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_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	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:Agrobacteriun 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	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	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_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	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

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

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	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**(BL5-Evaluate)** **CO6-** Create and design various hardware and software logics to make a computer system like ALU, Memory, Bus, etc.(Design)**(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	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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"CELEBRATING DREAMS"

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	Software Enineering
Course Code	BSCS0601[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 have knowledge about basic data structures , computer organization & programming language concepts.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember the basics of software engineering**(BL1-Remember)** **CO2-** To understand the basics characteristic's & crisis of software and process of software engineering systems**(BL2-Understand)** **CO3-** To implement various SDLC, ER, DFD models, to collect SRS, And understand the software.**(BL3-Apply)** **CO4-** To Analyze various various testing techniques and the concept of testing strategies**(BL4-Analyze)** **CO5-** To evaluate the the need of Software Maintenance and Software Project Management Software **(BL5-Evaluate)** **CO6-** To create the various Design Strategies, Architectural Design concept for better development of software.**(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)				

Part B

Modules	Contents	Pedagogy	Hours
Unit-1	Introduction to Software Engineering: Software, The changing nature of software, product and process, software engineering-a layered technology.	Lecturing	6
Unit-2	Process Models: Software Development Process Model, Waterfall Model, Prototyping Model, Spiral Model, Iterative Model	Case Study	6
Unit-3	Software Project Management: The Management Spectrum, Scheduling and Tracking, SW Measurement - Size, Process and Project Metrics; LOC	Lecturing	6
Unit-4	Software Design: Design Concepts-abstraction, architecture, modularity . Software Quality Assurance: Quality Concepts, Software Quality Assurance, Assurance, Software Reliability, Introduction to ISO standard.	Case Study	6
Unit-5	Software Testing and maintenance: Definition, Types of Testing: Black Box Testing, White Box Testing, Unit Testing, Integration Testing, system testing , Introduction of maintenance.	Case Study	6

Case Study
Software Engineering (402)

1. Analysing the challenges and solutions for software maintenance: Students are required to identify the challenges appeared during software maintenance using various types of information gathering tools and must propose a systematic and feasible maintenance plan with output showing growth with respect to following points
    - User Satisfaction level
    - Software periodic update
    - Software Licence renewable
    - Software upgradability.

2. Perform automated testing and design customized test cases on any project modules. Also report the bugs encountered during testing phase and compute time incurred in rectifying bugs during testing phase. Compare the time involved in rectifying bugs at development phase and at testing phase.
3. You are required to build a Inventory management system for a departmental store, Prepare a logical design as well as use case and system flowcharts for the same.

4. You are required to build a Student information system for a departmental of school of Engineering, Prepare a logical design as well as use case and system flowcharts for the same.
5.
6. Compute the following using any project/modules of your choice
    - Product Metrics
    - Process Metrics
    - Project Metrics
7. Prepare a complete SRS report of a software that is not in existence as well as software that is already is being used but needs to be updated.

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	Pressman, R. S., & Dr, B. R. M. (2014, January 23). Software Engineering: A Practitioner's Approach. McGraw-Hill Education. http://books.google.ie/books?
Articles	
References Books	Pressman, R. S., & Dr, B. R. M. (2014, January 23). Software Engineering: A Practitioner's Approach. McGraw-Hill Education. http://books.google.ie/books?
MOOC Courses	
Videos	https://onlinecourses.nptel.ac.in/noc20_cs68/preview

Course Articulation Matrix

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

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_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	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	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

M

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	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

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	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_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	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	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	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	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:Agrobacteriun 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_PCM

Title of the Course	Thermodynamics and Kinetic Theory of Gases
Course Code	BSPH0201[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	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 Thermodynamics and Kinetic theory of Gases**(BL1-Remember)** **CO2-** Understand the basic concepts of Thermodynamics and Kinetic theory of Gases**(BL2-Understand)** **CO3-** To apply the concepts of Thermodynamics and Kinetic theory of Gases to different system**(BL3-Apply)** **CO4-** To Analyze the laws of Thermodynamics and Kinetic theory of Gases **(BL4-Analyze)** **CO5-** To evaluate the laws of thermodynamics and Kinetic theory of Gases**(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	First Law of Thermodynamics and Heat engines Basic Concepts of Thermodynamics Reversible and irreversible process, First Law of Thermodynamics Heat engines, Definition of efficiency, Steam engine, Otto engine, Petrol engine, Diesel engine, Effective way to increase efficiency Carnot's ideal heat engine, Carnot's cycle, Second law of thermodynamics, Various statements of Second law of thermodynamics, Carnot's theorem Refrigerator, Coefficient of performance.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
2	Entropy & II law of thermodynamics Concept of entropy, Change in entropy in adiabatic process, Change in entropy in reversible Cycle Principle of increase of entropy, Change in entropy in irreversible process .T-S diagram, Physical significance of Entropy, Entropy of a perfect gas	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
3	Thermodynamic Potentials and Maxwell Relations Thermodynamic Potentials and Maxwell Relations and its applications like Clausius-Clapeyron equation, CP – CV , CP / CV Change in temperature in adiabatic change, TdS equations	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
4	Production of Low Temperatures Introduction, Traditional methods of cooling, Adiabatic cooling, Joule□Thomson effect, Adiabatic demagnetization, Practical uses and applications of low temperatures.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
5	Kinetic Theory of Gases Behavior of real gas and its deviation from an ideal gas, viral equation, Andrew's experiment on CO2 gas. Critical constants, continuity of the liquid and gaseous states. Vapour and gas state Boyal Temperature, Van der Waals equation for real gas, Values of critical constant, Law of corresponding state.	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 determine the Specific heat capacity of a given substance with help of electric kettle.	Experiments	BL2-Understand	3
2	To study of different thermocouples and Plot a graph between thermo EMF and temperature of hot junction.	Experiments	BL4-Analyze	3
3	To determine the mechanical equivalent of (J) with the help of Joule's calorimeter	Experiments	BL2-Understand	3
4	To verify Newton's law of cooling	Experiments	BL2-Understand	3
5	To Find the Melting Point of a given substance (Wax), Using Platinum Resistance Thermometer.	Experiments	BL2-Understand	3
6	Determine the Melting Point of Paraffin wax using thermocouples.	Experiments	BL2-Understand	3
7	To determine the Brake power of a Disel Engine	Experiments	BL2-Understand	3
8	To determine the specific fuel consumption. of a Disel Engine	Experiments	BL2-Understand	3
9	To determine the mechanical efficiency of Disel Engine	Experiments	BL2-Understand	3
10	To calculate the C. O. P. of Ice Plant.	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	Thermal Physics by Garg, Bansal and Ghosh
Articles	
References Books	Thermodynamics, Kinetic theory of gases 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_ComputerScience

Title of the Course	Thermodynamics and Kinetic Theory of Gases
Course Code	BSPH0201[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	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 Thermodynamics and Kinetic theory of Gases**(BL1-Remember)** **CO2-** Understand the basic concepts of Thermodynamics and Kinetic theory of Gases**(BL2-Understand)** **CO3-** To apply the concepts of Thermodynamics and Kinetic theory of Gases to different system**(BL3-Apply)** **CO4-** To Analyze the laws of Thermodynamics and Kinetic theory of Gases **(BL4-Analyze)** **CO5-** To evaluate the laws of thermodynamics and Kinetic theory of Gases**(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	First Law of Thermodynamics and Heat engines Basic Concepts of Thermodynamics Reversible and irreversible process, First Law of Thermodynamics Heat engines, Definition of efficiency, Steam engine, Otto engine, Petrol engine, Diesel engine, Effective way to increase efficiency Carnot's ideal heat engine, Carnot's cycle, Second law of thermodynamics, Various statements of Second law of thermodynamics, Carnot's theorem Refrigerator, Coefficient of performance.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
2	Entropy & II law of thermodynamics Concept of entropy, Change in entropy in adiabatic process, Change in entropy in reversible Cycle Principle of increase of entropy, Change in entropy in irreversible process .T-S diagram, Physical significance of Entropy, Entropy of a perfect gas	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
3	Thermodynamic Potentials and Maxwell Relations Thermodynamic Potentials and Maxwell Relations and its applications like Clausius-Clapeyron equation, CP – CV , CP / CV Change in temperature in adiabatic change, TdS equations	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
4	Production of Low Temperatures Introduction, Traditional methods of cooling, Adiabatic cooling, Joule□Thomson effect, Adiabatic demagnetization, Practical uses and applications of low temperatures.	Audio/Video clips, group discussion, lecture with ppt, on white board, quiz	8
5	Kinetic Theory of Gases Behavior of real gas and its deviation from an ideal gas, viral equation, Andrew's experiment on CO2 gas. Critical constants, continuity of the liquid and gaseous states. Vapour and gas state Boyal Temperature, Van der Waals equation for real gas, Values of critical constant, Law of corresponding state.	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 determine the Specific heat capacity of a given substance with help of electric kettle.	Experiments	BL2-Understand	3
2	To study of different thermocouples and Plot a graph between thermo EMF and temperature of hot junction.	Experiments	BL4-Analyze	3
3	To determine the mechanical equivalent of (J) with the help of Joule's calorimeter	Experiments	BL2-Understand	3
4	To verify Newton's law of cooling	Experiments	BL2-Understand	3
5	To Find the Melting Point of a given substance (Wax), Using Platinum Resistance Thermometer.	Experiments	BL2-Understand	3
6	Determine the Melting Point of Paraffin wax using thermocouples.	Experiments	BL2-Understand	3
7	To determine the Brake power of a Disel Engine	Experiments	BL2-Understand	3
8	To determine the specific fuel consumption. of a Disel Engine	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	Thermal Physics by Garg, Bansal and Ghosh
Articles	
References Books	Thermodynamics, Kinetic theory of gases 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_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]

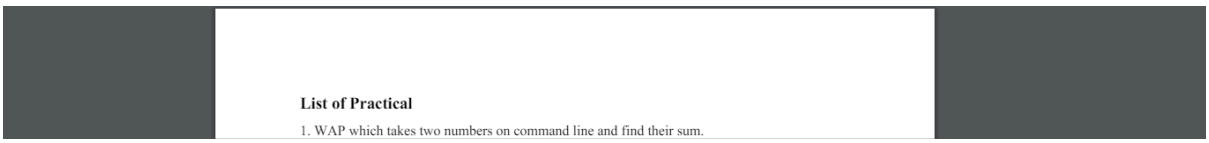
Part A

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_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_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_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_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	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	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 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	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	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_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_FoodTechnology

Title of the Course	Food and Business Management
Course Code	GE-III

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Generic Elective							
Pre-Requisite/s	candidates must have studied food processing & preservation and food additives in previous semester			**Co-Requisite/s**	Knowledge of food processing sector, food industry layout and food preservation			
Course Outcomes & Bloom's Level	**CO1-** To remember the managerial roles, management processes and types of organizations in the food businesses. **(BL1-Remember)** **CO2-** To understand the fundamentals of marketing, its research, consumer behaviour and advertising to apply them to promote the business.**(BL2-Understand)** **CO3-** To provide the students a specialized knowledge and understanding about manpower management, government schemes, and business ethics. **(BL3-Apply)** **CO4-** To apply the subject knowledge in future perspectives i.e. such as fulfilling corporate social responsibility and to formulate new business proposals.**(BL4-Analyze)** **CO5-** To evaluate the theoretical knowledge and implement the same to increase the profit of food business.**(BL5-Evaluate)**						
Coures Elements	Skill Development ✕ Entrepreneurship ✓ Employability ✓ Professional Ethics ✓ Gender ✕ Human Values ✕ Environment ✕		**SDG (Goals)**	SDG1(No poverty) SDG2(Zero hunger) SDG12(Responsible consuption and production)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to Food Business Management- Definitions, importance and principles; Theories and functions of management; Organizational structures, principles and types	Lecture, discussion, ppt	7
2	Food Products Marketing - Concept of market structure, micro and macro environments; Marketing research and marketing information systems. Consumer behaviour; consumerism; classification of food products and factors affecting prices, product life cycle; Advertising- functions, objectives, personal selling, sales promotion, publicity and public relations, product promotion strategies	Lecture, discussion, ppt	10
3	Human resource management: Definitions, objectives of manpower planning, process, sources of recruitment, process of selection; types of promotions and transfers; wage and salary administration and employee welfare; Corporate social responsibility: Importance, business ethics	Quiz, lecture, discussion	9
4	Finance management: Definition, scope, and objective; Different systems of accounting; Cost: Short run and long run cost, fixed cost, variable cost, total cost, average cost, marginal cost, opportunity cost in food industry and break even analysis; Budgeting and profit planning -types of budget and their preparations	Audio/Video clips, group discussion, lecture with ppt, quiz	10
5	Government regulations/ guidelines for food business, Foreign investment policies – FDI in food processing, Preparation of Business Proposals, Case studies on project formulation in various types of food industries - their production, marketing and cost analysis	Audio/Video clips, group discussion, lecture with ppt, quiz	9

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	Food and Beverage Management by Bernard Davis, Andrew Lockwood, Peter Alcott, Ioannis and S. Pantelidis
Articles	
References Books	Principles of Management by Gupta Meenakshi Managing by Mintzberg, H. Financial Management: Theory and Practice by Eugene F. Brigham and, Michael C. Ehrhardt
MOOC Courses	https://nptel.ac.in/courses/110101167
Videos	https://youtu.be/YUVybfnKA9I

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	3	3	3
CO2	2	1	1	1	1	-	-	3	-	2	-	3	3	3	3
CO3	2	1	1	1	1	-	-	3	-	2	-	3	3	3	3
CO4	2	1	1	1	1	-	-	2	-	2	-	3	3	3	3
CO5	2	1	1	1	1	-	-	2	-	2	-	3	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BSc_FoodTechnology

Title of the Course	Entrepreneurship Development [T]
Course Code	GE-IV [T]

Part A

Year	2nd	**Semester**	4th	**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-** 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_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	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-** 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)**	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	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-** 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)**							
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
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	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-** 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)**	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_FoodTechnology

Title of the Course	Food Supply chain Management [T]
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	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-** 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)**					

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	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_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-** 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)**	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	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-** 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)**	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_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-** 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)**	SDG1(No poverty) SDG2(Zero hunger) SDG3(Good health and well-being) SDG6(Clean water and sanitation)				

Part B

Modules	Contents	Pedagogy	Hours

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_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-** 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)**	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

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	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	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	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	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_FoodTechnology

Title of the Course	Food Additives [T]
Course Code	FT-103[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	BSc degree in Food Technology, Food Science, Food Engineering, Food Chemistry, Biotechnology, Microbiology, Biochemistry, or any other related field with a minimum of 50% marks.			**Co-Requisite/s**	Students must have basic knowledge of preservatives, chemical compounds and adultrants.			
Course Outcomes & Bloom's Level	**CO1-** The students will be able to comprehend about importance, classification and functions of additives like preservatives, acid, base, salts, chelating/sequestering agents, non-nutritive sweetness, emulsifier, stabilizer, thickeners, antioxidants, anticaking agents, firming agents, bulking agents, flour bleaching agents, bread improves and antimicrobial agents, humectants, acidulates, leavening agents in maintaining or improving food quality.**(BL1-Remember)** **CO2-** To give insight to various terminology such as isolation, functional properties and applications of proteins, starches and lipids as functional ingredients.**(BL2-Understand)** **CO3-** The students will be able to demonstrate the types and stability of flavours during food processing. They will also know about flavor emulsions, essential oils and oleoresins. **(BL3-Apply)** **CO4-** The course will illustrate the types and recommended doses of coloring agents.**(BL4-Analyze)** **CO5-** The course will describe the e-codes and uses and function of food additives in different food formulations.**(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 of food additives, classification and functions, preservatives, acid, base, salts, chelating/sequestering agents, nonnutritive sweetness, antioxidants, anticaking agents, firming agents, bulking agents, flour bleaching agents, bread improves and antimicrobialagents, humectants, acidulates, leavening agents.	Audio/Video clips, group discussion, lecture with ppt, quiz	12
2	Protein, starches and lipids as functional ingredients, isolation, functional properties and application in different food (modified starch), manufacturing and applications of fibers from food sources.	Audio/Video clips, group discussion, lecture with ppt, Review Analysis	12
3	Flavor technology-types of flavor, stability of flavors during food processing extraction and analysis techniques of flavor, flavor emulsions, essential oils andoleoresin.	Audio/Video clips, group discussion, lecture with ppt, classroom presentations	12
4	Coloring agents. Types, recommended doses of color. Sweeteners: Introduction, types, properties and uses of saccharin, acesulfame-K, aspartame, HFCS, invert sugar, and sugar alcohols (polyols) as sweeteners in food products	Audio/Video clips, group discussion, lecture with ppt, quiz	10
5	Emulsifiers: Introduction, types, selection of emulsifiers, emulsion stability, and mechanism of action. Thickeners and hydrocolloids: Introduction and types E-codes, CAS system. Uses and function of food additives in food formulations (different products).	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**

Part E

Books	
Articles	
References Books	Food Additives by BranenAL,DavidsonPMandSalminen S Encyclopedia of Food and Color Additives by Gerorge AB Fenaroli's Handbook of Flavor Ingredients by Gerorge AB Food Flavors by Morton IDandMacleod AJ Food Proteins by NakaiS andModlerHW
MOOC Courses	https://nptel.ac.in/courses/126105027
Videos	https://youtu.be/Dm3yP7FF4nI

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	1	1	2	2	2	-	-	-	-	-	-	3	1	1
CO3	3	1	1	3	2	2	-	-	-	-	-	-	3	1	1
CO4	3	2	1	1	2	2	-	-	-	-	-	2	3	3	3
CO5	3	1	2	2	1	1	-	-	-	-	-	2	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_FoodTechnology

Title of the Course	Beverage Technology [T]
Course Code	FT-301 [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 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**	Students should have basic knowledge about beverages, their composition, total soluble solids, etc.			
Course Outcomes & Bloom's Level	**CO1-** Comprehend the principles and methods involved in the processing of foods and discuss the food preservation by heating**(BL1-Remember)** **CO2-** To describe about irradiation, microwave processing and Ohmic heating as food processing techniques. **(BL2-Understand)** **CO3-** To illustrate different freezing techniques, advantages and mechanism of freezing in addition to its effect on food quality. **(BL3-Apply)** **CO4-** Interpret the use of natural as well as chemical and bio- based preservatives to increase the shelf life of food.**(BL4-Analyze)** **CO5-** Recognize different drying methods, different dryers used in food processing and drying mechanisms including sorption isotherm**(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	Water for beverages: Types of water required for beverages, treatment of water. Type of beverages: fruit & vegetable juices, fermented and non-fermented beverages, synthetic beverages, carbonated and non-carbonated beverages. Tea, Coffee and Cocoa: Production, composition, processing and preparation.	Lecture methods, Audio/Video clips, group discussion, quiz	9
2	Fruit and Vegetable Beverages: Juice extraction, clarification, preservation, packaging, concentration and drying. Various beverages from fruit juices, their preparation and preservation.	Lecture methods, Audio/Video clips, group discussion, classroom presentations	10
3	Non-carbonated and carbonated synthetic beverages: Ingredients, source of carbon dioxide, chemical and physical properties of carbon dioxide, carbonating process, packaging of carbonating beverages.	Lecture methods, Audio/Video clips, group discussion , classroom presentations	9
4	Alcoholic Beverages: Non-DistilledBeverages: Beer and Wine. Distilled Beverages: Vodka, Rum, Gin, Whisky, Arack, Toddy, Brandy	Lecture methods, Audio/Video clips, group discussion, quiz	10
5	Additives for beverages: Natural and synthetic sweeteners and colours, acids, emulsifiers, preservatives, flavoursand flavour enhancers. Quality control of beverage: Quality standards for beverages, chemical, microbial and sensory evaluation, product shelf life	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**

Part E

Books	
Articles	https://link.springer.com/article/10.1007/s13197-022-05439-8
References Books	Food Science -Potter NN and Hotchkiss Food Facts and Principles -Shakuntala Manay Beverages: Processing and Technology-Deepak Mudgil, Sheweta Barak Beverages: Technology, Chemistry and Microbiology-A. Varnam, J.M. Sutherland Fruit and Vegetable Preservation- Principles and Practices. International Book Distributors-Srivastava RP and Kumar S.
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	3	3	3	1	1	-	-	-	-	1	3	1	1
CO2	3	3	2	2	3	2	-	-	-	-	-	-	3	1	1
CO3	3	2	2	2	1	1	1	-	-	-	1	-	3	1	1
CO4	3	3	3	2	2	2	-	-	-	-	-	2	3	3	3
CO5	2	3	3	2	2	3	1	-	-	-	-	2	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

MSc_FoodTechnology

Title of the Course	Food analysis and Instrumentation [T]
Course Code	FT-302 [T]

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Discipline Electives							
Pre-Requisite/s	Students should have a bachelor's degree in Food Technology or in any science stream. They should have received at least a 50% marks in their graduation degree.			**Co-Requisite/s**	Students should have basic knowledge regarding various analytical techniques like chromatography, Spectroscopy and principles of these methods.			
Course Outcomes & Bloom's Level	**CO1-** To discover different kinds of chromatographic techniques, theirprinciples and applications. Main focus is to discuss the use of advanced chromatographic techniques in food analysis.**(BL1-Remember)** **CO2-** To insight about principle and various types of electrophoresis methods ,mainly SDS- PAGE and capillary electrophoresis.**(BL2-Understand)** **CO3-** To comprehend Principle, types and applications of centrifugation will be introduced to students. The course willalso cover principle and applications of ultra-centrifugation in food industry.**(BL3-Apply)** **CO4-** To describe the principle of spectrophotometry, working of a spectrophotometer and itsand different types of spectrophotometric techniques like UV, Visible, IR and fluorescenc espectroscopy, AAS, Polarimetry and Refractometry**(BL4-Analyze)** **CO5-** To illustrate different methods to estimate the food constituents like carbohydrates,proteins, minerals, vitamins, and lipids.**(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) SDG12(Responsible consuption and production)				

Part B

Modules	Contents	Pedagogy	Hours
1	Chromatographic technique: principle and application of adsorption, column, partition and affinity chromatography, Size exclusion chromatography and Ion exchange chromatography, Advance chromatographic techniques.	Lecture methods,Group discussion,	12
2	Electrophoresis: Introduction, principle and types of electrophoresis, PAGE, Capillary electrophoresis, SDS- PAGE, Isoelectric focusing and Isotachophoresis.	Lecture methods,Audio/Video clips,	10
3	Centrifugation: Principle, RPM, RCF, rotor types,and applications of centrifugation in food processing, Ultra centrifugation and their types, applications in food industry	Lecture methods, classroom presentations	9
4	Spectroscopic techniques: Lamberts-Beer law, Colorimetry, Principle and application of UV, Visible, IR and fluorescence spectroscopy, AAS, FTIR, Polorimetry and Refrectrometry.	Lecture methods,Audio/Video clips, quiz	12
5	Sampling methods, sample preparation,Determination of Carbohydrates – sugars, fibre, starch; Lipid – free fatty acids and fats, Proteins – amino acids and soluble and insoluble proteins, Vitamins andMinerals from food products, Measurement of color, flavor, taste and texture using sophisticated instruments	Lecture methods,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	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	Kirk, R. S., & Sawyer, R. (1991, January 1). Pearson's Composition and Analysis of Foods. Addison-Wesley Longman Limited.
Articles	https://www.tandfonline.com/doi/pdf/10.1080/20014091091878
References Books	Debnath, M. (2005, January 1). Tools and Techniques of Biotechnology. Nielsen, S. (2003, April 30). Food Analysis. Springer Science & Business Media.
MOOC Courses	https://nptel.ac.in/courses/106101224
Videos	https://youtu.be/1qKsm0A41IM?si=J-I_zLmqPhxlnmkf

Course Articulation Matrix

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