares the student to understand the basic concepts of Bioinformatics, its applications and future prospects.**(BL1-Remember)** **CO2-** The subject Bioinformatics is designed for post graduate students of biotechnology for understanding of basic concepts of each and every division of Bioinformatics along with its applications in other fields**(BL2-Understand)** **CO3-** The course aims to provide experimental basis, and to enable students to acquire a specialized knowledge and understanding.**(BL3-Apply)** **CO4-** The course aims to provide basis of analyzing the applications of Bioinformatics in various fields of research and industries.**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education) SDG8(Decent work and economic growth)				

Part B

Modules	Contents	Pedagogy	Hours
1	Overview of Bioinformatics, bioinformatics as multidisciplinary domain, divisions, scope and future prospects of bioinformatics, Sequence Formats: NCBI, EBI, SWISS PROT, PDB, EMBL Sequence Databases: NCBI, EBI, SWISSPROT, DDJB, PDB	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Pairwise sequence alignment, types, significance and applications, Sequence alignment tools; BLAST, FASTA, Types and versions of BLAST and FASTA, Matrices for sequence alignment	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
3	Multiple sequence alignment methods and softwares, phylogenetic analysis: Methods of phylogenetic prediction Tree building methods, .Algorithms for phylogenetic analysis, Markov models; Concept of HMMS	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	8
4	Insilico comparative modeling, Methods of Insilico comparative modeling, fold recognition, Ab initio methods for structure prediction, Use of genome analysis programs, primer designing tools, theory of profiles and their use in sequence analysis, computer aided drug designing: Basic principles and applications.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lectures	8
5	DNA Microarray, proteomics, 2D- Electrophoresis for total cellular protein, Advantages and disadvantages of DNA and protein microarrays, Total expression vs functional proteomics, oligosaccharide microarrays for glycomics, Pharmaco genomics, introduction to metabolomics, Proteomics applications.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Accession of protein sequences from SWISSPROT.	Experiments	BL3-Apply	3
2	Pairwise alignment and analysis of DNA sequences using BLASTn software	Experiments	BL3-Apply	3
3	Pairwise alignment and analysis of protein sequences using BLASTp software	Experiments	BL3-Apply	3
4	Pairwise alignment and analysis of protein sequences using FASTA software.	Experiments	BL3-Apply	3
5	Alignment of DNA/protein sequences using dot matrix.	Experiments	BL3-Apply	3
6	Multiple sequence alignment and analysis of protein sequences using CLUSTALW software.	Experiments	BL3-Apply	3
7	Phylogenetic prediction of protein sequences using TREETOP/T-COFFEE software.	Experiments	BL3-Apply	3
8	Secondary structure prediction of protein sequences using 3d-PSSM software.	Experiments	BL3-Apply	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	

Part E

Books	Bioinformatics: D.W. Mount, Cold Spring Harbour Laboratories Ltd.
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1122955/
References Books	Introduction to bioinformatics by Cynthia Gibas
MOOC Courses	https://nptel.ac.in/courses/102106065
Videos	https://nptel.ac.in/courses/102106065

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	2	-	-	-	-	-	-	-	1	2	-
CO2	1	2	-	-	-	3	-	-	-	-	-	-	1	2	-
CO3	1	2	-	1	-	-	-	-	-	-	-	-	1	2	-
CO4	1	2	-	-	-	-	1	-	-	-	-	-	1	2	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	LAB COURSE III
Course Code	BT 206

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					0	0	3	3
Course Type	Lab only							
Course Category	Foundation core							
Pre-Requisite/s	Knowledge about biochemicals			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To impart knowledge on structural, functional and dynamic aspects of biological components**(BL1-Remember)** **CO2-** To understand ability to difference between a chemical catalyst and biocatalyst**(BL2-Understand)** **CO3-** To apply the role of enzymes in clinical diagnosis and industries**(BL3-Apply)** **CO4-** To analyze the various biomolecules in biological samples**(BL4-Analyze)** **CO5-** To evaluate the applications of biomolecules in various fields**(BL5-Evaluate)**								
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Qualitative analysis of carbohydrates		2
2	Qualitative analysis of lipids and fats	Experiment	3
3	Qualitative analysis of proteins	Experiment	3
4	Quantitative estimation of carbohydrates	Experiment	3
5	Quantitative estimation of proteins	Experiment	3
6	Determination of acid value in the given fat sample	Experiment	3
7	Determination of esterification value of given fat sample	Experiment	3
8			

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Antibiotic sensitivity test against microorganism	Experiments	BL4-Analyze	2 days
II	Biochemical characterizartion of the given sample	PBL	BL4-Analyze	1 week
III	Adulteration test of various samples	Case Study	BL5-Evaluate	1 week

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	50				
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7545035/
References Books	David Plummer Practical Biochemistry Volume 3 Imer T and P L Bonner Enzymes: Biochemistry, Biotechnology, Clinical Chemistry 3rd Edition
MOOC Courses	https://nptel.ac.in/courses/102103097
Videos	https://nptel.ac.in/courses/102103097

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	2	-	-	-	2	-	-	1	-	1
CO2	2	3	2	-	2	2	-	-	-	2	-	-	1	-	3
CO3	3	1	1	-	1	-	-	-	-	-	-	-	3	-	3
CO4	3	2	1	-	1	-	-	-	-	2	-	-	2	-	2
CO5	2	1	1	-	1	-	-	-	-	2	-	-	2	-	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	LAB COURSE IV
Course Code	BT 207

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					0	0	3	3
Course Type	Lab only							
Course Category	Discipline Core							
Pre-Requisite/s	Knowledge about biomolecules and immunity			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To observe and understand the types of DNA and its replication among prokaryotes & eukaryotes.**(BL1-Remember)** **CO2-** To understand the Different cells & proteins involved in Immune system**(BL2-Understand)** **CO3-** To compare and distinguish the functions of various enzymes involves in transcription process of prokaryotes as well as eukaryotes.**(BL3-Apply)** **CO4-** To apply the use of Proteins & receptors in antibody formation**(BL3-Apply)** **CO5-** To evaluate the applications of Antigens & Antibodies in Diagnostic & Medical Research**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education) SDG8(Decent work and economic growth)				

Part B

Modules	Contents	Pedagogy	Hours
1	Quantitative estimation of DNA.	Experiment	3
2	Quantitative estimation of RNA	Experiment	3
3	Quantification of Protein spectrophotometrically	Experiment	3
4	Separation and estimation of DNA by Agarose gel electrophoresis	Experiment	3
5	Preparation of stock and buffer solutions/calculation for PAGE	Experiment	3
6	Protein profile using NATIVE Polyacrylamide gel Electrophoresis	Experiment	3
7	Protein profiling using SDS-PAGE	Experiment	3
8	DNA amplification by PCR	Experiment	3

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	DNA isolation from onion	Experiments	BL4-Analyze	2
II	Protein analysis of different samples	PBL	BL4-Analyze	6
III	To perform ELISA test	PBL	BL4-Analyze	15 DAYS

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1122955/ https://medcraveonline.com/MOJI/cytokines-and-their-role-in-health-and-disease-a-brief-overview.html
References Books	Ivam M Roitt Roits Essentials Immunology 12th Edition David Frei Felder Molecular Biology 4 th Edition Lewin and Benjamin Genes 12th Edition Abdul K Abbas Cellular & Molecular Immunology 10th Edition
MOOC Courses	https://nptel.ac.in/courses/102106065 https://nptel.ac.in/courses/102105083
Videos	https://nptel.ac.in/courses/102106065 https://nptel.ac.in/courses/102105083

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	2	-	-	-	2	-	-	1	-	1
CO2	2	3	2	2	2	1	-	-	-	2	-	-	1	-	3
CO3	3	1	1	2	1	-	-	-	-	-	-	-	3	2	2
CO4	3	2	1	1	1	-	-	-	-	2	-	-	2	3	2
CO5	2	2	1	1	1	-	-	-	-	2	-	-	2	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	Genetic Engineering
Course Code	BT 301 (T)

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	knowledge of DNA RNA structure and mutation types in DNA			**Co-Requisite/s**	Effects of Changes in DNA on cell and Protein formation and use of different proteins in Health and Medicine Industry			
Course Outcomes & Bloom's Level	**CO1-** To remember the role of all the enzymes used in the DNA editing**(BL1-Remember)** **CO2-** To understand the method of creating new molecules such as DNA & RNA**(BL2-Understand)** **CO3-** To understand the importance Nucleic acid editing tools **(BL2-Understand)** **CO4-** To apply the understanding of creation of new DNA, RNA & Protein and its use in different Fields.**(BL3-Apply)** **CO5-** To evaluate the applications of in various fields such as research, Agriculture, Pharmaceutical industries**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG4(Quality education) SDG8(Decent work and economic growth)				

Part B

Modules	Contents	Pedagogy	Hours
1	Essential enzymes used in r-DNA technology, Types of Restriction enzymes and their mechanism, Restriction modification system. Cloning vectors- Plasmids, Cosmids, Phagmids, Phasmids, Artificial hromosomes (YAC and BAC), Shuttle vectors, Expression vectors, for E.coli, Hybrid Plasmid and phage vectors. Host organism used for expression system	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
2	Genetic transformation in plants:Agrobacteriun mediated transformation in plants, crown gall and hairy root producing strains, structure and features of Ti and Ri plasmids, mechanisms of DNA transfer. Recalcitrance of monocot for Agrobacteriun mediated transformation.Ti and Ri plasmid based vectors, Binary vectors, use of 35SCaMV and other promoters, selectable marker, Reporter genes. Methods of direct DNA transfer, particle bombardment, electroporation, Microinjection. Transfection, Alternative DNA transfer methods	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
3	Strategies for development of Tolerant/Resistant plants and their utility for productivity and performance: Herbicide resistance (Glyphosate, phosphoinothricin, Sulfonylurea, Atrazine). Insect resistance: Bt Genes, Non-Bt like protease inhibitors, Alpha amylase inhibitor, Trypsin inhibitor; Genitically modifies plants: Examples, Advatages and disadvantages	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lectures	8
4	Gene therapy: types of gene therapy, Strategies of gene delivery, Gene replacement/augmentation, gene therapy for cancer cells, Gene silencing. RNA interference; Si RNA and mi RNA.. DNA fingerprinting and its applications.Human genome project: Objective and goals. Protein engineering : examples and application	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lectures	8
5	Applications of r-DNA technology in health, agriculture, industrial sectors and pharmaceuticals. Molecular Farming: Pharming in animals and plants, Nutritional quality: golden rice,protein, vitamins. Archeogenetics: Introduction and application	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Preparation of stock and buffer solutions for DNA isolation	Experiments	BL2-Understand	3
2	Isolation of DNA from yeast cells.	Experiments	BL3-Apply	3
3	Isolation of DNA from Plant cell.	Experiments	BL3-Apply	3
4	Isolation of plasmid DNA	Experiments	BL3-Apply	3
5	Agarose gel electrophoresis of Genomic DNA	Experiments	BL5-Evaluate	3
6	Quantification of DNA by spectrophotometer(260/280nm)	PBL	BL2-Understand	6
7	Isolation of RNA from Yeast cell	PBL	BL3-Apply	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	0	40	20	60	30

Part E

Books	TA Brown Gene cloning 4th Edition
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3078015/
References Books	Waston J.D. Molecular Biology of the Gene: 4th Edition Primrose andTwyman Principles of Gene Manipulation and Genomics 8th Edition
MOOC Courses	https://nptel.ac.in/courses/102103074
Videos	https://nptel.ac.in/courses/102103074

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	-	-	-	2	1	-	-	-	-	1	1	3
CO2	1	2	2	-	-	-	2	1	-	-	-	-	2	1	2
CO3	2	3	2	-	-	-	1	2	-	-	-	-	2	1	2
CO4	2	3	1	-	-	-	2	2	-	-	-	-	3	2	2
CO5	3	1	3	-	-	-	3	3	-	-	-	-	3	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	Plant Biotechnology
Course Code	BT 302(T)

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	Should be acquainted with the basic knowledge of plants, tissue culture techniques, molecular biology and genetics			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To understand and recall the basic terms, techniques, historical landmarks of plant tissue culture**(BL1-Remember)** **CO2-** To understand the establishment of callus and suspension cultures**(BL2-Understand)** **CO3-** To observe and differentiate the behavior of various explants towards the different types of nutrient media**(BL3-Apply)** **CO4-** To standardize the techniques and nutrient media for the growth and development of in vitro cultures using techniques like single cell culture, protoplast culture, anther culture, etc**(BL6-Create)** **CO5-** To develop in vitro regenerated and transgenic plantlets using various tools and techniques of plant tissue culture.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG12(Responsible consuption and production) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours
I	Objectives, roles and landmarks in plant tissue culture. Concepts and basic techniques in tissue culture. media (composition and preparation), seed production techniques: release of new varieties, Initiation and maintenance of callus and suspension cultures, cell synchronization, somatic embryogenesis.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
II	Shoot tip culture for rapid clonal propagation and production of virus free Plants, Microproapgation: principle, technique, applications and abnormalities of micropropagated plants. Organogenesis	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	9
III	Somaclonal variations and applications,Anther culture & their application Embryo culture /embryo rescue. Protoplast culture: isolation, fusion and culture, somatic hybridization, selection of hybrid cells and, regeneration of hybrid cell and cybrids. Synthetic seeds	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience,ABL Experiments, Video lectures	9
IV	Secondary metabolites and their production. Plant cloning vectors: Ti plasmid and direct gene transfer. Cryopreservation: techniques and application. Concept of Intellectual property right (IPR) and protection (IPP), patenting of biological material	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lectures	8
V	Transgenic crops: Pest and herbicide resistance. Insect resistance: BT genes, non-BT like protease inhibitors , lectins. Plant breeder's right: UPOV 369,370, 372. Genetically modified crops for resistance against biotic and abiotic stresses and improved nutritional quality	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lectures	9

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
II	Establishment of Callus and suspension cultures	PBL	BL3-Apply	5
III	Estbalishment of in vitro regeenerated plantlets and aanalyze their secondary metabolite production	PBL	BL5-Evaluate	7
III	in vitro regeneration of a commercially important plant	Internships	BL6-Create	3 months

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	Smith.R; Plant Tissue Culture: Techniques and Experiments. Academic Press, 2012 Singh B.D. Plant Biotechnology, Kalyani Publishers, 2014.
Articles	https://www.mdpi.com/2223-7747/9/12/1733 https://www.nature.com/articles/nbt1100_1151
References Books	Bhojwani.S.S & Raazdan.M.K.Plant Tissue Culture Kole, C., Michler, C., Abbott, A.G., Hall, T.C. (Eds.) Transgenic Crop Plants: Volume 1: Principles and Development. Springer. 2010 Kole, C., Michler, C., Abbott, A.G., Hall, T.C. (Eds.) Transgenic Crop Plants: Volume 2: Utilization and Biosafety. Springer. 2010
MOOC Courses	https://nptel.ac.in/courses/102103016
Videos	https://nptel.ac.in/courses/102103016

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	2	2	1	-	-	-	-	-	-	1	2	2
CO2	1	-	2	3	1	-	-	-	-	-	-	-	2	1	3
CO3	1	2	1	3	-	2	1	-	-	-	1	-	-	2	1
CO4	2	2	3	1	1	2	1	-	-	-	-	-	2	3	2
CO5	1	1	1	-	2	1	-	-	-	-	1	-	1	3	1
CO6	1	2	1	2	3	-	-	-	-	-	-	-	-	2	1

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	Animal Biotechnology
Course Code	BT 303 (T)

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	The course prepares the student to understand the Animal Biotechnology: and how does it interact with living and non-living molecules.			**Co-Requisite/s**	The course aims to provide basis of analyzing the applications of Animal Biotechnology in various fields such as research and industries for the production of diff. therapeutic product and stem cell technology also use for treatment of different diseases			
Course Outcomes & Bloom's Level	**CO1-** The course prepares the student to understand the Animal Biotechnology: and how does it interact with living and non-living molecules**(BL1-Remember)** **CO2-** The subject Fundamental of Animal Biotechnology is designed to under graduate students of biotechnology for understanding of basic concepts of each and every part of Animal Biotechnology and their types.**(BL2-Understand)** **CO3-** The course aims to provide experimental basis, and to enable students to acquire a specialized knowledge and understanding.**(BL3-Apply)** **CO4-** The course aims to provide basis of analyzing the applications of Animal Biotechnology in various fields such as research and industries for the production of diff. therapeutic product and stem cell technology also use for treatment of different diseases.**(BL4-Analyze)** **CO5-** To apply the understanding of Animal Biotechnology in evaluation in various Biological Samples and to evaluate the applications of Animal Biotechnology in various fields such as research and industries**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	History and Scope of animal biotechnology: Design of animal tissue culture lab, Layout, Planning, construction, cell culture vessels. Nutritonal reuirement of cell and growth media selection of media, types of medium, cell culture medium. Basic aseptic techniques	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Design of experiments in tissue culture: Tissue culture technique, Primary cell culture and types, Chicken embryo culture, Fibroblast culture, Secondary culture, Suspension culture, Characteristics of cell in culture: contact inhibition, anchorage dependence and independence, Organ culture: methods, the behavior of organ ex-plants and the utility of organ culture. Growth study of the cell, cell proliferation, cell cycle, and mitosis in growing cells.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
3	Cell lines: definition development of cell lines, characterization, and maintenance. Established cell lines, Characteristics, and cryopreservation. Freeze storing of cell and transport of culture. Cell cloning and selection, Transfection, and Transformation. Expression of the cloned protein in animal cells.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	9
4	Cell culture Reactors: Scale-up in suspension, scale-up in monolayer, Different reactors used in Suspension, and monolayer culture. Commercial Scale Production of an animal cell, Stem cell, and the application of ATC in drug testing and toxicity of environmental pollutants in cell culture.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lectures	8
5	Mass Production: Mass Production of biologically important compounds. Harvesting of Products, Purification and Assay. Production of Human and Viral Vaccines. Production and Application of monoclonal antibody. Transgenic animals: Technique and application. Tissue engineering and its application	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	Freshney, Wiley-Liss,-Culture of Animal Cells-5 th Edition-2005
Articles	https://www.nature.com/subjects/animal-biotechnology#:~:text=Animal%20biotechnology%20is%20a%20branch,pharmaceutical%2C%20agricultural%20or%20industrial%20applications
References Books	G.Zubay -Animal Cell Culture Techniques-3 rd Edition
MOOC Courses	https://nptel.ac.in/courses/102104059
Videos	https://nptel.ac.in/courses/102104059

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	3	1	3	3	1	1	1	3	1	-	-	-
CO2	2	3	3	2	1	3	1	2	2	3	3	1	-	-	-
CO3	3	3	1	1	3	3	3	2	1	1	3	2	-	-	-
CO4	2	1	2	1	3	1	1	3	2	2	3	1	-	-	-
CO5	3	3	2	2	1	3	3	1	1	1	1	2	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	Agriculture Biotechnology and IPR
Course Code	BT 305 (T)

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	Student should have basic knowledge of botany and genetic engineering			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To define and contrast the terms agriculture and agricultural biotechnology**(BL1-Remember)** **CO2-** To understand the techniques, skills, and modern engineering tools necessary for engineering practice in agriculture biotechnology**(BL2-Understand)** **CO3-** To define the concept of utilizing plants for production of vaccines and production of biofertilizers**(BL2-Understand)** **CO4-** To apply the knowledge of engineering principles of agriculture biotechnology to living entities for societal welfare**(BL3-Apply)** **CO5-** The students will be able to develop the relationship between science and society and will be able to give justification for biotechnological manipulation of plants for human use**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
I	Introduction To Agricultural Biotechnology: Origin of cultivated plants and plant indication, Introduction to Indian Agriculture heritage; Soil management and its relevance in Pre-modern India. Review of plant cell structure and function; Review of water uptake Introduction to plant nutrition; Mineral availability- uptake of minerals	Lecture method, demonstrations, field visit, ABL, Case studies, ABL.	8
II	Methods of breeding self-pollinated and vegetatively propagated plants; Seed Germination and Seedling Growth; Photoperiodism and its significance; Vernalization and hormonal control. Heterosis-Genetic and Molecular basis, Apomixis -Mechanism and significance in crop improvement	Lecture method, demonstrations, field visit, ABL, Case studies, ABL.	9
III	Post Harvest Biotechnology: Importance of post harvest physiology; Stages of growth; Maturity indices; Fruit ripening- changes during ripening; Post harvest losses-types; Technologies to control post harvest losses; Respiration and transpiration loss, methods to measure respiration and transpiration losses; Spoilage of fruit and vegetable, Microbial contaminants and post-harvest pathology	Lecture method, demonstrations, field visit, ABL, Case studies, ABL.	8
IV	Biotechnology In Organic Farming: Organic farming, principles and its scope in India; Role of Biotechnology in organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming; Molecular Farming And Nitrogen Fixation: Molecular farming for the production of industrial enzymes, biodegradable plastics, polyhydroxybutyrate, antibodies, edible vaccines; Metabolic engineering of plants for the production of fatty acids, industrial oils, flavonoids etc.,.	Lecture method, demonstrations, field visit, ABL, Case studies, ABL.	9
V	Introduction to Intellectual Property Rights Concept and Theories Kinds of Intellectual Property Rights Economic analysis of Intellectual Property Rights Need for Private Rights versus Public Interests Advantages and Disadvantages of IPR, International Regime Relating to IPR TRIPS and other Treaties (WIPO,WTO, GATTS)		8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	To analyze the soil samples of various locations to check it sfertility.	PBL	BL4-Analyze	1 week
II	To study the mechanism and significance in crop improvement.	Industrial Visit	BL4-Analyze	8 hrs
III	To apply for the patent for a specific product, product developement process or any idea	PBL	BL6-Create	15 days

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	MS Swamynathan,Biotechnology in Agriculture, a Dialogue,1981 Arun K. Sharma,Hand book of organic farming Agrobios,2002
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8751662/
References Books	Arie Altman Paul Hasegawa,Plant Biotechnology and Agriculture,2011 K. Lindsey and M.G.K. Jones,Plant biotechnology in Agriculture, 1989
MOOC Courses	https://nptel.ac.in/courses/126105014 https://nptel.ac.in/courses/126105337 https://nptel.ac.in/courses/109106128
Videos	https://nptel.ac.in/courses/126105014 https://nptel.ac.in/courses/126105337 https://nptel.ac.in/courses/109106128

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	1	2	-	-	-	-	-	1	2	3	2
CO2	1	-	2	3	-	3	2	-	-	-	-	-	1	2	2
CO3	1	3	1	3	1	1	1	1	-	-	-	-	-	1	2
CO4	2	1	2	2	1	-	2	-	-	-	-	-	2	2	1
CO5	2	3	1	2	2	2	1	-	-	-	-	-	3	2	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	Biophysics and Biochemistry
Course Code	BT-101[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Biophysics and Biochemistry is an interdisciplinary research field that is rapidly developing and expanding. The objective is to ensure that students acquire essential knowledge of modern biochemistry and molecular biophysics, including the principles of biological phenomena.			**Co-Requisite/s**	To impart knowledge on structural, functional, and dynamic aspects of biological components			
Course Outcomes & Bloom's Level	**CO1-** To remember the structure of various biomolecules like carbohydrates, fats, amino acids, etc.**(BL2-Understand)** **CO2-** To comprehend the biological material; and its relation to living matter and elaborate the structure and functions of different biomolecules**(BL4-Analyze)** **CO3-** To understand the importance of biophysical chemistry and its applications.**(BL2-Understand)** **CO4-** To provide experimental basis and to enable students to analyze the various biomolecules in food samples.**(BL3-Apply)** **CO5-** To evaluate the applications of biomolecules in various fields such as research and industries**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕			**SDG (Goals)**	SDG4(Quality education) SDG8(Decent work and economic growth)			

Part B

Modules	Contents	Pedagogy	Hours
1	Basic Biochemistry: Types of solutions, Buffer and buffering capacity, concept of pH and pKa., Acids, base, ionization of weak acids and bases; Henderson-Hasselbatch equation. Principle of thermodynamics, Concept of free energy, entropy, High energy biomolecules, and their significance, Bonds in the biological system.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Carbohydrates: Introduction, Classification, Structure, Properties and biological role of sugars. Basic structure and functions of monosaccharides and Oligosaccharides, optical isomerism, important derivatives of monosaccharide, Structure, and functions of polysaccharides, Mucopolysaccharides, Proteoglycans, Glycoproteins, Cell wall. Vitamins: Introduction, Classification, and functions of vitamins and their coenzyme activity	Tutorials, Demonstrations, Project methods, Hands on experience, Experiments,	8
3	Lipids: Classification, nomenclature, and structure of fatty acids. Classification, structure, and biological functions of lipids. Structure and function of Biomembranes: Micelles, Liposomes and their application. Hormones: Types (animal hormone and plant hormones) and biological roles	utorials, Demonstrations, Project methods, Hands on experience, Experiments,	8
4	Amino acid: Structure, Classification, and functions of amino acid; essential and nonessential amino acids, common rare and non- protein amino acids. Properties and Chemical reactions of amino acids, biologically active peptides Proteins: Classification, Properties and biological functions of proteins, coagulation and denaturation of proteins, Ramachandran plot. Conformation and structure of proteins□are primary, secondary, tertiary, and quaternary.	utorials, Demonstrations, Project methods, Hands on experience, Experiments,	8
5	Nucleic acids: Structure and functions of purines, pyrimidines, nucleosides, nucleotides Structure, properties and biological role of DNA. Various types of DNA, Melting of DNA, Denaturation, and annealing of DNA. Structure and biological role of different types of RNA, Ribozymes: structure and functions.	utorials, Demonstrations, Project methods, Hands on experience, Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Qualitative analysis of carbohydrates	Experiments	BL3-Apply	3
2	Qualitative analysis of lipids and fats	Experiments	BL3-Apply	3
3	Qualitative analysis of proteins	Experiments	BL3-Apply	3
4	Quantitative estimation of carbohydrates	Experiments	BL3-Apply	3
5	Quantitative estimation of proteins	Experiments	BL3-Apply	3
6	Determination of acid value in the given fat sample	PBL	BL3-Apply	3
7	Determination of esterification value of given fat sample	PBL	BL3-Apply	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	20	60	

Part E

Books	Lehninger's Principle of Biochemistry: Nelson, L.D. and M. M Cox, Macmillan, Worth Publication Inc.
Articles	https://www.nature.com/subjects/biochemistry
References Books	Voetand JG.Voet, JWileyand Sons. Biochemistry 6th Edition
MOOC Courses	https://onlinecourses.nptel.ac.in/noc24_bt12/preview https://onlinecourses.nptel.ac.in/noc24_bt14/preview
Videos	https://onlinecourses.nptel.ac.in/noc24_bt12/preview https://onlinecourses.nptel.ac.in/noc24_bt14/preview

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	3	3	1	2	-	-	-	-	-	1	3	-
CO2	1	3	2	1	-	-	1	-	-	-	-	-	2	3	1
CO3	1	2	1	1	1	2	2	-	-	-	-	-	-	1	1
CO4	1	2	1	1	3	2	1	-	-	-	-	-	2	1	2
CO5	1	2	3	1	1	2	3	-	-	-	-	-	2	1	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	General Microbiology and Microbial Genetics
Course Code	BT-102[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Microbiology is the study of life forms too small to be seen with the naked eye, including Viruses, Bacteria, Archaea, and Protists. The paper emphasizes on study of distribution, morphology, physiology and nutrition of microorganisms in addition to skills in aseptic procedures, isolation and identification and their classification. This course also takes account of study on gene transfer mechanisms and a detailed insight into mutations and their analysis.			**Co-Requisite/s**	Microbial classification and methods of gene transfer			
Course Outcomes & Bloom's Level	**CO1-** To remember the basic concepts and view of professional and scientific communication approaches for microbiology and biotechnology settings. **(BL1-Remember)** **CO2-** To understand the gene transfer mechanisms and a detailed insight into mutations and their analysis.**(BL2-Understand)** **CO3-** To describe comprehensive understanding of sterilization processes and media preparation pipelines.**(BL2-Understand)** **CO4-** To provide experimental basis, and to enable students to analyze the basic concepts of microbial evolution, phylogeny, nutritional aspects and elements of microbial genetics. **(BL3-Apply)** **CO5-** To evaluate the genetic analysis and gene transfer mechanisms of microbes**(BL5-Evaluate)** **CO6-** To apply Appraise the current regulatory, quality control, and legal frameworks that impact biotechnology and ethical behaviors that foster positive and productive interactions in diverse microbiology and biotechnology settings.**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education) SDG8(Decent work and economic growth)				

Part B

Modules	Contents	Pedagogy	Hours
1	History and scope of microbiology, modern development of microbiology, Classification of microorganism: Haeckel's; three kingdom concept, Whittaker; five kingdom concept. Introduction and general characteristic of bacteria, fungi. Algae andvirus.	Tutorials, Demonstrations, videos, case studies ,	8
2	Concept of Sterilization - Definition of sterilization, methods of sterilization; dry and moist heat, pasteurization, tyndalization; radiation, filtration, disinfection, sanitization. Stains and staining techniques -Mechanism of gram staining, acid fast staining, negative staining, capsule staining, flagella staining.	Tutorials, Demonstrations, videos, case studies ,	8
3	Culture media: Type of media and their uses, pure culture techniques. Microbial growth: growth curve, measurement of growth and factor affecting the growth, Microbial nutrition: Nutritional classification of microorganism. Cultivation of microorganism: aerobic and anaerobic culture and preservation of microbial culture. Oxygen toxicity: Study	Tutorials, Demonstrations, videos, case studies ,	8
4	Gene transfer mechanisms: transformation, transduction, conjugation and transfection, Mechanism and applications, genetic analysis of microbes- bacteria and yeast. Plasmids: characteristics and their uses in genetic analysis/as cloning vectors, replication of selected plasmids. Transposable genetic elements: transposons, types of transposons and their uses.	Tutorials, Demonstrations, videos, case studies ,	8
5	Genetic analysis of bacteria: Importance and uses of Mutation analysis. Inheritance in bacteria, types of mutations, spontaneous and induced mutagenesis. Isolating mutants, selecting mutants, mutant enrichment. Reversions versus suppression. Complementation test	Tutorials, Demonstrations, videos, case studies ,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Grams staining	Experiments	BL2-Understand	3
2	Negative & capsular staining	Experiments	BL2-Understand	3
3	serial dilution	Experiments	BL3-Apply	3
4	Pour plate method	Experiments	BL3-Apply	3
5	sterlization technique	Experiments	BL3-Apply	3
6	isolation of microorganisms from soil sample	Experiments	BL4-Analyze	3
7	To prepare sigmoid growth curve for bacterial growth	PBL	BL4-Analyze	1 week

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	20	60	

Part E

Books	Fundamental Bacterial Genetics by Nancy Trun and Janine Trempy, 1st edition; Blackwell Science Publishers; 2004. 2. Modern Microbial Genetics by U.N. Streips and R.E. Yasbin, 2nd edition; Wiley Publishers; 2002. 3. Microbial Genetics by Stanly R. Maloy, John E. Cronan, Jr. and David Freifelder, 2nd edition; Narosa
Articles	https://www.nature.com/subjects/microbiology
References Books	Stanier, R.Y. Adelberg, E.EA. and Ingraham, J.L. (1984). General Microbiology, IVth Eds., Mac. Millan Press. 5. Pelczar, M.J. Chan, E.C.S. and Krieg, N.R. (1986). Microbiology, Vth Eds., Mc. Graw Hill.
MOOC Courses	https://nptel.ac.in/courses/102103015
Videos	https://nptel.ac.in/courses/102103015

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	-	-	-	2	-	-	-	-	-	1	1	3
CO2	1	2	2	-	-	-	1	-	-	-	-	-	2	-	-
CO3	1	2	2	-	-	-	3	-	-	-	-	-	2	-	-
CO4	2	1	2	-	-	-	2	-	-	-	-	-	2	-	-
CO5	1	2	2	-	-	-	1	-	-	-	-	-	-	3	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	Bioanalytical Techniques
Course Code	BT-104[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	To be familiar with the basic instruments present in the laboratory and their working principles.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember and understand and learn the basic microscopic & centrifugation techniques **(BL1-Remember)** **CO2-** To understand the separation of components using various techniques like chromatography, electrophoresis, centrifugation etc**(BL2-Understand)** **CO3-** To utilize the separation techniques in order to distinguish the different types of molecules present in the sample.**(BL3-Apply)** **CO4-** To evaluate, identify and compare the molecules on the basis of bioanalytical techniques.**(BL4-Analyze)** **CO5-** To purify the specific protein/molecules/compound for its further utilization in food, dairy, chemical and beverage industries**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
I	Microscopy: Light microscopy, Bright & Dark Field microscopy, Fluorescence microscopy, Phase Contrast microscopy, TEM, SEM, Centrifugation: Basic principle, Factors affecting Sedimentation velocity, Standard Sedimentation Coefficient, types of centrifugations, instrumentation and applications.	Lecture methods, group dicussions, 3D animated videos, ABL, PBL,Experiments.	10
II	Chromatography: Principle, types, instrumentation and applications: Column, Affinity chromatography, Ion exchange chromatography, HPLC . Electrophoresis: Principle, types and applications, Isoelectric-focusing, 2D gel electrophoresis	Lecture methods, group dicussions, 3D animated videos, ABL, PBL,Experiments.	10
III	Spectroscopy: Basic principles, instrumentation and applications of UV-visible spectrophotometry, IR Spectrophotometry, Atomic absorption spectroscopy: Flame emission spectroscopy. Polarimetry: Principle, instrumentation and applications	Lecture methods, group dicussions, 3D animated videos, ABL, PBL,Experiments.	9
IV	ESR: Principle, instrumentation and applications, NMR Principle, and applications, circular dichroism (CD) Principle, and applications, GC Mass: Basic principle, instrumentation and applications, Mass spectroscopy.	Lecture methods, group dicussions, 3D animated videos, ABL, PBL,Experiments.	8
V	X Ray crystallography: Principle and application. Autoradiography: Principles, and applications. Flow cytometry	Lecture methods, group dicussions, 3D animated videos, ABL, PBL,Experiments.	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Qualitative analysis of various plant pigments using thin layer chromatography	PBL	BL4-Analyze	5
II	To plot bacterial growth curves using U.V.Visible spectroscopy	PBL	BL4-Analyze	6 days

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	Wilson.K;Principles and Techniques of Biochemistry and Molecular Biology;7th Edition; (2010) Sheehan .D;Physical Biochemistry: Principles and Applications 2nd Edition, John Wiley & Sons (2009)
Articles	https://www.sciencedirect.com/topics/earth-and-planetary-sciences/spectrophotometry https://www.mdpi.com/journal/chromatography
References Books	Rodney F. Boyer,Hall.P.P;;Biochemistry Laboratory: Modern Theory and Techniques, ; 2nd Edition (2010). Talluri.S;Bioanalytical Techniques;I.K. Internationlal Publishing House Pvt. Ltd. (2012) Dua .S and Garg.N,Biochemical methods of analysis: Theory and applications. Alpha Science Intl Ltd; 1st Edition (2010)
MOOC Courses	https://nptel.ac.in/courses/102103044
Videos	https://nptel.ac.in/courses/102103044

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	2	-	-	-	-	-	-	1	2	1
CO2	1	1	-	3	2	1	-	-	-	-	-	-	2	1	-
CO3	1	2	2	2	2	-	1	-	-	-	-	1	1	2	2
CO4	3	2	2	2	1	2	1	-	-	-	-	-	2	1	2
CO5	1	3	1	1	2	1	-	-	-	-	-	-	2	-	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	Lab
Course Code	BT-106[P]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					0	0	3	3
Course Type	Lab only							
Course Category	Discipline Core							
Pre-Requisite/s	Biophysics and Biochemistry and Microbiology is an interdisciplinary research field that is rapidly developing and expanding.			**Co-Requisite/s**	Ensure that students acquire essential knowledge of modern biochemistry and molecular biophysics, and Microbiology including the principles of biological phenomena. To impart knowledge on structural, functional and dynamic aspects of biological components.			
Course Outcomes & Bloom's Level	**CO1-** To provide experimental basis, and to enable students to analyze the various biomolecules in food samples.**(BL1-Remember)** **CO2-** To evaluate the applications of biomolecules in various fields such as research and industries**(BL2-Understand)** **CO3-** To provide experimental basis, and to enable students to analyze the basic concepts of microbial evolution, phylogeny, nutritional aspects and elements of microbial genetics. **(BL2-Understand)** **CO4-** To evaluate the genetic analysis and gene transfer mechanisms of microbes.**(BL3-Apply)** **CO5-** To apply Appraise the current regulatory, quality control, and legal frameworks that impact biotechnology and ethical behaviors that foster positive and productive interactions in diverse microbiology and biotechnology settings.**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Qualitative analysis of carbohydrates	Experiments	BL3-Apply	3
2	Qualitative analysis of lipids and fats	Experiments	BL3-Apply	3
3	QualitativQuantitative estimation of carbohydratese analysis of proteins	Experiments	BL3-Apply	3
4	Quantitative estimation of proteins	Experiments	BL3-Apply	3
5	Determination of acid value in the given fat sample	Experiments	BL3-Apply	3
6	Determination of esterification value of given fat sample	PBL	BL4-Analyze	6
7	Introduction of Laboratory equipment, cleaning of Glassware, Autoclaving	Experiments	BL3-Apply	3
8	Introduction to balancing and pipetting	Experiments	BL3-Apply	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Fundamental Bacterial Genetics by Nancy Trun and Janine Trempy, 1st edition; Blackwell Science Publishers; 2004. Modern Microbial Genetics by U.N. Streips and R.E. Yasbin, 2 nd edition; Wiley Publishers; 2002. Microbial Genetics by Stanly R. Maloy, John E. Cronan, Jr. and David Freifelder, 2nd edition; Narosa Stanier, R.Y. Adelberg, E.EA. and Ingraham, J.L. (1984). General Microbiology, IVth Eds., Mac. Millan Press. Pelczar, M.J. Chan, E.C.S. and Krieg, N.R. (1986). Microbiology, Vth Eds., Mc. Graw Hill.
Articles	https://www.nature.com/subjects/biochemistry https://www.nature.com/subjects/microbiology
References Books	Lehninger's Principle of Biochemistry: Nelson, L.D. and M. M Cox, Macmillan, Worth Publication Inc. Biochemistry: Stryer, L., W.H. Freeman and Co. NY Biochemistry: Voet and Voet, John Wiley and Sons. Biochemistry: Jeoffery Zubay, WMC. Brown Publ. Biochemistry: West, B. Todd, M. Mason, R.V. Bruggen and MacMillan.
MOOC Courses	https://nptel.ac.in/courses/105107173 https://nptel.ac.in/courses/118106019 https://nptel.ac.in/courses/102103015
Videos	https://nptel.ac.in/courses/105107173 https://nptel.ac.in/courses/118106019 https://nptel.ac.in/courses/102103015

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	2	-	2	2	-	-	-	-	-	1	1	-
CO2	2	2	3	2	1	-	2	-	-	-	-	-	1	2	2
CO3	1	1	1	2	3	2	3	-	-	-	-	-	-	2	1
CO4	2	1	1	-	3	1	2	-	-	-	-	-	2	2	2
CO5	3	2	2	2	1	1	-	-	-	-	-	-	3	1	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	Lab
Course Code	BT-107[P]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					0	0	3	3
Course Type	Lab only							
Course Category	Discipline Core							
Pre-Requisite/s	Student must be aquainted by the basic knowledge of cell biology, molecuar biology and bioinstrumentation			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Students will recognize the cellular components underlying mitotic cell division**(BL3-Apply)** **CO2-** Students will apply their knowledge of cell biology to selected examples of changes or losses in cell function**(BL4-Analyze)** **CO3-** Students will create a model by using cell biology basics**(BL6-Create)** **CO4-** To utilize the separation techniques in order to distinguish the different types of molecules present in the sample.**(BL3-Apply)** **CO5-** To evaluate, identify and compare the molecules on the basis of bioanalytical techniques.**(BL4-Analyze)** **CO6-** To purify the specific protein/molecules/compound for its further utilization in food, dairy, chemical and beverage industries**(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Introduction to chromosome preparation: Pre-treatment, Fixation, Staining, Squash and Smear preparation. Preparation of permanent slides	Experiments	BL2-Understand	3
X	To plot bacterial growth curves using U.V.Visible spectroscopy	PBL	BL4-Analyze	6 days
III	Study of mitotic chromosome: Metaphase chromosome preparation, free hand drawing under high power objective.	Experiments	BL2-Understand	3
IV	The determine osmolarity in RBCs.	Experiments	BL5-Evaluate	3
V	The fractionation of rat Liver	Experiments	BL4-Analyze	5
VI	Estimation of chlorophyll content in spinach leaves.	Experiments	BL4-Analyze	3
VII	To separate casein from milk using centrifugation	Experiments	BL3-Apply	3
VII	To separate plant pigments using paper chromatography	Experiments	BL4-Analyze	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Lehninger's Principle of Biochemistry: Nelson, L.D. and M. M Cox, Macmillan, WorthPublication Inc.
Articles	https://www.sciencedirect.com/topics/earth-and-planetary-sciences/spectrophotometry https://www.mdpi.com/journal/chromatography
References Books	Wilson and Walker;Principles and Techniques of Biochemistry and Molecular Biology Gerald Karp;Cell and Molecular Biology: Concepts and experiments Sheehan .D;Physical Biochemistry: Principles and Applications 2nd Edition, John Wiley &Sons (2009)
MOOC Courses	https://nptel.ac.in/courses/102103044
Videos	https://nptel.ac.in/courses/102103044

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	1	2	-	-	-	-	-	-	-	2	1
CO2	1	2	2	2	2	2	1	-	-	-	-	-	1	2	2
CO3	1	3	-	1	3	-	1	-	-	-	-	-	2	1	2
CO4	1	-	2	1	1	1	-	-	-	-	-	-	2	1	-
CO5	2	1	2	2	3	-	-	-	-	-	-	-	1	3	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	Applied Biotechnology & Microbiology
Course Code	BT-201[T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	Student must be aquainted with the basic knowledge of biotechnological and microbiological applications			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To understand professional and scientific communication approaches for microbiology and biotechnology settings.**(BL2-Understand)** **CO2-** Demonstrate comprehensive understanding of organizational processes and product development pipelines**(BL2-Understand)** **CO3-** Distinguish among diverse methods and technologies and their applications in microbiology and biotechnology**(BL3-Apply)** **CO4-** Appraise the current regulatory, quality control, and legal frameworks that impact biotechnology and ethical behaviors that foster positive and productive interactions in diverse microbiology and biotechnology settings.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education) SDG8(Decent work and economic growth)				

Part B

Modules	Contents	Pedagogy	Hours
I	Functional Genomics and Proteomics -- Approaches to analyze differential expression of genes; Gene tagging; Gene trapping; Gene silencing; Knockout mutants; Approaches to proteome analysis; Dynamic modulation of protein structure and function	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
II	Molecular biology tools for Environmental management, rDNA technology in waste treatment, Genetically modified organisms in Waste management, Genetic Sensors, Metagenomics, Bioprospecting, Nanoscience in Environmental management, Biosensors development to monitor pollution	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
III	Bioremediation: In situ and ex-situ techniques, advantages of bioremediation. Phytoremediation: Phytoremediation of xenobiotics and bioaccumulation of metals using plants. Biodegradation of petroleum constituents and associated heavy metal, case study with example	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	8
IV	Nanotechnology in medicine Basics of nanotechnology, nanomaterials and nanoparticles, nanotools, Nanoparticles in cancer therapeutics, Nanodiagnostics. In vitro nanodiagnostics − nanobiochips and nanobiosensors, cantilever biosensors, nanoproteomics In vivo nanodiagnostics− gold nanoparticles, nanotubes, quantum dots− nanobiochips and nanobiosensors, cantilever biosensors, nanoproteomics.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lectures	8
V	Pharmacology & Drug development Introduction to Pharmacology Concept of Essential Drugs Routes of Drug Administration Introduction to Drug Discovery and Development. Hurdles in Drug Development Sources of Drugs Approaches to Drug Discovery Pharmacovigilance Factors affecting drug response	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Grams staining	Experiments	BL2-Understand	3
II	To understand the bioremediation process	PBL	BL2-Understand	3 days
III	Identification of plants showing phytoremediation	Experiments	BL3-Apply	1 week

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Prentice hall, International, Katzung, B.G;Basic and Clinical Pharmacology ;7th Edition Mehra.J.K;Drug interaction;Basic Bussiness Publ, Bombay
Articles	
References Books	Lippincott, Williams and Wilkins;Remington Pharmaceutical Sciences. Chattopadhyay K K "Microbial Genomics And Proteomics" by Niyaz Ahmed;Introduction to Nanoscience and Nanotechnology
MOOC Courses	https://nptel.ac.in/courses/105107173 https://nptel.ac.in/courses/118106019
Videos	https://nptel.ac.in/courses/105107173 https://nptel.ac.in/courses/118106019

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	1	2	1	-	-	-	-	-	2	2	1
CO2	1	1	2	2	-	1	-	-	-	-	1	-	1	3	2
CO3	1	2	2	2	1	1	1	-	-	-	-	-	1	1	2
CO4	3	2	1	1	2	1	-	-	-	-	-	-	1	1	1
CO5	1	2	-	2	2	3	-	-	-	-	-	-	2	3	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	Stem cell biology
Course Code	BT-205 (T)

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	Knowledge about basics of cell			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember the basics of stem cell structure and properties.**(BL1-Remember)** **CO2-** To understand the techniques involved in the culturing of functional stem cell.**(BL2-Understand)** **CO3-** To apply the bioengineering and development of mammalian stem cells in the laboratory**(BL3-Apply)** **CO4-** To interpret the various applications of stem cells in treating various diseases**(BL4-Analyze)** **CO5-** To Justify the industrial approach to stem cells. Ethical and Legal issues: and Guidelines in conducting human stem cell research.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Basic of biology of stem cells; Unique properties of stem cells. Types & sources of stem cells: embryonic, fetal, cord blood, placenta, adult, bone marrow: hematopoietic and Mesenchymal stem cells. Organ Derived Stem cells, Cancer stem cells, induced pluripotent stem cells, Stem cell banking.	Lecture menthod, demonstrations, experiment, ABL, PBL, case studies	8
2	Stem cell characterizations: Bone Marrow Mesenchymal Stem Cells, Hematopoietic Stem Cells isolation & characterizations, markers & their identification. Blood cell formation from Bone marrow stem cell.	Lecture menthod, demonstrations, experiment, ABL, PBL, case studies	8
3	Growth factor requirement and stem cell maintenance in in-vitro culture. Bone marrow transplantation versus Stem cell transplantation. Stem Cells and Cloning, Molecular basis of stem cell self-renewal, pluripotency, and differentiation, Metaplasia, and trans-differentiation	Lecture menthod, demonstrations, experiment, ABL, PBL, case studies	8
4	Role of signal transduction pathways in self-renewal and differentiation of stem cells. Cell cycle regulators in stem cells. Therapeutic application of stem cells: Current State and Future Perspectives, Neurodegenerative diseases, Spinal cord injury, Heart disease, Diabetes, Burns and Skin ulcers, Muscular Dystrophy.	Lecture menthod, demonstrations, experiment, ABL, PBL, case studies	8
5	Orthopedic applications, Stem cells, and gene therapy. An industrial approach to stem cells. Ethical and Legal Issues: ICMR DBT Guidelines in conducting human stem cell research	Lecture menthod, demonstrations, experiment, ABL, PBL, case studies	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	To study the basic features of stem cell	Experiments	BL2-Understand	2
2	Study of stem cells preserved under in vitro conditions	PBL	BL4-Analyze	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	R. Lanza, I. Weissman, J. Thomson, and R. Pedersen, 1. Handbook of Stem Cells, Two Volume, Volume 1-2: Volume 1-Embryonic Stem Cells; Volume 2-Adult&Fetal Stem Cells,2012, Academic Press. Volume, Volume 1-2: Volume 1- 2012, Academic Press. J.J.Mao, G.Vunjak-Nova kovicetal (Ed):"Transational ApproachesinTissue J.J.Mao, G.Vunjak-Nova kovicetal (Ed):"Transational ApproachesinTissue
Articles	https://www.mdpi.com/2306-5354/8/5/50
References Books	R.Lanza,J.Gearhartetal (Ed), Elsevier Academic press. Essentials of Stem Cell Biology, 1. . Elsevier Academic press. Engineering & Regenerative Medicine" 2008, Artech House. INC Publications. NaggyN. Habib,M.Y.Levicar, L.G. Jiao and N. Fisk: Stem Cell Repair andRegeneration.Volume-2,2007, Imperial College Press Volume 2, 2007, Imperial College Press
MOOC Courses	https://nptel.ac.in/courses/102106035
Videos	https://nptel.ac.in/courses/102106035

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	2	-	-	-	2	-	-	1	-	1
CO2	2	3	2	2	2	1	-	-	-	2	-	-	1	-	3
CO3	3	1	1	2	1	-	-	-	-	-	-	-	3	2	3
CO4	3	2	1	1	1	-	-	-	-	2	-	-	2	3	2
CO5	2	1	1	2	1	-	-	-	-	2	-	-	2	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	Research Methodology
Course Code	BT-305 (T)

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	Provides understanding of the basic concepts of research, their types and applications of Biostatistics in research and development.			**Co-Requisite/s**	Should have basic knowledge of data and its applications			
Course Outcomes & Bloom's Level	**CO1-** The course prepares the student to understand the basic concepts of Research Methodology, its applications in experimental design and future prospects.**(BL1-Remember)** **CO2-** The subject Research Methodology is designed for post graduate students of Food Technology for describing the basic concepts of each and every division of the subject along with its applications in other fields. **(BL2-Understand)** **CO3-** The course aims to provide experimental basis, and to enable students to acquire a specialized knowledge and understanding of data and its applications in experimental verification.**(BL3-Apply)** **CO4-** The course aims to provide basis of analyzing the applications of Research Methodology in various fields of research and industries**(BL3-Apply)** **CO5-** The course aims to provide basis of experimental design, computer applications and use of statistical tools in research and industries.**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG2(Zero hunger) SDG4(Quality education) SDG6(Clean water and sanitation) SDG8(Decent work and economic growth)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction: Definition of Research, Qualities of Researcher, Components of Research Problem, Various Steps in Scientific Research, Types of Research; Hypotheses Research Purposes - Research Design - Survey Research - Case Study Research. Research Reports, Introduction to SPSS	Class room teaching (chalk-board) Power Point Presentations Online Classes Interactive Videos	8
2	Data Collection: Sources of Data: Primary Data, Secondary Data; Procedure Questionnaire - Sampling Merits and Demerits - Experiments - Kinds - Procedure; Control Observation	Class room teaching (chalk-board) Power Point Presentations Online Classes Interactive Videos	8
3	Introduction to Statistics - Probability Theories - Conditional Probability, Point and Interval Estimates of Means and Proportions; Hypothesis Tests, One Sample Test - Two Sample Tests / Chi-Square Test, t-test - Standard deviation	Class room teaching (chalk-board) Power Point Presentations Online Classes Interactive Videos	8
4	Statistical Applications: Analysis of Variance, Completely Randomized Design, Randomized Complete Block Design, Latin Square Design	Class room teaching (chalk-board) Power Point Presentations Online Classes Interactive Videos	8
5	Computer application: Use of computers for preparing and presenting Documents. Appropriate Statistical and other relevant packages, internet .Use of MS-Office, Library documentation and Scientific literature searching	Class room teaching (chalk-board) Power Point Presentations Online Classes Interactive Videos	8

M

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Steps in scientific research methodology	Case Study	BL2-Understand	3
2	Sampling process	Case Study	BL2-Understand	3
3	Developing Hypothesis	Case Study	BL2-Understand	3
4	Data collection	Case Study	BL2-Understand	3
5	ANOVA: CRD	Field work	BL3-Apply	3
6	RBD	Field work	BL3-Apply	3
7	Components of scientific research paper	Case Study	BL2-Understand	3
8	t-test	Case Study	BL3-Apply	3
9	Chi Square Test	Field work	BL3-Apply	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	20
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
0	0	0	0	0	0

Part E

Books	Research methodology, C.R. Kothari, 6th Edition
Articles	https://nptel.ac.in/courses/127106227
References Books	Methodology and techniques of Social Research, Wilkinson and Bhandarkar, 3rd Edition
MOOC Courses	https://nptel.ac.in/courses/121106007
Videos	https://nptel.ac.in/courses/121106007

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	2	-	-	-	-	-	-	2	-	2
CO2	1	2	3	2	3	2	-	-	-	-	-	-	1	2	3
CO3	1	2	2	2	2	2	-	-	-	-	-	-	2	2	1
CO4	1	2	2	1	2	-	-	-	-	-	-	-	2	2	1
CO5	1	2	2	1	2	1	-	-	-	-	-	-	2	1	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	Bioprocess Engineering
Course Code	BT304 (T)

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	Should be familiar with the basics of Bioprocess Engineering, techniques used for the production, purification and transport of metabolites, production of different metabolites with the help of microbes and their kinetics.			**Co-Requisite/s**	Should have the different fermentation processes, transport phenomenon and production of some important industrial metabolites			
Course Outcomes & Bloom's Level	**CO1-** The course prepares the student to understand the basic concepts of Bioprocess Engineering, its applications and future prospects.**(BL1-Remember)** **CO2-** The subject Bioprocess Engineering is designed for post graduate students of biotechnology for understanding of basic concepts of each and every division of the subject along with its applications in other fields. **(BL2-Understand)** **CO3-** The course aims to provide experimental basis, and to enable students to acquire a specialized knowledge and understanding.**(BL3-Apply)** **CO4-** The course aims to provide basis of analyzing the applications of Bioprocess Engineering in various fields of research and industries**(BL3-Apply)** **CO5-** The course aims to provide basis of design, production and purification of bioproducts produced through research and in industries.**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✕ Environment ✕			**SDG (Goals)**	SDG2(Zero hunger) SDG3(Good health and well-being) SDG4(Quality education) SDG8(Decent work and economic growth)			

Part B

Modules	Contents	Pedagogy	Hours
1	Units and dimensions: dimensional analysis, stiochiometric and composition relationship, Newton's law of viscosity and its measurement. Introduction to bioprocess technology Isolation and screening of Industrial microorganisms, Preservation and maintenance of industrial microorganisms	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Kinetics of microbial growth, death and product synthesis; Air and media sterilization, Construction, design and types of bioreactor. Kinetics of batch, fed batch and continuous reactor. Automation for monitoring and control	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Transport phenomenon in biochemical engineering: Mass transfer, heat transfer, rheology, Aeration and agitation. Product recovery processes, centrifugation, chromatography, extraction process, crystallization, drying and packaging. Quality assurance and safety consideration in DSP, Bioprocess Economics.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	Microbial production of Antibiotics (Penicillin and Streptomycin) and Enzymes (Amylase, Protease) with applications. Microbial Production of Vitamin (Vitamin B12), amino acids (Glutamic acid).	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lecture	8
5	Microbial production of Organic acids (Citric acid and Acetic Acid), solvents (Ethanol and acetone). Microbial production of food-SCP.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Isolation of industrially important microbes from soil by serial dilution method	Experiments	BL3-Apply	3
2	Isolation of industrially important microbes from water	Experiments	BL3-Apply	3
3	Isolation of industrially important microbes from air	Experiments	BL3-Apply	3
4	Microbial production of ethanol from orange juice using S. Cereviseae	Experiments	BL4-Analyze	3
5	Microbial production of ethanol from pineapple juice using S. Cereviseae	Experiments	BL3-Apply	3
6	Microbial production of ethanol from grape juice using S. Cereviseae	Experiments	BL3-Apply	3
7	Microbial production of citric acid using Aspergillus niger	Experiments	BL3-Apply	3
8	Microbial production of acetic acid	Experiments	BL3-Apply	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	20
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	30

Part E

Books	Bioprocess Engg. Principles, P.M. Doran, Elsevier.
Articles	https://www.researchgate.net/topic/Bioprocess-Engineering
References Books	Bioprocess Engg., Schular, Kargi
MOOC Courses	https://nptel.ac.in/courses/102106022
Videos	https://nptel.ac.in/courses/102106022

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	-	-	-	-	-	-	-	-	-	1	1	-
CO2	1	2	1	-	-	-	-	-	-	-	-	-	1	2	-
CO3	1	2	2	-	-	-	-	-	-	-	-	-	1	2	-
CO4	1	2	2	-	-	-	-	-	-	-	-	-	1	2	-
CO5	1	2	1	-	-	-	-	-	-	-	-	-	1	2	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	Lab Course V
Course Code	BT306 (P)

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					0	0	3	3
Course Type	Lab only							
Course Category	Discipline Core							
Pre-Requisite/s	Student must have basic knowledge of botany and plant physiology			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To standardize the techniques and nutrient media for the growth and development of in vitro cultures using techniques like single cell culture, protoplast culture, anther culture, etc.**(BL3-Apply)** **CO2-** To develop in vitro regenerated and transgenic plantlets using various tools and techniques of plant tissue culture.**(BL4-Analyze)** **CO3-** To understand and develop new varieties of genetically modified crops in order to increase the production **(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG13(Climate action) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Laboratory design and set up of plant tissue culture unit.	Experiments	BL2-Understand	2
X	Preparation of atificial seeds to overcome seed dormancy	PBL	BL6-Create	5
III	Sterilization of media and apparatus	Experiments	BL3-Apply	3
IV	Surface sterilization, sealing of culture, sources of contamination and their check measures.	Experiments	BL3-Apply	3
V	Callus induction, propagation and differentiation.	Experiments	BL4-Analyze	5
VI	Suspension culture	Experiments	BL4-Analyze	3
VII	Micrografting studies.	Experiments	BL5-Evaluate	3
VIII	Acclimatization of a in vitro raised plantlets	Experiments	BL6-Create	5

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	40				
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	Smith.R; Plant Tissue Culture: Techniques and Experiments. Academic Press, 2012 Singh B.D. Plant Biotechnology, Kalyani Publishers, 2014.
Articles	https://www.mdpi.com/2223-7747/9/12/1733 https://www.nature.com/articles/nbt1100_1151
References Books	H.S. Chawla;An Introduction to Plant Biotechnology Kole, C., Michler, C., Abbott, A.G., Hall, T.C. (Eds.) Transgenic Crop Plants: Volume 2:Utilization and Biosafety. Springer. 2010 Kole, C., Michler, C., Abbott, A.G., Hall, T.C. (Eds.) Transgenic Crop Plants: Volume 1:Principles and Development. Springer. 2010
MOOC Courses	https://nptel.ac.in/courses/102103016
Videos	https://nptel.ac.in/courses/102103016

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	1	1	-	-	-	-	-	-	3	2	2
CO2	2	2	1	1	2	2	11	-	-	-	-	1	1	3	2
CO3	1	1	1	2	3	-	-	-	-	-	-	-	1	1	2
CO4	-	-	-	-	`	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	Lab Course-VI
Course Code	BT307(P)

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					0	0	3	3
Course Type	Lab only							
Course Category	Disciplinary Major							
Pre-Requisite/s	The Bioprocess Engineering is designed to provide understanding of basic concepts of production techniques, their designing, applications, and perfectly blend with concepts of upstream and downstream process.			**Co-Requisite/s**	The student should have basic knowledge of design of experiments and the production of useful metabolites			
Course Outcomes & Bloom's Level	**CO1-** The course aims to provide basis of analyzing the applications of Bioprocess Engineering in various fields of research and industries.**(BL3-Apply)** **CO2-** The course aims to provide basis of design, production and purification of bioproducts produced through research and in industries**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Isolation of industrially important microbes from the environment.	Experiments	BL3-Apply	3
2	Isolation of Industrially important microorganisms for microbial processes.	Experiments	BL3-Apply	3
3	Microbial production of alcohol using grape juice	Experiments	BL3-Apply	3
4	Microbial production of alcohol using orange juice	Experiments	BL3-Apply	3
5	Microbial production of alcohol using pineapple juice	Experiments	BL3-Apply	3
6	Microbial production of acetic acid	Experiments	BL3-Apply	3
7	Microbial production of alcohol using molasses	Experiments	BL3-Apply	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	50				
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	0	40	20	60	30

Part E

Books	Experiments in Microbiology, biotechnology, food microbiology, K. R. Aneja
Articles	https://www.researchgate.net/topic/Bioprocess-Engineering
References Books	Bioprocess Engg. Principles, P.M. Doran, Elsevier.
MOOC Courses	https://nptel.ac.in/courses/102106022
Videos	https://nptel.ac.in/courses/102106022

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	-	-	-	1	2	-	-	-	-	-
CO2	1	1	-	-	-	-	-	-	1	1	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	Research Project
Course Code	BT401

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					0	0	14	14
Course Type	Project							
Course Category	Projects and Internship							
Pre-Requisite/s	Student must have basic knowledge of biotechnological laboratory skills			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To provide students with the fundamental tools and practical skills required to generate competent and highly qualified post graduates. **(BL2-Understand)** **CO2-** To acquaint the students with the principles of biosafety and ethical perspectives of biotechnological systems.**(BL2-Understand)** **CO3-** To develop students' ability to apply knowledge and skills to solve theoretical and practical problems in biology and biotechnology.**(BL5-Evaluate)** **CO4-** To provide students with the basis for the life-long self-learning in an attempt to keep up with the continuous quick changes in the field of biotechnology. **(BL3-Apply)** **CO5-** To equip students with the necessary critical theoretical background, develop the analytical, and basic research skills that will help students to pursue higher education in reputed institutes at both national and international levels**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG8(Decent work and economic growth)				

Part B

Modules	Contents	Pedagogy	Hours

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	100				
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
200	0	200	100		

Part E

Books	
Articles	
References Books	
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	1	1	-	1	-	-	-	-	-	-	2	2
CO2	1	1	2	1	2	2	1	-	-	-	-	-	2	3	1
CO3	1	2	2	2	2	2	2	-	-	-	-	-	1	2	2
CO4	1	2	1	1	2	2	2	-	-	-	-	-	1	1	1
CO5	3	-	1	1	-	-	2	-	-	-	-	-	1	3	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_Biotechnology

Title of the Course	Research Report and Presentation
Course Code	BT402

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					0	0	4	4
Course Type	Project							
Course Category	Projects and Internship							
Pre-Requisite/s	Student must have basic knowledge of biotechnological laboratory skills.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Dissertation, Works As Skills Development In Students.**(BL3-Apply)** **CO2-** Increases Their Mental Ability.**(BL4-Analyze)** **CO3-** Express Their Opinion And Thoughts**(BL5-Evaluate)** **CO4-** Enhancing Writing Skills And Knowledge.**(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	50				
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	0	100	50		

Part E

Books	
Articles	
References Books	
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	2	-	-	-	-	-	-	-	-	-	1	-	2
CO2	1	1	1	3	2	-	-	-	-	-	-	-	2	2	3
CO3	2	1	1	2	1	-	1	-	-	-	-	-	2	2	3
CO4	1	1	1	1	2	-	1	-	-	-	-	-	2	1	1
CO5	1	2	3	1	1	-	-	-	-	-	-	-	1	3	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_FoodTechnology

Title of the Course	Sensory Evaluation and Food Waste Management [T]
Course Code	FT-105[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	Completed Bsc/BE in Food Technology/ Food Processing/ Food Engineering			**Co-Requisite/s**	Knowledge of food processing and preservation			
Course Outcomes & Bloom's Level	**CO1-** To analyze the basic concepts of sensory evaluation and requirements of a sensory laboratory. **(BL1-Remember)** **CO2-** To illustrate criteria for selection of sensory panelists, sensory quality parameters and factors affecting sensory measurements. **(BL2-Understand)** **CO3-** To define different sensory tests like discrimination, descriptive, affective; flavor profile and tests; ranking tests, detection, threshold and dilution tests. **(BL3-Apply)** **CO4-** Summarizes by-product utilization of different fruits such as apple, grape, papaya, orange, citrus, mango. **(BL4-Analyze)** **CO5-** The course will provide an understanding about nutritional quality of foods and its assessments like Digestibility, Biological value, NPU, PER, etc. **(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG6(Clean water and sanitation)				

Part B

Modules	Contents	Pedagogy	Hours
I	Introduction to sensory analysis, general testing conditions, Requirements of sensory laboratory; organizing sensory evaluation programmers.	Audio/Video clips, group discussion, lecture with ppt, quiz	09
II	Selection of sensory panelists; Factors influencing sensory measurements; Sensory quality parameters -Size and shape, texture, aroma, taste, color and Gloss	Audio/Video clips, group discussion, lecture with ppt, Review Analysis	10
III	Different tests for sensory evaluation– discrimination, descriptive, affective; Flavor profile and tests; Ranking tests, Detection, threshold and dilution tests.	Audio/Video clips, group discussion, lecture with ppt, classroom presentations	10
IV	By Product utilization of different fruits such as apple, grape, papaya, orange, citrus, mango.	Audio/Video clips, group discussion, lecture with ppt, quiz	10
V	Nutritional Quality of foods and its assessments: Food proteins (Digestibility, Biological value, NPU, PER)	Audio/Video clips, group discussion, lecture with ppt, quiz	09

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	Ramaswamy, H. S., & Marcotte, M. (2005, August 23). Food Processing. CRC Press.
Articles	
References Books	Lal, G., Siddappa, G. S., & Tandon, G. L. (1986, January 1). Preservation of Fruits and Vegetables Fortin, N. D. (2016, October 25). Food Regulation. John Wiley & Sons.
MOOC Courses	https://nptel.ac.in/courses/126105336
Videos	https://youtu.be/k1a2PSEXahM

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	1	-	1	-	-	3	1	2
CO2	3	2	2	2	1	-	-	1	1	1	1	-	3	1	2
CO3	3	3	2	2	2	1	1	2	2	1	-	-	3	1	2
CO4	3	2	2	2	2	2	1	2	2	1	-	-	3	2	2
CO5	3	3	3	2	2	1	1	2	1	1	1	-	3	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_FoodTechnology

Title of the Course	lab Course-I
Course Code	FT-106 [P]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					0	0	3	3
Course Type	Lab only							
Course Category	Discipline Core							
Pre-Requisite/s	The candidate must hold a B.Sc degree in Food Technology, B.Sc. Biology, B.Sc. Bio-Chemistry or equivalent. The minimum percentage in the qualifying examination should be 50%			**Co-Requisite/s**	Student should have theoretical knowledge about food processing and food chemistry			
Course Outcomes & Bloom's Level	**CO1-** To recognize the importance and different ways of food preservation**(BL1-Remember)** **CO2-** To describe the composition of food and interaction of different food components with each other during processing and storage. **(BL2-Understand)** **CO3-** To estimate the effect of different processing on nutritional value of food and other components. **(BL3-Apply)** **CO4-** To apply the processing methods in real life to preserve food for longer term.**(BL4-Analyze)** **CO5-** To evaluate the spoilage in foods, its critical analysis and prevention strategies**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG12(Responsible consuption and production)				

Part B

Modules	Contents	Pedagogy	Hours

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Examination of the enzymatic browning in fruits and vegetables.	Experiments	BL2-Understand	3
2	Determination of Total Soluble Solids (TSS), pH, and titratable acidity in given Samples	Experiments	BL4-Analyze	3
3	Examination of the catalase and peroxidase activity in fresh and blanched samples.	Experiments	BL4-Analyze	3
4	Study the effect of blanching on vitamin C content in given food sample	Experiments	BL3-Apply	3
5	Study the effect of nitrites on meat colour	Experiments	BL3-Apply	3
6	Estimation of sodium Benzoate in Food sample	Experiments	BL5-Evaluate	3
7	Determining proximate composition of given food sample	Experiments	BL5-Evaluate	3
8	Determination of vitamin C from citrus fruits.	Experiments	BL4-Analyze	3
9	Examination of oxidative rancidity (PV value) of fats	Experiments	BL4-Analyze	3
10	Determination of saponification value from edible fats and oils.	Experiments	BL5-Evaluate	3
11	Determination of antioxidant activity of given food samples.	Experiments	BL5-Evaluate	3
12	Determination of diastase enzyme activity in honey	Experiments	BL5-Evaluate	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	
Articles	
References Books	Food Science-Potter NN and Hotchkiss Food Dehydration-Arsdel WB, Copley MJ andMorgan Food Processing Technology: Principle and Practice. -Fellows PJ Principles of Food Chemistry-DeMan JM. Food Chemistry-Fenemma
MOOC Courses	https://nptel.ac.in/courses/126105020
Videos	https://youtu.be/h5NpTku5BGc

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3	3	3	3	-	-	-	-	-	-	3	1	1
CO2	2	3	3	2	2	2	-	-	-	-	-	-	3	1	1
CO3	3	2	3	2	3	3	-	-	-	-	-	-	3	1	1
CO4	3	2	3	3	3	3	-	-	-	-	-	-	3	3	3
CO5	3	3	2	3	2	2	-	-	-	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_FoodTechnology

Title of the Course	Lab course-II
Course Code	FT-107 [P]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					0	0	3	3
Course Type	Lab only							
Course Category	Discipline Core							
Pre-Requisite/s	The candidate must hold a B.Sc degree in Food Technology, B.Sc. Biology, B.Sc. Bio-Chemistry or equivalent. The minimum percentage in the qualifying examination should be 50%			**Co-Requisite/s**	Student should have basic theoretical knowledge about sensory evaluation and food microbiology			
Course Outcomes & Bloom's Level	**CO1-** To identify the characteristics of microorganisms grown on different media**(BL1-Remember)** **CO2-** To discover isolation techniques of microbes**(BL2-Understand)** **CO3-** To apply the knowledge gained on utilizing the by-products into various value added products and differentiating products on sensory perception.**(BL3-Apply)** **CO4-** To analyse the food materials using instruments and compare the properties with sensory evaluation.**(BL4-Analyze)** **CO5-** To predict the industrial utilization of different under-utilized by-products and train the panellists for sensory evaluation**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG12(Responsible consuption and production)				

Part B

Modules	Contents	Pedagogy	Hours

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Introduction to Microbiology Laboratory Safety, use of equipment and perform sterilization techniques	Experiments	BL2-Understand	3
2	To prepare culture media (Nutrient broth and agar)	Experiments	BL3-Apply	3
3	To perform different streaking techniques	Experiments	BL3-Apply	3
4	To examine the microbial load of different food samples	Experiments	BL4-Analyze	3
5	To perform simple and Gram's staining	Experiments	BL3-Apply	3
6	Use nine-point hedonic scale for sensory evaluation	Experiments	BL3-Apply	3
7	Dio-trio test for sensory evaluation	Experiments	BL5-Evaluate	3
8	Preparation of dilution sample for sensory evaluation	Experiments	BL4-Analyze	3
9	Threshold test in different food products	Experiments	BL3-Apply	3
10	Estimation of color properties in food sample	Experiments	BL4-Analyze	3
11	Extraction of pigments from fruits and vegetables	Experiments	BL6-Create	3
12	Preparation of value-added products from by-products	Experiments	BL6-Create	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	
Articles	
References Books	Food microbiology-Khetarpaul, N Sensory Science: Theory and Applicatons in Foods. -Lawless HT & Klein BP Microbiology-Maslowitz H. Product Testing and Sensory Evaluation of Foods. -Pelzar, H.J. and Rober, D.
MOOC Courses	https://nptel.ac.in/courses/126105020
Videos	https://youtu.be/h5NpTku5BGc

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	2	1	1	1	-	-	-	-	1	3	1	1
CO2	2	3	2	2	1	2	-	-	-	-	-	1	3	1	1
CO3	3	2	2	3	3	3	-	-	-	-	-	1	3	1	1
CO4	3	3	3	2	2	2	-	-	-	-	-	2	3	3	3
CO5	3	3	3	3	2	2	-	-	-	-	-	2	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_FoodTechnology

Title of the Course	Lab course-III [P]
Course Code	FT-206 [P]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					0	0	3	3
Course Type	Lab only							
Course Category	Discipline Core							
Pre-Requisite/s	The student must hold a B.Sc degree in Food Technology, B.Sc. Biology, B.Sc. Bio-Chemistry or equivalent. The minimum percentage in the qualifying examination should be 50%			**Co-Requisite/s**	Student should have knowledge of fruits and vegetables, cereals and cereal products. Also they should have the theoretical knowledge of various milk and milk products.			
Course Outcomes & Bloom's Level	**CO1-** To identify different preparation techniques of fruits and vegetable products.**(BL1-Remember)** **CO2-** To explain different preservation methods of fruits and vegetable products.**(BL2-Understand)** **CO3-** To explain different preservation methods of cereal and milk products.**(BL3-Apply)** **CO4-** To identify different preparation techniques of cereal and milk products.**(BL4-Analyze)** **CO5-** To measure different levels or macro & micro nutrient in cereal & milk products.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG2(Zero hunger) SDG3(Good health and well-being) SDG4(Quality education) SDG11(Sustainable cities and economies) SDG12(Responsible consuption and production)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to food engineering, Introduction to thermodynamics, fundamentals of heat, Mass transfer in food processing.Energy and material balance, Numerical problems on material balance related to food processing	Lecture methods,Audio/Video clips, group discussion, quiz	10

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	To prepare the dehydrated fruits and vegetables food products.	Experiments	BL3-Apply	3
2	To prepare fruit jam using seasonal fruits	Experiments	BL3-Apply	3
3	To prepare fruit jelly using seasonal fruits	Experiments	BL3-Apply	3
4	To prepare fruit jam using citrus fruits	Experiments	BL3-Apply	3
5	To prepare and evaluate RTS and squash using seasonal fruits	Experiments	BL5-Evaluate	3
6	To prepare papain/guava cheese using seasonal fruits.	Experiments	BL6-Create	3
7	To determine 1000 kernel weight, bulk density, particle density and angle of repose of given cereals, millets and pulses	Experiments	BL4-Analyze	3
8	To determine the gluten content of wheat flour	Experiments	BL4-Analyze	3
9	Preparation of Channa and paneer	Experiments	BL6-Create	3
10	To study the preparation of soy milk	Experiments	BL4-Analyze	3
11	To determine the purity of milk using lactometer	Experiments	BL5-Evaluate	3
12	Detection of adulterants in milk like water, urea, neutralizers, preservatives, sucrose starch	Experiments	BL4-Analyze	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	0

Part E

Books	Potter, N. N., & Hotchkiss, J. H. (2012, December 6). Food Science. Springer Science & Business Media.
Articles	
References Books	Chakrabarty, M. (2003, November 9). Chemistry and Technology of Oils & Fats. Van Arsdel, W. B., & Copley, M. J. (1963, January 1). Food Dehydration.
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	3	2	-	-	-	-	-	2	3	1	1
CO2	3	1	3	2	3	3	1	-	-	1	1	2	3	1	1
CO3	3	2	3	3	3	2	1	-	-	1	1	2	3	1	1
CO4	3	2	2	3	3	2	1	-	-	-	1	2	3	3	3
CO5	3	1	2	2	3	3	-	-	-	-	-	2	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_FoodTechnology

Title of the Course	Lab course- IV [P]
Course Code	FT-207 [P]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Lab only							
Course Category	Discipline Core							
Pre-Requisite/s	The student must hold a B.Sc degree in Food Technology, B.Sc. Biology, B.Sc. Bio-Chemistry or equivalent. The minimum percentage in the qualifying examination should be 50			**Co-Requisite/s**	Student should have theoretical knowledge of meat and meat products and milk products.			
Course Outcomes & Bloom's Level	**CO1-** To analyse physiochemical properties of milk **(BL3-Apply)** **CO2-** To analyse spoilage in milk products**(BL5-Evaluate)** **CO3-** To measure different levels or macro & micro nutrient in cereal & milk products. **(BL2-Understand)** **CO4-** To observe the structure of egg, its properties and quality.**(BL2-Understand)** **CO5-** To summarize the quality parameters of meat and its processing.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**					

Part B

Modules	Contents	Pedagogy	Hours

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Determination of Quality parameters of bottled water	Experiments	BL3-Apply	2
2	To determine protein content in milk	Experiments	BL4-Analyze	2
3	To study the preparation of soy milk	Experiments	BL3-Apply	2
4	To determine the purity of milk using lactometer	Experiments	BL4-Analyze	2
5	Detection of adulterants in milk like water, urea, neutralizers, preservatives, sucrose starch	Experiments	BL4-Analyze	2
6	Preparation of Channa and paneer	Experiments	BL6-Create	2
7	Determination of water holding capacity of meat	Experiments	BL4-Analyze	2
8	Determination of extract release volume (ERV) of meat	Experiments	BL4-Analyze	2
9	To study the effect of curing on the color of meat	Experiments	BL3-Apply	2
10	Preparation of meat emulsion and meat balls	Experiments	BL6-Create	2
11	To visit a related industry	Industrial Visit	BL2-Understand	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	0

Part E

Books	Debnath, M. (2005, January 1). Tools and Techniques of Biotechnology.
Articles	
References Books	
MOOC Courses	https://nptel.ac.in/courses/106101224
Videos	https://youtu.be/1qKsm0A41lM

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	-	-	1	1	1	-	3	1	1
CO2	2	2	1	1	1	-	-	-	-	-	1	-	3	1	1
CO3	2	2	2	2	1	1	1	-	1	-	1	-	3	1	1
CO4	3	2	2	2	1	-	1	1	-	-	2	-	3	3	3
CO5	3	3	2	2	2	2	2	2	1	1	2	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_FoodTechnology

Title of the Course	Research Methodology [T]
Course Code	FT-305 [T]

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Soft skill							
Course Category	Specialization Elective Courses							
Pre-Requisite/s	The student must hold a B.Sc degree in Food Technology, B.Sc. Biology, B.Sc. Bio-Chemistry or equivalent. The minimum percentage in the qualifying examination should be 50%			**Co-Requisite/s**	Student should have basic knowledge of mean, median mode,sampling methods and probability			
Course Outcomes & Bloom's Level	**CO1-** The course prepares the student to understand the basic concepts of ResearchMethodology, its applications in experimental design and future prospects.**(BL1-Remember)** **CO2-** The subject Research Methodology is designed for post graduate students of Biotechnology for describing the basic concepts of each and every division of the subject along with its applications in other fields.**(BL2-Understand)** **CO3-** The course aims to provide experimental basis, and to enable students to acquirea specialized knowledge and understanding of data and its applications in experimental verification.**(BL3-Apply)** **CO4-** The course aims to provide basis of analyzing the applications of Research Methodology in various fields of research and industries.**(BL4-Analyze)** **CO5-** To apply the understanding of statistical tools in evaluation in various samples.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✓ Gender ✕ Human Values ✓ Environment ✕		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Definition of Research, QualitiesofResearcher, Componentsof ResearchProblem,VariousStepsinScientific Research,TypesofResearch;HypothesesResearch Purposes -Research Design -Survey Research -Case Study Research. Research Reports, Introduction to SPSS. Technology transfer: Introduction and procedure.	Lecture methods,Audio/Video clips,group discussion,quiz	12
2	Data Collection: Sources of Data: Primary Data, Secondary Data;Procedure Questionnaire Sampling Merits and Demerits-Experiments-Kinds-Procedure; Control Observation.	Lecture methods,Audio/Video-clips	9
3	Introduction to Statistics Probability Theories Conditional Probability, Point and Interval Estimates of Means and Proportions; Hypothesis Tests, One Sample Test-Two Sample Tests/Chi- Square Test,t-test-Standard deviation.	Lecture methods, Audio/Video-clips,group discussion	10
4	Statistical Applications: Analysis of Variance, Completely Randomized Design, Randomized Complete Block Design, Latin Square Design. Use of computers for preparing and presenting Documents. Standard operating procedure (S.O.P): Introduction and procedure	Lecture methods,Audio/Video-clips,group discussion,quiz	12
5	Research proposal and thesis writing: Purpose of research proposal, Academic/ Project/ Case study proposals, Steps for the preparing proposal and Common mistakes, Methods selecting relevant literature, Structure of Thesis, Steps in thesis writing, Citation and Referencing: Different ways of work citation, Publication in Research journals	Lecture methods,Audio/Video-clips,group discussion,quiz	12

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	Kothari, C. R. (2004, January 1). Research Methodology. New Age International.
Articles	
References Books	Panneerselvam, R. (2014, April 4). RESEARCH METHODOLOGY. PHI Learning Pvt. Ltd. Wilkinson, T. S., & Bhandarkar, P. L. (2003, January 1). Methodology and Techniques of Social Research. Young, P. V. (1956, January 1). Scientific Social Surveys and Research. Englewood Cliffs, N.J. : Prentice-Hall.
MOOC Courses	https://nptel.ac.in/courses/110105091
Videos	https://youtu.be/oXnjR0OtfBI

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	2	-	-	-	-	-	1	3	1	1
CO2	2	2	3	2	1	1	-	-	-	1	-	-	3	1	1
CO3	2	2	2	1	2	2	-	-	-	-	-	-	3	1	1
CO4	1	1	2	2	1	2	-	-	-	-	-	1	3	3	3
CO5	1	3	3	2	3	2	1	-	-	-	1	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_FoodTechnology

Title of the Course	Lab Course-V [P]
Course Code	FT-306 [P]

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					0	0	3	3
Course Type	Lab only							
Course Category	Discipline Core							
Pre-Requisite/s	The candidate must hold a B.Sc degree in Food Technology, B.Sc. Biology, B.Sc. Bio-Chemistry or equivalent. The minimum percentage in the qualifying examination should be 50%			**Co-Requisite/s**	Student should have basic knowledge of food analysis and instrumentation and beverage technology			
Course Outcomes & Bloom's Level	**CO1-** To study the concept of additives being used in beverages**(BL2-Understand)** **CO2-** To evaluate the quality standards comprising of Chemical, Microbial & Sensory Evaluation **(BL5-Evaluate)** **CO3-** To discover different kinds of chromatographic techniques, their principles and applications.**(BL4-Analyze)** **CO4-** To understand about principle and various types of electrophoresis methods, mainly SDS- PAGE and electrophoresis.**(BL2-Understand)** **CO5-** To design different methods to estimate the food constituents like crude fibre, crude fat, calcium content, protein content, etc.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**					

Part B

Modules	Contents	Pedagogy	Hours

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Determination of Quality parameters of bottled water	Experiments	BL4-Analyze	2
2	Brewing perfect French press coffee from roasted coffee beans	Experiments	BL3-Apply	3
3	Preparation of fruit smoothies	Experiments	BL6-Create	3
4	Determination of the caffeine level in stimulating beverages	Experiments	BL4-Analyze	3
5	Preparation of coconut water energy drink	Experiments	BL6-Create	3
6	Preparation of seasonal-fruit based RTS	Experiments	BL6-Create	3
7	Estimation of chlorophyll content in each sample using spectrophotometer	Experiments	BL4-Analyze	3
8	To perform paper chromatography	Experiments	BL3-Apply	3
9	To study HPLC process	Experiments	BL4-Analyze	3
10	Estimation of calcium content in given food sample	Experiments	BL4-Analyze	3
11	Determination of total polyphenolic content in given food samples using Spectrophotometer	Experiments	BL5-Evaluate	3
12	To study the working of FTIR	Experiments	BL3-Apply	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	12	60	0

Part E

Books	Chakrabarty, M. (2003, November 9). Chemistry and Technology of Oils & Fats. Allied Publishers.
Articles	
References Books	De, S. (1991, January 1). Outlines of Dairy Technology. Dendy, D. A. V., & Dobraszczyk, B. J. (2001, January 1). Cereals and Cereal Products. Boom Koninklijke Uitgevers.
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	3	1	1
CO2	-	-	-	-	-	-	-	-	-	-	-	-	3	1	1
CO3	-	-	-	-	-	-	-	-	-	-	-	-	3	1	1
CO4	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3
CO5	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_FoodTechnology

Title of the Course	Lab course-VI [P]
Course Code	FT-307 [P]

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					0	0	3	3
Course Type	Lab only							
Course Category	Discipline Core							
Pre-Requisite/s	The student must hold a B.Sc degree in Food Technology, B.Sc. Biology, B.Sc. Bio-Chemistry or equivalent. The minimum percentage in the qualifying examination should be 50%			**Co-Requisite/s**	The student should have theoretical knowledge of various food packaging materials			
Course Outcomes & Bloom's Level	**CO1-** To understand the manufacturing and characteristics of various packaging materials viz paper, glass, metal, and plastic**(BL2-Understand)** **CO2-** To provide the students a specialized knowledge about packaging equipment and machinery and testing of packaging systems for various types of food**(BL3-Apply)** **CO3-** To demonstrate new packaging systems and safety and legislative requirements**(BL6-Create)** **CO4-** To apply the knowledge gained from specialized techniques in food packaging such as Active, aseptic, controlled & modified atmospheric packaging etc. to create innovative food package systems.**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG12(Responsible consuption and production)				

Part B

Modules	Contents	Pedagogy	Hours

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Identification of different types of packaging and packaging materials	Experiments	BL3-Apply	3
2	To perform different destructive tests for glass containers	Experiments	BL3-Apply	3
3	Measurement of thickness of packaging materials	Experiments	BL4-Analyze	3
4	Determination of water-vapour transmission rate	Experiments	BL4-Analyze	3
5	Testing of chemical resistance of packaging materials	Experiments	BL5-Evaluate	3
6	To perform sterilization of different packaging materials	Experiments	BL3-Apply	3
7	To determine leakage of plastic pouches	Experiments	BL4-Analyze	3
8	To determine the basis weight, density and grammage of paper and paper board	Experiments	BL4-Analyze	3
9	To determine the wax content in given sample of wax paper	Experiments	BL4-Analyze	3
10	Visit to relevant industries	Experiments	BL3-Apply	3

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Hall, G. M. (2012, December 6). Fish Processing Technology. Springer Science & Business Media.
Articles	
References Books	Viets, F. G., Service, U. S. C. A. M., & Hageman, R. H. (1967, January 1). Agriculture Handbook.
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	3	1	1
CO2	-	-	-	-	-	-	-	-	-	-	-	-	3	1	1
CO3	-	-	-	-	-	-	-	-	-	-	-	-	3	1	1
CO4	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3
CO5	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_FoodTechnology

Title of the Course	Research Project [P]
Course Code	FT-401 [P]

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					0	0	18	18
Course Type	Project							
Course Category	Projects and Internship							
Pre-Requisite/s	The student should have knowledge of food science			**Co-Requisite/s**	enable students observe, first hand, work flow and processes in food industries and associated enterprises			
Course Outcomes & Bloom's Level	**CO1-** The student will be able to appreciate different processing and production technologies in various industrial settings**(BL4-Analyze)** **CO2-** The student will be exposed to the diverse setting in food industries **(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG2(Zero hunger) SDG3(Good health and well-being)				

Part B

Modules	Contents	Pedagogy	Hours
1	Selection of industry relevant to food and allied products	Hands-on working experience in the industry/ Internship Report	8
2	Working in department/s within the selected industry	Hands-on working experience in the industry/ Internship Report	8
3	Periodic analysis of data and preparation of report	Hands-on working experience in the industry/ Internship Report	8
4	Final preparation of internship report	Hands-on working experience in the industry/ Internship Report	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
200	0	200	0	0	0

Part E

Books	
Articles	
References Books	
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	3	2	2
CO2	-	-	-	-	-	-	-	-	-	-	-	-	3	2	3
CO3	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3
CO4	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3
CO5	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3

Syllabus-2023-2024

MSc_FoodTechnology

Title of the Course	Research Report and Presentation [P]
Course Code	FT-402 [P]

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					0	0	4	4
Course Type	Project							
Course Category	Projects and Internship							
Pre-Requisite/s	Complete knowledge of all the core discipline subjects of Food Technology			**Co-Requisite/s**	Project presentation/Dissertation			
Course Outcomes & Bloom's Level	**CO1-** dissertation, works as skills development in students.**(BL1-Remember)** **CO2-** increases their mental ability.**(BL2-Understand)** **CO3-** express their opinion and thoughts.**(BL3-Apply)** **CO4-** enhancing writing skills and knowledge.**(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professional Ethics ✕ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**					

Part B

Modules	Contents	Pedagogy	Hours

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	0	100	0	0	0

Part E

Books	
Articles	
References Books	
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	2	2	1
CO2	-	-	-	-	-	-	-	-	-	-	-	-	2	3	2
CO3	-	-	-	-	-	-	-	-	-	-	-	-	3	3	2
CO4	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3
CO5	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-