



Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

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

Part A

Year	1st	Semester	1st	Credits	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Foundation core							
Pre-Requisite/s	Student should know the interpersonal skills and be an effective goal-oriented team player.			Co-Requisite/s	Communicative skills, workshop, Leadership development etc.			
Course Outcomes & Bloom's Level	CO1- Determine interpersonal skills and be an effective goal-oriented team player.(BL1-Remember) CO2- Elaborate creativity and lateral thinking.(BL2-Understand) CO3- to evaluate themselves by giving oral presentations and will receive feedback on their performances.(BL3-Apply) CO4- Paraphrase text(s) and use appropriate referencing styles(BL4-Analyze) CO5- Design and present/publish technical documents(BL5-Evaluate)							
Courses Elements	Skill Development ✓ Entrepreneurship ✗ Employability ✗ Professional Ethics ✗ Gender ✗ Human Values ✗ Environment ✗		SDG (Goals)	SDG4(Quality education) SDG5(Gender equality)				

Part B

Modules	Contents	Pedagogy	Hours
Module 1	Introduction to Communication Definition, Process, Principles and Types • Forms & Grapevine Barriers & Noise	Classroom Lecture, Story telling, role play, group discussions	4
Module 2	Language Know-how Common Errors Learning through examples Functional Grammar & Contemporary usage	Classroom Lecture, Story telling, role play, group discussions	6
Module 3	Paragraph Development Techniques Principles & Methods Instruments for Cohesive Writing Creating Mind Maps/Infographic	Classroom Lecture, Story telling, role play, group discussions	8
Module 4	Writing skills Introduction to writing skills. Tone, Orientation, Attitude, Formal vs Informal, general writing, technical writing Letter/ Application/e-mail, Format, and content Indian isms in Email Writing Writing for the Web: Do's & Don'ts of Email Writing, Netiquette	Classroom Lecture, Story telling, role play, group discussions	6
Module 5	Resume Writing - Concept, types, and Application Curriculum Vitae: difference between Resume and CV Interview Skills Group Discussion and Debate	Classroom Lecture, Story telling, role play, group discussions	6

Part D(Marks Distribution)

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

Part E

Books	Prasad, V., "Advanced Communication Skills", Atma Ram Publications, New Delhi
Articles	https://www.jetir.org/papers/JETIR2108373.pdf https://open.lib.umn.edu/communication/chapter/1-2-the-communication-process/ https://www.iosrjournals.org/iosr-jbm/papers/Vol22-issue8/Series-2/E2208024254.pdf
References Books	Madhukar, R., K, "Business Communication", Vikas Publishing House Pvt. Ltd.
MOOC Courses	https://nptel.ac.in/courses/109103020
Videos	https://nptel.ac.in/courses/109103020

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	Animal Diversity
Course Code	BSBT GE I [T]

Part A

Year	1st	Semester	1st	Credits	L	T	P	C	
					3	0	1	4	
Course Type	Embedded theory and lab								
Course Category	Generic Elective								
Pre-Requisite/s	Based on Animal Diversity classification taxonomy so create basic knowledge of animal identification and classification.			Co-Requisite/s	Create basic platform to all other animal based subject/course.				
Course Outcomes & Bloom's Level	<p>CO1- To describe general taxonomic rules on animal classification(BL1-Remember)</p> <p>CO2- To understand the taxonomy of invertebrates and vertebrates animals, their affinities and their association with evolution and phylogeny.(BL1-Remember)</p> <p>CO3- To understand the importance of kingdom Animalia and its applications(BL3-Apply)</p> <p>CO4- To provide experimental basis, and to enable students to basic concept of classification and animal identification(BL4-Analyze)</p> <p>CO5- To evaluate the applications of taxonomy in various fields such as research and development.(BL5-Evaluate)</p> <p>CO6- To apply the understanding of animal diversity in identification of animals and their phylogeny in organic evolution(BL6-Create)</p>								
Coures Elements	Skill Development ✗ Entrepreneurship ✗ Employability ✓ Professional Ethics ✗ Gender ✗ Human Values ✗ Environment ✗		SDG (Goals)	SDG4(Quality education) SDG15(Life on land)					

Part B

Modules	Contents	Pedagogy	Hours
1	<p>Basic principles and concepts of Taxonomy. Binomial and Trinomial nomenclature, Origin of Invertebrates and vertebrates</p> <p>Characteristics & classification of non-chordates phylum's up to sub-classes according to Parker and Haswell with suitable examples.</p> <p>Chordata: Classification of Phylum up to sub-classes according to Parker and Haswell with suitable examples.</p> <p>Dynamic Programming in Computational Zoology applications</p>	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	<p>Phylum –Protozoa: Brief description with example, Type study of paramecium and plasmodium, Protozoa and human diseases,</p> <p>Phylum –Porifera: Brief description with example, type study of Sycon, Canal system in poriferanes, corals and their importance</p> <p>Phylum –Coelentarata: type study of Obelia, Metagenesis</p>	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	<p>Phylum -Platyhelminthes: Type study of Taenia solium, Helminthic diseases</p> <p>Phylum -Nematehelminthes: Type study of Ascaris,</p> <p>Phylum -Annelida: Type study of Neries, Economic importance of annelids</p> <p>Phylum -Arthropoda: Type study of Prawn, Economic importance of insects, social insects & their life cycle</p>	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	<p>Phylum – Mollusca: Type study of Pila.</p> <p>Phylum – Echinodermata: External Features of star fish, and different larval stages of Echinodermata.</p> <p>Sub- Phylum- Hemichordate: External features and affinities of Balanoglossus.</p> <p>Sub- Phylum- Cephalochordata- Type study of Amphioxus. Affinities of Amphioxus</p>	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

5	<p>Sub- Phylum- Urochordata- Type study of Herdmania (excluding Development). Super Class- Tetrapoda: Amphibia, Reptelia, Aves, Mammalia: Classification with Suitable Examples</p> <p>Comparison between Petromyzon and Myxine.</p>	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
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Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Spotting: As per theory syllabus via museum specimen of animals	Field work	BL2-Understand	8
2	Study of sponge gemmule via temporary glycerin mount slide	PBL	BL4-Analyze	8
3	Study of Obelia colony via temporary glycerin mount slide	Experiments	BL4-Analyze	4
4	Study of fish scales via temporary glycerin mount slide	Experiments	BL4-Analyze	4
5	Study of Arthropods larva via temporary glycerin mount slides	Experiments	BL5-Evaluate	8
6	Study of Nervous system, Osphridium, ptenidium, Radula of Pila	PBL	BL4-Analyze	8
7	Study of Mouth parts : Cockroach	PBL		
8	Study of Nervous system, Digestive system and Appendages in Prawn	PBL		
9	Study of Visceral organs of Earthworm	PBL		

Part D(Marks Distribution)

Theory					
Total Marks	Minimum Passing Marks	External Evaluation	Min. External Evaluation	Internal Evaluation	Min. Internal Evaluation
100	40	40	12	60	0
Practical					
Total Marks	Minimum Passing Marks	External Evaluation	Min. External Evaluation	Internal Evaluation	Min. Internal Evaluation
100	50	40	20	60	0

Part E

Books	Text Book of Zoology by: S. Chand
Articles	https://www.nature.com/articles/ncomms12718
References Books	Unified Zoology by: V.K. Tiwari Invertebrate and Vertebrate zoology by: Veerbala Rastogi
MOOC Courses	https://nptel.ac.in/courses/102104042
Videos	https://nptel.ac.in/courses/102104042

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(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	<p>CO1- To remember the structure of various biomolecules like carbohydrates, fats, amino acids, etc (BL1-Remember)</p> <p>CO2- To comprehend the biological material; and its relation to living matter and elaborate the structure and functions of different biomolecules(BL2-Understand)</p> <p>CO3- To understand the importance of biophysical chemistry and its applications.(BL3-Apply)</p> <p>CO4- To provide experimental basis, and to enable students to analyze the various biomolecules in food samples.(BL4-Analyze)</p> <p>CO5- To evaluate the applications of biomolecules in various fields such as research and industries(BL5-Evaluate)</p>							
Courses 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 (Henderson 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: Structure, occurrence classification and functions of Monosaccharide, Disaccharides, and Polysaccharides. Structure and occurrence of storage and structural polysaccharides. Isomerism-Optical and stereoisomerism D and L form importance	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments	9
3	Lipids: Classification, structure-function, role in biological membrane Phospholipids: Lecithin Cephalin, Plasmalogen Triacylglycerol-Structure and Function, 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	Vitamins & Minerals: Classification: source and biochemical function, RDA, Composition, structure and function of nucleic acids: DNA & RNA, Conformation of nucleic acids and its types	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
9	Determination of alpha-amylase activity in the given plant sample	PBL		
10	Determination of carbohydrate by anthrone test	PBL		

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

(SOS)(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	Disciplinary Major							
Pre-Requisite/s	the basic concepts and view of professional and scientific communication approaches for microbiology settings			Co-Requisite/s	comprehensive understanding of sterilization processes and media preparation pipelines			
Course Outcomes & Bloom's Level	<p>CO1- To identify the basic concepts and view of professional and scientific communication approaches for microbiology settings (BL1-Remember)</p> <p>CO2- To understand the gene transfer mechanisms and a detailed insight into mutations and their analysis (BL2-Understand)</p> <p>CO3- To describe comprehensive understanding of sterilization processes and media preparation pipelines (BL3-Apply)</p> <p>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)</p> <p>CO5- To apply Appraise the current regulatory, quality control, and legal frameworks that impact biotechnology and ethical behaviours that foster positive and productive interactions in diverse microbiology and biotechnology settings.(BL5-Evaluate)</p>							
Courses Elements	Skill Development ✓ Entrepreneurship ✗ Employability ✓ Professional Ethics ✗ Gender ✗ Human Values ✗ Environment ✗		SDG (Goals)	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	<p>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.</p> <p>Algae and virus and their physiological characteristics.</p>	Tutorials, Collaborative, Demonstrations, Project methods Experiments	8
2	<p>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.</p>	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	<p>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</p>	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	9
4	<p>Gene transfer mechanisms: transformation, transduction, conjugation and transfection, Mechanism and applications, genetic analysis of microbes- bacteria and yeast. Plasmids: characteristics and their uses in genetic analysis/as cloning vectors, replication of selected plasmids. Transposable, genetic elements: transposons, types of transposons and their uses.</p>	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	<p>Genetic analysis of bacteria: Importance and uses of Mutation analysis. Inheritance in bacteria, types of mutations, spontaneous and induced mutagenesis. Isolating mutants, selecting mutants, mutant enrichment. Reversions versus suppression. Complementation tests, recombination tests and gene replacements, Cloning genes by</p>	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

complementation, cloning genes by marker rescue.

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Identification of & taxonomy of animals	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

(SOS)(Bsc_Microbiology)

Title of the Course	Cell Structure and Dynamics
Course Code	BSMB103[T]

Part A

Year	1st	Semester	1st	Credits	L	T	P	C	
					3	0	1	4	
Course Type	Embedded theory and lab								
Course Category	Disciplinary Major								
Pre-Requisite/s	Student must have basic knowledge of cell, its structure and functions			Co-Requisite/s					
Course Outcomes & Bloom's Level	<p>CO1- Students should develop the concept of the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles(BL1-Remember)</p> <p>CO2- Students will understand how these cellular components are used to generate and utilize energy in cells(BL2-Understand)</p> <p>CO3- Students will recognize the cellular components underlying mitotic cell division(BL3-Apply)</p> <p>CO4- Students will apply their knowledge of cell biology to selected examples of changes or losses in cell function(BL4-Analyze)</p> <p>CO5- Students will create a model by using cell biology basics(BL6-Create)</p>								
Coures Elements	Skill Development ✗ Entrepreneurship ✗ Employability ✓ Professional Ethics ✗ Gender ✗ Human Values ✗ Environment ✗		SDG (Goals)	SDG4(Quality education)					

Part B

Modules	Contents	Pedagogy	Hours
I	<p>Historical perspectives. Discovery of cell, the cell theory, the ultra-structure of a eukaryotic cell- (both plant and animal cells), the difference between prokaryotic and Eukaryotic cell</p> <p>Structural organization and functions of cell wall and plasma membrane: Composition and Models, fluid mosaic model and movement of lipids Diffusion potential and Nernst Equation. Transport across cell membrane their types and function</p>	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
II	<p>Structure and functions of different cellular organelles: Nucleus, Mitochondria, Endoplasmic Reticulum, Golgi Complex, Chloroplast, Ribosomes, Lysosomes, Peroxisomes And Vacuole</p> <p>Intracellular compartments and protein sorting, Compartmentalization. Protein sorting into Golgi body and Lysosomes, Nucleus and Mitochondria</p>	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
III	<p>Cytoskeleton Structure: Microtubule, Microfilament and intermediate filament and its working mechanism,</p> <p>Role of actin and myosin and its significance, Cell contraction and Locomotion (Sliding Filament Theory)</p>	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
IV	Extra cellular matrix: Composition and Function , Cellcell junction (tight junctions and gap junctions) and cell matrix junction. (Hemidesmosome & Actin linked cell junction). Proteins involved in junctional complex: structure and function	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
V	Cell- Cell communication: Cell Signaling- Autocrine, Paracrine and Endocrine, Signaling molecules and their various	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9

receptors, Importance of cell signaling. Cell death: Apoptosis and necrosis and Necrosis Comparison.

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Introduction to chromosome preparation: Pre-treatment, Fixation, Staining, Squash and Smear preparation. Preparation of permanent slides	Experiments	BL2-Understand	2
II	Determination of mitotic index and frequency of different mitotic stages in pre-fixed root tips of <i>Allium cepa</i>	Experiments	BL4-Analyze	2
III	Study of mitotic chromosome: Metaphase chromosome preparation	Experiments	BL2-Understand	2
IV	The determine osmolarity in RBCs.	Experiments	BL4-Analyze	2
V	The fractionation of rat Liver	Experiments	BL5-Evaluate	2
VI	Estimation of chlorophyll content in spinach leaves.	Experiments	BL4-Analyze	2
VII	Isolation of chlorophyll types by TLC.	Experiments	BL4-Analyze	2
VIII	Differential Centrifugation of various organelles	PBL	BL4-Analyze	8

Part D(Marks Distribution)

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

Part E

Books	Molecular Biology of the Gene. Seventh Edition (2013). James D. Watson, Tania A. Baker, Stephen Molecular Cell Biology, Eighth Edition (2013). Harvey Lodish, Arnold Berk. W. H. Freeman Co.,
Articles	https://training.seer.cancer.gov/anatomy/cells_tissues_membranes/cells/structure.html
References Books	Molecular Biology of the Cell. Sixth Edition (2014). Bruce Alberts, Alexander Johnson, Julian Lewis
MOOC Courses	https://nptel.ac.in/courses/102103012
Videos	https://nptel.ac.in/courses/102103012

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	Bioinstrumentation
Course Code	SECI[T]

Part A

Year	1st	Semester	1st	Credits	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	The course prepares the student to understand the Bio-Instrumentation; and how doesn't interact 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	<p>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)</p> <p>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)</p> <p>CO3- The course aims to provide experimental basis, and to enable students to acquire a specialized knowledge and understanding. (BL4-Analyze)</p> <p>CO4- The course aims to provide basis of analyzing the applications of Bio-Instrumentation in various fields such as research and industries. (BL4-Analyze)</p> <p>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)</p>							
Courses 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 (with ray diagrams) Simple and compound microscopy, upright and inverted microscopy: Differences and comparison (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	Spectrum and their Types, wave length range of electromagnetic radiation. Spectroscopy: basic principle and applications of colorimetry and U.V-Visible Spectroscopy and Infrared spectroscopy. Microtomy: Basic principle and applications	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
4	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
5	Electrophoresis: principles, types and applications of paper, agarose gel & PAGE electrophoresis. Radioactivity: principle of radioactive decay, half-life.	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

(SOS)(Bsc_Microbiology)

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	Foundation core							
Pre-Requisite/s	Should be acquainted with the basics knowledge of environment and its management			Co-Requisite/s				
Course Outcomes & Bloom's Level	<p>CO1- To remember the concept of different types of resources available and their limitations. (BL1-Remember)</p> <p>CO2- To Understand the concepts of ecosystems, biodiversity and conservation (BL2-Understand)</p> <p>CO3- To develop positive attitude towards practical response to different stages of disaster management by adopting advance technology and sustainable development. (BL3-Apply)</p> <p>CO4- Acquire expertise and skills needed for the Environmental Management Systems and techniques of monitoring, Environment audit, Environmental Impact Analysis, environment instrumentation and control systems and for the projects development, implementation, and maintenance. (BL4-Analyze)</p> <p>CO5- Students acquire skills for to communicate, prepare, plan and implement the environmental management plan in any projects. (BL5-Evaluate)</p>							
Courses 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 consumption and production) SDG13(Climate action) SDG14(Life below water) SDG15(Life on land) SDG17(Partnerships for the goals)				

Part B

Modules	Contents	Pedagogy	Hours
1	Environment - Definition and its segments, (Lithosphere, Hydrosphere, Atmosphere and Biosphere) Ecology and Ecosystem: Basic concepts, Type & Components, Energy Flow, Food chain, food web, Ecological Pyramids. Biodiversity: Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Species and ecosystem threat categories. Major conservation policies: in-situ and ex-situ conservation approaches.	Whiteboard, PPT, Video Case Study, Project Based Activity, Application Based Activity	8
2	Natural Resources – Classification, Water Resources and Forest Resources. Energy Resources- Classification-Conventional resources (Mineral, Oil, Coal, Gas, Nuclear Energy and Thermal Power)-Non-conventional resources (Solar, Geothermal, Wind energy, Biomass and Bio-gas).	Whiteboard, PPT, Video Case Study, Project Based Activity, Application Based Activity	8
3	Water pollution – sources & effects. Characteristics and treatment of waste water (STP & ETP). Soil - formation of soil, elementary and mineral composition, soil pollution, effects and abatements. Air Pollution- Classification, sources and toxic effects of air pollutants. engineered systems for air purification: Atmospheric cleansing process, approaches to contamination control. Noise Pollution – sources & effects.	Whiteboard, PPT, Video Case Study, Project Based Activity, Application Based Activity	8
4	Population Growth & Explosion. Green house gas effect, Global warming, Climate change, Acid rain, Ozone layer depletion and Photochemical Effect. Environmental legislation of India-Air act-1984, Water act-1974, Environment Protection act-1986, Forest conservation act-1980, Wild life protection act-1972.	Whiteboard, PPT, Video Case Study, Project Based Activity, Application Based Activity	8
5	Ethics- (types & theories) and moral values, NGOs and their role in environmental preservations, Effectiveness of various religions in environmental conservation A case study of Anupam Mishra (Ponds are still relevant, Saaf Maathe Ka Samaj, Rajasthan Ki Rajat Bunden & Paryavaran Ke Path). Solid waste - impacts on Society & management strategies. Swachha Bharat Abhiyan. Sustainable Habitat: Green Building, GRIHA Rating Norms.	Whiteboard, PPT, Video Case Study, Project Based Activity, Application Based Activity	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1		Experiments	BL2-Understand	2

Part D(Marks Distribution)

Theory					
Total Marks	Minimum Passing Marks	External Evaluation	Min. External Evaluation	Internal Evaluation	Min. Internal Evaluation
100	40	60	18	40	
Practical					
Total Marks	Minimum Passing Marks	External Evaluation	Min. External Evaluation	Internal Evaluation	Min. Internal Evaluation
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	1	2	-	-	-	-	1	2	-	-	-	-	1	-	-
CO2	1	2	-	-	-	-	1	2	-	-	-	-	1	-	-
CO3	1	2	-	-	-	-	1	2	-	-	-	-	-	-	-
CO4	1	2	-	-	-	-	3	2	-	-	-	-	-	2	-
CO5	1	2	-	-	-	-	3	2	-	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Syllabus-2023-2024

(SOS)(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	Disciplinary Major							
Pre-Requisite/s	This course will introduce to the applied aspects of immunology in disease detection and diagnosis			Co-Requisite/s	The students should be well versed with different types of immune responses which show different types of changes.			
Course Outcomes & Bloom's Level	CO1- To remember the structure of various Immunological Barriers of the body(BL1-Remember) CO2- To understand the Different cells & proteins involved in Immune system(BL2-Understand) CO3- To understand the connection of immune system failure & disorders. (BL2-Understand) CO4- To apply the use of Proteins & receptors in antibody formation(BL3-Apply) CO5- To evaluate the applications of Antigens & Antibodies in Diagnostic & Medical Research(BL3-Apply)							
Courses 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, 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. Cells and organs of the immune system,	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Hematopoietic development and mediators of the process. Sign and symptoms and mechanism involved in inflammatory response. Second unit inflammation response, add the concept of Primary and secondary immune response, TLR Receptors Antigens & Immunogens and its properties, Epitopes and CDRS designing	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Structure, classification and functions of Antibody, Antigen-antibody reactions :Precipitation and agglutination reactions, Organization and expression of Immunoglobulin genes, Monoclonal antibodies: production and application	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	Major histocompatibility complex (MHC), Types of MHC and Display of antigenic peptide, Role of MHC in antigen processing and presentation. Complement system: component, activation pathway , Complement deficiency diseases	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Hypersensitivity: Allergens and its types, types of hypersensitivity and There mechanism, Introduction to Autoimmune disorders(Central and peripheral Tolerance). Immunization: active and passive immunization, types of vaccines and their production strategy.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Anatomical view of mammalian thymus and various immune organs	Experiments	BL3-Apply	2
2	To observe Precipitation reaction	Internships	BL4-Analyze	15 DAYS
3	Blood Group Detection by Agglutination Reaction	PBL		
4	To perform Radial immune diffusion	Experiments	BL3-Apply	2
5	To perform Double immuno diffusion	Experiments	BL3-Apply	2
6	Haemoglobin detection by given Blood Sample	Experiments	BL3-Apply	2
7	To perform Widal Test	PBL	BL4-Analyze	5
8	Immune cell visualization, phagocytosis cell movement-virtually.	PBL		
9	To demonstrate phagocytosis cell movement- virtually.	PBL		

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

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

Part A

Year	1st	Semester	2nd	Credits	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Knowledge of Fundamentals of Analytical Chemistry			Co-Requisite/s				
Course Outcomes & Bloom's Level	CO1- To remember basic concept and principle of analytical techniques(BL1-Remember) CO2- To understand the difference between the analytical techniques(BL2-Understand) CO3- To use/apply the basic statistical treatment of the analytical data for getting a correct result and analytical methods(BL3-Apply) CO4- To Analyse Qualitative and Quantitative aspects(BL4-Analyze) CO5- To Evaluate the data obtained from the analysis(BL5-Evaluate)							
Courses 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, Expeieced 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, Expeieced examples,	8

Part C

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	Hindi I
Course Code	BSMB AECII (T)

Part A

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

Part B

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

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

Part A

Year	1st	Semester	2nd	Credits	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	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)							
Courses 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. Chromatographic methods used in forensic science: History, principle and applications	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

(SOS)(Bsc_Microbiology)

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

Part A

Year	1st	Semester	2nd	Credits	L	T	P	C
					2	0	0	2
Course Type	Theory only							
Course Category	Ability Enhancement Courses							
Pre-Requisite/s	<p>1. *Understanding of Sociological Concepts*: A foundational knowledge of sociological concepts is essential to grasp the composition of Indian society discussed in Unit I. This includes understanding social institutions, cultural environments, and threats to national integration. 2. *Historical Background*: Familiarity with the history of India, particularly the Indian Freedom Movement, is crucial for comprehending Unit II. Knowledge of events such as the Revolt of 1857, the emergence of nationalism, and the various phases of the freedom struggle provides context for understanding the birth of the Indian nation-state. 3. *Awareness of Political Movements*: A basic understanding of political movements in India, particularly those led by figures like Gandhi, is necessary for Unit III. Familiarity with concepts like non-cooperation, civil disobedience, and the Quit India movement aids in analyzing the dynamics of Indian freedom and partition. 4. *Knowledge of Post-Independence Era*: Understanding the phases of nation-building since independence is vital for Unit IV. This includes awareness of the planned progress era, populist policies, and the paradigm shift towards liberalization and globalization. Knowledge of responses from different societal groups and regions enriches the understanding of India's post-independence journey. 5. *Global Awareness*: Unit V delves into global concerns such as environmental issues, globalization, and movements for democracy and sustainability. A broad understanding of global trends and their impact on nations is necessary to engage with this content effectively.</p>			Co-Requisite/s		<p>1. *Foundational Understanding of Sociological Concepts*: - Understanding social institutions, cultural environments, and threats to national integration is fundamental. - Familiarity with sociological theories such as functionalism, conflict theory, and symbolic interactionism can provide a deeper comprehension of societal dynamics. 2. *Historical Context of India*: - Knowledge of Indian history, including the colonial period, the struggle for independence, and post-independence developments, offers context for understanding the evolution of Indian society. - Understanding the socio-economic impacts of colonial rule and the transition to independence enhances insight into contemporary social issues. 3. *Understanding of Political Movements in India*: - Knowledge of key figures, ideologies, and strategies of political movements in India, including those led by Gandhi, Nehru, and other prominent leaders, is essential. - Awareness of the socio-political context of colonial India and the role of various stakeholders in the struggle for independence enriches understanding. 4. *Familiarity with Post-Independence Developments*: - Understanding the socio-economic and political changes in post-independence India, including the Nehruvian era, economic reforms, and social movements, is crucial. - Awareness of key policies, such as the Green Revolution, reservation system, and economic liberalization, provides insights into contemporary Indian society. 5. *Global Perspective and Awareness*: - Knowledge of global trends in areas such as technology, economics, environment, and geopolitics enhances understanding of India's position in the global context. - Understanding global issues like climate change, international trade, and human rights movements enables students to analyze their impact on India and vice versa.</p>		
Course Outcomes & Bloom's Level	<p>CO1- It will help students to remember their personality and thinking horizon for being a good and concerned Indian citizen (BL1-Remember) CO2- The students will have an understanding of making of India as a nation (BL2-Understand) CO3- The students will have an analyse salient features of modern India (BL3-Apply) CO4- At the end of this course, students would analyze intellectually well equipped to have a sense of modern Indian history and culture (BL4-Analyze)</p>							
Courses Elements	<p>Skill Development ✓ Entrepreneurship ✗ Employability ✓ Professional Ethics ✗ Gender ✗ Human Values ✓ Environment ✓</p>		SDG (Goals)		<p>SDG1(No poverty) SDG3(Good health and well-being) SDG4(Quality education) SDG5(Gender equality) SDG10(Reduced inequalities) SDG12(Responsible consumption and production) SDG13(Climate action)</p>			

Part B

Modules	Contents	Pedagogy	Hours
Unit 1	Idea of India in historical perspective a) Indian culture, b) cultural commonness, c)cultural diversities, d)unity in diversity, e) culturall accomodations, f) cultural conflicts, g)Idea of India and British Rule , h) Role of Indian Intelligentsia	lecture method and video clips/films on specific themes/topics, illustrations, classroom discussions, role play	8 hrs
Unit 2	. Emergence and growth of Indian Nationalism a) Anti-colonial basis ,b) Economic Nationalism ,c) communalism and nationalism ,d) revivalism and Indian nationalism ,e)Enlightenment values ,f)European Nationalism and Indian Nationalism	lecture method and video clips/films on specific themes/topics, illustrations, classroom discussions, role play	8 hrs
Unit 3	Social Reform Movements a) British Rule and Indian introspection ,b)Raja Rammohan Roy, c) social reform movements in 19th century , d)Swami Vivekanand ,e)The women issue ,f)Caste system	lecture method and video clips/films on specific themes/topics, illustrations, classroom discussions, role play	8 hrs
Unit 4	Indian National Movement a)Early Revolts and 1857 Revolt, b)Early Nationalists ,c) Bang Bhang Movement , d) Gandhi led Mass Movements, e) Socialist and Left trends , f) Princely States and their integration into nation, h)Partition and Independence .	lecture method and video clips/films on specific themes/topics, illustrations, classroom discussions, role play, debates	8 hrs
Unit 5	India after independence a)Making of Indian Constitution ,b) Post Independent Nehru Era , c) India facing Wars , d) Indian econmy- From Planning to LPG ,e) Achievements, f) Challenges in 21st century India.	lecture method and video clips/films on specific themes/topics, illustrations, classroom discussions, role play	8 hrs

Part C

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	Molecular Biology –I
Course Code	BSMB201(T)

Part A

Year	1st	Semester	2nd	Credits	L	T	P	C
					03	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Molecular Biology is an advance paper, therefore student must know about Gene structure and gene regulation.			Co-Requisite/s	Student must have background with Genetics.			
Course Outcomes & Bloom's Level	CO1- To understand the basic terms in contrast to genes, genome and their interactions(BL2-Understand) CO2- To identify and isolate the genomic DNA from the different samples.(BL3-Apply) CO3- To compare and analyze the different DNA present among the various samples(BL4-Analyze) CO4- To evaluate the different fragments of DNA using restriction enzymes and molecular techniques(BL5-Evaluate) CO5- To apply the understanding of biomolecules in various fields in research and development (BL1-Remember)							
Courses Elements	Skill Development ✗ Entrepreneurship ✗ Employability ✓ Professional Ethics ✗ Gender ✗ Human Values ✗ Environment ✗		SDG (Goals)	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
I	Nature of gene concept, chemical nature of gene Gene and genome concept, Complexity of eukaryotic genome, Genome size, c- value paradox. Structure of DNA and their properties, A, B, C and Z types of DNA, Structure property and types of RNA, Nucleic acid as a genetic information carriers: experimental evidence.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
II	DNA replication in prokaryotes: Conservative and dispersive types, Experimental evidence for semi- conservative replication: DNA Replication: polymerase enzymes, other enzymes and protein factors involved in replication, Mechanism of replication. Comparison of replication in prokaryotes and eukaryotes	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9
III	Transcription in prokaryotes: RNA polymerase, promoters, initiation, elongation, rho dependent and rho in dependent termination of RNA synthesis. Reverse transcription, post transcriptional processing of RNA	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	10
IV	Genetic code: basic features of genetic code, biological significance of degeneracy, wobble hypothesis, gene within gene and overlapping genes. Housekeeping genes Mechanism of translation in prokaryotes: five stages of protein biosynthesis, aminoacyl-tRNA synthetases, initiation, elongation, termination, folding and processing, inhibitors of protein synthesis Principles of gene regulation: negative and positive regulation, Regulation of gene expression in prokaryotes: operon concept, lac operon, Trp operon and Ara operon.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	10
V	Mutation: Molecular basis of Mutation, Physical and chemical mutagens types of mutation, e.g. transition, transversion, frame shift, insertion, deletion, suppressor sensitive, germinal and somatic, backward and forward mutations, spontaneous and induced mutations. DNA damage and repair: types of damage (deamination, oxidative damage, alkylation and pyrimidine dimers), repair mechanism	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	9

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Analysis of soil: 1. pH 2. organicmatter 3. Water holdingcapacity, 4. Texture ofsoil.	Experiments	BL2-Understand	2
VII	To prepare standard curve of protein	Experiments	BL6-Create	2
VIII	Estimation of protein in given sample.	Experiments	BL5-Evaluate	2
IV	Quantitative test of RNA in given sample	Experiments	BL3-Apply	2
V	Spectrophotometric analysis of DNA	Experiments	BL4-Analyze	2
VI	Isolation of chromosomal DNA from E. coli cells	Experiments	BL3-Apply	2
VII	To prepare standard curve of protein	PBL	BL4-Analyze	4
VIII	Estimation of protein in given sample	PBL	BL5-Evaluate	7

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	Albert B;Molecular Biology of the cell James D. Watson, Tania A. Baker, Stephen;Molecular Biology of the Gene. Seventh Edition (2013).
Articles	https://www.researchgate.net/publication/378498325_Innovations_in_Molecular_Biology-Cutting-Edge_Breakthroughs_in_Molecular_Genetics
References Books	Freidfelder D;Microbial Genetics Watson and Baker ; Molecular Biology of Gene ;5th Edition lar Biology. Alberts.B, Johnson.A, Lewis.J,Molecular Biology of the Cell. Sixth Edition (2014).
MOOC Courses	Refer to Neptel Link https://nptel.ac.in/courses/102103341
Videos	https://nptel.ac.in/courses/102103341

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	General anatomy & comparative anatomy of Vertebrates
Course Code	BSMBGE II (P)

Part A

Year	1st	Semester	2nd	Credits	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Generic Elective							
Pre-Requisite/s	Should be acquainted with the basics knowledge of Principle of Anatomy and histology of chordate Zoology			Co-Requisite/s	create basic knowledge about physiology GEIV-A			
Course Outcomes & Bloom's Level	CO1- To describe basic concepts of anatomy and anatomical structure of the organs of animals. (BL1-Remember) CO2- To understand the Anatomy, histology, and comparative anatomy in different vertebrates (BL2-Understand) CO3- To understand the importance of Anatomy and its applications (BL3-Apply) CO4- To provide experimental basis, and to enable students to acquire a specialized knowledge and understanding in advanced the field of Anatomy and histology (BL4-Analyze) CO5- To evaluate the applications of genetics in various fields such as research and development, medical science genetic engineering etc (BL5-Evaluate) CO6- To apply the understanding of analysing the applications of Anatomy and histology in various fields such as research and industries (BL6-Create)							
Courses Elements	Skill Development ✗ Entrepreneurship ✗ Employability ✓ Professional Ethics ✗ Gender ✗ Human Values ✗ Environment ✗		SDG (Goals)	SDG5(Gender equality)				

Part B

Modules	Contents	Pedagogy	Hours
1	<p>Introduction to General Anatomy</p> <p>Animal Tissues: - Epithelium, Connective tissue, skeletal tissue, circulatory tissue, and nervous tissue (An overview)</p> <p>Circulatory Tissue: Blood components, Blood clotting Mechanism,</p> <p>Muscular tissue: Types of Muscles, Mechanism of Muscular contraction</p>	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	<p>Study of Visceral Organs Mammals: Structure of Heart, structure of lungs, Structure of Brain, Sense organs & their Structure, Blood vessels, Structure of Kidney</p> <p>Study of Human Skeletal system. blood and blood components and clotting of blood</p>	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	<p>Comparative account of integument of vertebrates (Amphibia, Reptiles, Birds and Mammals), Derivatives of integument, Study of feathers of birds</p> <p>Comparative account of Digestive system of Vertebrates (Amphibia, Reptiles, Birds and Mammals)</p> <p>Comparative account of limb bones</p> <p>Comparative account of pectoral and pelvic girdles of vertebrates (Amphibia, Reptiles, Birds and Mammal)</p>	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	<p>Comparative account of Brain vertebrates (Amphibia, Reptiles, Birds and Mammals) Comparative account of Brain vertebrates (Amphibia, Reptiles, Birds and Mammals)</p>	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	<p>Comparative account of Aortic & Heart of vertebrates (Amphibia, Reptiles, Birds and Mammals).</p> <p>Comparative account of urinogenital system of vertebrates (Amphibia, Reptiles, Birds & mammals).</p> <p>Genetic Algorithm: Basic Concepts, Applications in bioinformatics</p>	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Spotting: Study of histology through permanent slides as per theory syllabus	Experiments	BL2-Understand	8
2	Study of Visceral organs via models	Experiments	BL2-Understand	8
3	Comparative study of Integument in animals	Experiments	BL4-Analyze	4
4	Study of Human Skeleton	Experiments	BL4-Analyze	4
5	Study of Feathers in birds	PBL	BL4-Analyze	6
6	Comparative Study of Girdles (Pectoral and pelvic) in animals	PBL		
7	Temporary glycerin mount slides preparation of materials (as per theory syllabus)	PBL		
8	Determination of Blood group in own blood sample	PBL		
9	Study of pigment cells in Skin	PBL		

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	60	

Part E

Books	Jordan E.L. & Verma P.S. (2003). Chordate Zoology. S. Chand & Company Ltd. New Delhi. Chaki K.K. Kundu G. & Sarkar S. (2005). Introduction to Geology. Book of Zoology Volume II: Marshall and Willam (Eds.) 7th Ed. Macmillan Press London
Articles	https://www.nature.com/articles/152088a0
References Books	G.J.Tortora & N.P.anagnostakos: Principal of anatomy and Physiology
MOOC Courses	No courses found for given search
Videos	https://www.google.com/search?sca_esv=e2da69de12d3bb4c&sca_upv=1&rlz=1C1NMEO_enIN999IN999&q=General.+Anatomy+in+animals&tbm=vid&source=lnms&prmd=ivsnbmtz&

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	Plant Ecology
Course Code	BSMBGE II (T)

Part A

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

Part B

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

Part C

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	General anatomy & comparative anatomy of Vertebrates
Course Code	BSMBGE II (T)

Part A

Year	1st	Semester	2nd	Credits	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Electives							
Pre-Requisite/s	Should be acquainted with the basics knowledge of Principle of Anatomy and histology of chordate Zoology			Co-Requisite/s	create basic knowledge about physiology GEIV-A			
Course Outcomes & Bloom's Level	CO1- To describe basic concepts of anatomy and anatomical structure of the organs of animals. (BL1-Remember) CO2- To understand the Anatomy, histology, and comparative anatomy in different vertebrates (BL2-Understand) CO3- To understand the importance of Anatomy and its applications (BL3-Apply) CO4- To provide experimental basis, and to enable students to acquire a specialized knowledge and understanding in advanced the field of Anatomy and histology (BL4-Analyze) CO5- To evaluate the applications of genetics in various fields such as research and development, medical science genetic engineering etc (BL5-Evaluate) CO6- To apply the understanding of analysing the applications of Anatomy and histology in various fields such as research and industries (BL6-Create)							
Courses Elements	Skill Development ✗ Entrepreneurship ✗ Employability ✓ Professional Ethics ✗ Gender ✗ Human Values ✓ Environment ✗		SDG (Goals)	SDG5(Gender equality)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to General Anatomy Animal Tissues - Epithelium Connective tissue skeletal tissue circulatory tissue and nervous tissue	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Structure of Heart of mammals Structure of Brain Sense organs & their Structure Skeletal system Blood vessels, Mammals Kidney and Reproductive organs of mammals	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Comparative account of integument of vertebrates (Amphibia Reptiles Birds and Mammals) Comparative account of Digestive system of Vertebrates (Amphibia Reptiles Birds and Mammals) Comparative account of limb bones and girdles of vertebrates Amphibia Reptiles Birds and Mammal	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	Comparative account of Respiratory system of Vertebrates (Amphibia Reptiles Birds, and Mammals) Comparative account of Brain vertebrates (Amphibia Reptiles Birds and Mammals)	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Comparative account of Aortic & Heart of vertebrates (Amphibia Reptiles Birds and Mammals). Comparative account of urinogenital system of vertebrates (Amphibia Reptiles Birds & mammals).	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Spotting: based on histology	Experiments	BL2-Understand	8
2	Spotting: Visceral Organs	Experiments	BL2-Understand	8
3	Study of human visceral organs as per syllabus	Experiments	BL4-Analyze	4
4	Osteology and study of fethers	Experiments	BL4-Analyze	4
5	Study of organ system	Experiments	BL5-Evaluate	4
VI	Determination of Blood group and ABH factor in own blood sample	PBL	BL4-Analyze	6

Part D(Marks Distribution)

Theory					
Total Marks	Minimum Passing Marks	External Evaluation	Min. External Evaluation	Internal Evaluation	Min. Internal Evaluation
100	40	40	12	60	0
Practical					
Total Marks	Minimum Passing Marks	External Evaluation	Min. External Evaluation	Internal Evaluation	Min. Internal Evaluation
100	40	40	20	60	0

Part E

Books	Jordan E.L. & Verma P.S. (2003). Chordate Zoology. S. Chand & Company Ltd. New Delhi. Chaki K.K. Kundu G. & Sarkar S. (2005). Introduction to General Zoology Volume II: Marshall and Willam (Eds.) 7th Ed. Macmillan Press London
Articles	https://www.nature.com/articles/152088a0
References Books	G.J.Tortora & N.P.anagnostakos: Principal of anatomy and Physiology
MOOC Courses	No courses found for given search
Videos	https://www.google.com/search?sca_esv=e2da69de12d3bb4c&sca_upv=1&rlz=1C1NMEO_enIN999IN999&q=General.+Anatomy+in+animals&tbm=vid&source=lnms&prmd=ivsnbmtz&

Course Articulation Matrix

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



Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

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

Part A

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

Part B

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

Part C

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	English II
Course Code	BSMB AECIII (T)

Part A

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

Part B

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

Part D(Marks Distribution)

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

Part E

Books	Fluency in English - Part II, 2006, Oxford University Press. • Business English, 2008, Pearson Publication.
Articles	https://www.frontiersin.org/articles/10.3389/feduc.2019.00087/full https://www.cii.co.uk/media/6158020/a-useful-guide-to-swot-analysis.pdf http://www.mmmut.ac.in/News_content/35141tpnews_10142020.pdf
References Books	• Language, Literature and Creativity, 2013, Orient Blackswan. • John E Warriner, Harcourt, Brace, Jovanovich, Warriner's English Grammar and Composition: Complete Course, 1973.
MOOC Courses	https://www.edx.org/learn/leadership/catalyst-leading-with-effective-communication-inclusive-leadership-training?hs_analytics_source=referrals&utm_source=mooc.org&utm_medium=referral&utm_campaign=mooc.org-course-list https://www.edx.org/learn/writing/university-of-california-berkeley-academic-and-business-writing?hs_analytics_source=referrals&utm_source=mooc.org&utm_medium=referral&utm_campaign=mooc.org-course-list
Videos	https://www.youtube.com/watch?v=fq98P9N9Hbg https://www.youtube.com/watch?v=uA5YeqgsjmY https://www.youtube.com/watch?v=eBSeCp_xhl

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

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

Part B

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

Part C

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	Disaster Management
Course Code	BSMB VACIII (T)

Part A

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

Part B

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	Molecular Biology-II
Course Code	BSMB301(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 Knowledge of structure of DNA RNA gene , nucleotide and nucleoside			Co-Requisite/s	gain knowledge of Gene expression and there regulation system			
Course Outcomes & Bloom's Level	CO1- To remember the structure of biomolecules DNA, RNA & Protein(BL1-Remember) CO2- To understand DNA & RNA and its relation to the formation of Protein(BL2-Understand) CO3- To understand the importance of Molecular editing tools in the cell(BL2-Understand) CO4- To provide experimental basis, and to enable students to analyze the isolation of nucleic acid from various samples(BL3-Apply) CO5- To evaluate the applications of nucleic acid in various fields such as research and industries(BL5-Evaluate)							
Courses Elements	Skill Development ✗ Entrepreneurship ✗ Employability ✓ Professional Ethics ✗ Gender ✗ Human Values ✗ Environment ✗		SDG (Goals)	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	DNA Replication: General features of chromosomal replication: DNA Replication machinery in prokaryotes and its comparison with eukaryotes, prokaryotes, Enzymology of DNA replication, Regulation of DNA replication.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Transcription in eukaryotes: Initiation, elongation and termination, Structure and function of eukaryotic/ prokaryotic promoters, RNA polymerases Types and properties of transcription factors, types and properties; Enhancers/silencers structure and properties. Post transcriptional processing, Autocatalytic RNA.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Translation: Translation machinery of prokaryotes, Successive stages of protein synthesis in prokaryotes and its comparison with eukaryotes, Translational factors- Types and properties Post- translational Modification: Types and Significance.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	Regulation of Gene Expression in Eukaryotes: cis – acting DNA elements; Supercoiling of DNA and packaging of DNA in nucleus & organelles; Chromatin Organization and regulation of gene expression; regulation at the level of processing of transcripts. RNA editing; Gene Alteration; DNA methylation and gene regulation; Regulation of gene expression by hormones	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	DNA libraries; Genomic and C-DNA Library, Transposable elements in prokaryotes and Eukaryotes: Types and Significance. Oncogenes and Tumor Suppressor Genes: Properties and Significance .Molecular basis of mutation: types and repair	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Identification of chromosomes and spotting as per theory syllabus	Experiments	BL3-Apply	2
2	Quantitation of DNA	Experiments	BL4-Analyze	2
3	Determination of max of purified DNA fragments	Experiments	BL3-Apply	2
4	Determination of T _m of nucleic acid	Experiments	BL3-Apply	2
5	Isolation of RNA	Experiments	BL5-Evaluate	2
6	Comparative analysis of DNA isolation from different tissue of plants. Student will understand about the foundational scientific principles and findings in current molecular biology	PBL	BL4-Analyze	8

Part D(Marks Distribution)

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

Part E

Books	Nelson, Cox and Lehninger, principles of Biochemistry, 8 edition
Articles	https://idmic.net/wp-content/uploads/2016/10/molecular-diagnostic-techniques.pdf
References Books	Arnold Berk, Chris A. Kaiser, Harvey Lodish, Molecular Cell Biology, 3rd Edition
MOOC Courses	https://nptel.ac.in/courses/102103038
Videos	https://nptel.ac.in/courses/102103038

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

Syllabus-2023-2024

(SOS)(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)							
Courses 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, simulations, 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, simulations, 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, simulations, Demonstrations, Project methods Experiments,	8
IV	Somatic hybridization: technique and application. Single cell culture: isolation, culture technique and application. Elicitors, Secondary metabolites and their production. Cryopreservation: technique and application.	Tutorials, simulations, Demonstrations, Project methods Experiments,	8
V	Plant cloning vectors and their applications. <i>Agrobacterium</i> mediated transformation in plants. Transgenic plants: technique and application. Application of plant tissue culture in agriculture and forestry. Concept of Intellectual property right (IPR) and	Tutorials, simulations, 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	Bhowani.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

(SOS)(Bsc_Microbiology)

Title of the Course	Genetics							
Course Code	BSMB303(T)							
Part A								
Year	2nd	Semester	3rd	Credits	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Generic Elective							
Pre-Requisite/s	Knowledge about Fundamentals and principles about genetics also provide knowledge about Genetic techniques.			Co-Requisite/s	Relate all Biotech and microbiology engeneering techniques like RDT PTC ATC etc.			
Course Outcomes & Bloom's Level	CO1- To describe basic principles and concepts of genetics(BL1-Remember) CO2- To understand the Mendalian and non Mendalian inheritance(BL2-Understand) CO3- To understand the importance of heredity and its applications(BL3-Apply) CO4- To provide experimental basis, and to enable students to acquire a specialized knowledge and understanding in advanced the field of genetics(BL4-Analyze) CO5- To evaluate the applications of genetics in various fields such as research (BL5-Evaluate) CO6- To apply the understanding of heredity and variation and genetic disorders and mutations and others in various fields or industries(BL6-Create)							
Coures Elements	Skill Development ✓ Entrepreneurship ✗ Employability ✓ Professional Ethics ✗ Gender ✗ Human Values ✗ Environment ✗		SDG (Goals)	SDG1(No poverty) SDG4(Quality education) SDG11(Sustainable cities and economies) SDG14(Life below water) SDG15(Life on land)				

Part B

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

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Spotting: As per theory syllabus with the help of permanent slides	Experiments	BL2-Understand	4
2	Squash Preparation with onion root tip and study of Mitosis cell division	Experiments	BL3-Apply	4
3	Study of Meiosis in grasshopper testis	Experiments	BL3-Apply	4
4	Genetic problems based on mendalism	Experiments	BL2-Understand	4
5	Study of Nucleic acids with the help of models or charts	Field work	BL4-Analyze	8
6	Study of Special type of chromosomes in salivary gland of Chironomus larva	PBL		
7	Genetic problems based on Linkage and crossing over	PBL		
8	Study of multiple alleles by ABO blood system	PBL		

Part D(Marks Distribution)

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

Part E

Books	Principles of genetics By P K Gupta
Articles	https://www.nature.com/scitable/topicpage/gregor-mendel-and-the-principles-of-inheritance-593/
References Books	Genetics BY B D Singh Genetics By: A G Gardner
MOOC Courses	https://nptel.ac.in/courses/102104052
Videos	https://www.google.com/search?sca_esv=e2da69de12d3bb4c&sca_upv=1&rlz=1C1NME0_enIN999IN999&q=Principles+of+Genetics&tbm=vid&source=Inms&prmd=ivsnbmtz&sa=X&Ptxld_Ga7k,st:0

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	Inorganic Chmeistry
Course Code	BSMBGEIII (T)

Part A

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

Part B

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

Part C

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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



Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	HINDI II
Course Code	BSMB AECIV

Part A

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

Part B

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	Plant Physiology
Course Code	BSMB 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	Discipline Electives							
Pre-Requisite/s				Co-Requisite/s				
Course Outcomes & Bloom's Level	<p>CO1- To remember the basic concepts and view of physiology of plants(BL1-Remember)</p> <p>CO2- To understand the mechanisms of photosynthesis, photophosphorylation and Light and dark reactions.(BL1-Remember)</p> <p>CO3- To describe the mechanism of active and passive adsorption(BL3-Apply)</p> <p>CO4- To provide experimental basis, and to enable students to analyze the mechanism of plant respiration and different pathways(BL4-Analyze)</p> <p>CO5- To evaluate the growth and development of different plants across geological periods. (BL5-Evaluate)</p> <p>CO6- To apply the understanding of growth and development and nutrition system in plants(BL6-Create)</p>							
Coures Elements	Skill Development ✗ Entrepreneurship ✗ Employability ✓ Professional Ethics ✗ Gender ✗ Human Values ✗ Environment ✓		SDG (Goals)	SDG4(Quality education)				

Part B

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

Part C

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(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	<p>CO1- To describe fundamental knowledge of animal physiology (BL1-Remember)</p> <p>CO2- To understand the detailed concepts of digestion respiration excretion the functioning of nerves and muscles Hormones and reproduction(BL2-Understand)</p> <p>CO3- To understand the importance of Physiology and its applications(BL3-Apply)</p> <p>CO4- To provide experimental basis, and to enable students to basic concept of physiology(BL4-Analyze)</p> <p>CO5- To evaluate the applications of Physiology in various fields such as research and development as well as in various industries(BL5-Evaluate)</p> <p>CO6- To apply the understanding of Physiology in their future perspective fields i.e. Medical and clinical, Pathological, drug industries etc. (BL6-Create)</p>							
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	<p>Introduction to Physiology and its Need & importance for animal life</p> <p>Physiology of Nutrition- Nutrients and their Functions, Physiology of Digestion, Hormonal control of digestion, absorption of Food, assimilation and egestion of food</p> <p>Metabolism- carbohydrates , proteins and fats</p>	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	<p>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</p>	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	<p>Immune System In Mammals : An overview. Excretory System & Physiology of Excretion in Mammals Counter current theory Thermoregulation in Animals Hibernation Aestivation.</p>	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	<p>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</p>	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	<p>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</p>	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 digestive system and experiments based on metabolism	Experiments	BL2-Understand	8
VI	Detection of Carbohydrates, Protein and fats in given samples	PBL	BL4-Analyze	6
III	determination of Blood group Blood pressure and study of Immune organs	Experiments	BL4-Analyze	4
IV	Spotting Muscular and nervous tissue	Experiments	BL2-Understand	4
V	Study of hormonal action and study of gonads	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

(SOS)(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	<p>CO1- To remember the role of all the enzymes used in the DNA editing(BL1-Remember)</p> <p>CO2- To understand the method of creating new molecules such as DNA & RNA(BL2-Understand)</p> <p>CO3- To understand the importance Nucleic acid editing tools(BL2-Understand)</p> <p>CO4- To evaluate the applications of in various fields such as research, Agriculture, Pharmaceutical industries(BL5-Evaluate)</p> <p>CO5- To apply the understanding of creation of new DNA , RNA & Protein and its use in different Fields.(BL3-Apply)</p>							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✓ Gender ✓ Human Values ✗ Environment ✗		SDG (Goals)	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to gene cloning and its necessity: DNA modifying enzymes: Restriction enzymes (RE)- structure function and types, polymerase, kinases, ligase, alkaline phosphatase, exonuclease etc.. Cloning methods. linkers and adaptors.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Methods of introduction of DNA into living cells, E.coli, plant and animal cells, Genetic transformation in plants:Agrobacterium mediated transformation in plants,structure and features of Ti and Ri plasmids.Genomic libraries and cDNA libraries.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Cloning vectors: Plasmids and Bacteriophages, Phagemids, Cosmids, Artificial chromosomes (BAC and YAC) for <i>E.coli</i> , yeast. Strategies for identification of recombinant clones containing cloned genes: Nucleic acid hybridization, immune screening etc. Expression vectors for E.coli andYeast. Model organism used for RDT study.	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, Artificial 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

(SOS)(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	<p>CO1- The course prepares the student to understand the basic concepts of Bioprocess Engineering, its applications and future prospects. (BL1-Remember)</p> <p>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)</p> <p>CO3- The course aims to provide experimental basis, and to enable students to acquire a specialized knowledge and understanding. (BL2-Understand)</p> <p>CO4- The course aims to provide basis of analyzing the applications of Bioprocess Engineering in various fields of research and industries. (BL3-Apply)</p> <p>CO5- The course aims to provide basis of design, production and purification of bioproducts produced through research and in industries. (BL3-Apply)</p>							
Courses 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, stoichiometric 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	Factors involved in bioreactor , 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 <i>Aspergillus niger</i>	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

(SOS)(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	<p>CO1- Student will be able to learn the major classes of enzyme and their functions in the cell(BL1-Remember)</p> <p>CO2- Student will understand the role of co-enzyme cofactor in enzyme catalyzed reaction(BL2-Understand)</p> <p>CO3- Differentiate between equilibrium and steady state kinetics and analyzed simple kinetic data and estimate important parameter (Km, Vmax, Kcat etc); (BL2-Understand)</p> <p>CO4- To define and describe the properties of enzymes in and regulates biochemical pathways (inhibition, allosterism)(BL3-Apply)</p> <p>CO5- To analyze options for applying enzymes and their inhibitors in medicine and various industries(BL4-Analyze)</p>							
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 K_m and V_{max}	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. Diagnostic enzymology, 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 vegetables	Experiments	BL2-Understand	3
II	To analyse 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

(SOS)(Bsc_Microbiology)

Title of the Course	Bioethics and Biosafety
Course Code	BSMBSECIV (T)

Part A

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

Part B

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	Environmental Issues and Sustainable Development
Course Code	BSMBVACIV (T)

Part A

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

Part B

Modules	Contents	Pedagogy	Hours
1	History and emergence of the concept of Sustainable Development, Environmental issues and crisis, Resource degradation, greenhouse gases and Effects, desertification, social insecurity, Industrialization, Globalization and Environment. Dimensions of Sustainable Development, Principles of Sustainable Development.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, discussion (questions & answers section)	8
2	Sustainable Development Goals: Capacity Building for Sustainable Environment, Sustainable Land Management. Global and regional progress on SD, Individual and collective actions for SD, Sustainable Mountain development, Clean air for Climate Mitigation and Human Health, Sustainable Corporate Practices, Sendai Framework for Disaster Risk Reduction, Conservation and Management of Global Forest Ecosystem	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	8
3	Society, environment, culture and economy; current challenges - natural, political, socio-economic imbalance; sustainable development initiatives and policies of various countries: global, regional, national, local; needs of present and future generation – political, economic, and environmental. Global Indicators Framework, Sustainable development indicators, SDG Reports 2023 & 2019. Socio-economic challenges.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	8
4	GSD-2019, GSD 2023. Implementation Progress: SDG Progress report, Sustainability and development indicators and SDGs, UN's outlook of sustainable development and efforts	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	8

5	Case Studies & Projects on Rural Sustainable Development (Indian village perspectives) - Village resources (broad perspectives); current challenges and thematic areas; village social hierarchy; village economy; needs of present and future generation; conflicts - sustainability and rural culture & tradition; road to achieving sustainable development goals – bridging conflicts and way forward. <i>AI for achieving sustainable development goals.</i>	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion. Field visits. Industrial Visit (MSW/BMW/STP/ETP)	8
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Part C

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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



Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	Cellular Metabolism
Course Code	BSMB 502 (T)

Part A

Year	3rd	Semester	5th	Credits	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Disciplinary Major							
Pre-Requisite/s	Knowledge about basics of biomolecules			Co-Requisite/s				
Course Outcomes & Bloom's Level	<p>CO1- To impart knowledge on structural, functional and dynamic aspects of biological components. (BL1-Remember)</p> <p>CO2- To comprehend the understanding of the metabolic pathways involving the four major metabolic compounds: (BL2-Understand)</p> <p>CO3- To estimate the relation of biological material to living matter and elaborate the structure and functions of different biomolecules. (BL3-Apply)</p> <p>CO4- To analyze the various biomolecules in biological samples (BL4-Analyze)</p> <p>CO5- To evaluate the applications of biomolecules in various fields (BL5-Evaluate)</p>							
Courses Elements	Skill Development ✓ Entrepreneurship ✗ Employability ✗ Professional Ethics ✗ Gender ✗ Human Values ✗ Environment ✗		SDG (Goals)	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Basic Concepts of Intermediary metabolism, Carbohydrate metabolism: Glycolysis, Kreb's Cycle, glycogenolysis, glycogenesis, pentose phosphate pathway, gluconeogenesis, glyoxalate pathway, Cori cycle. Metabolic disorders	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	7
2	Biosynthesis and degradation of fatty acids, Biosynthesis of lipids, Degradation of lipids, Regulation of lipid metabolism. Formation of ketone bodies Ketosis. Metabolic disorders	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	7
3	Transamination, Oxidative deamination, decarboxylation, Biosynthesis of amino acids, Degradation of amino acids, Regulation of amino acids metabolism. Nitrogen Metabolism - Assimilation of inorganic Nitrogen sources; Urea cycle	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments,	7
4	Biosynthesis and degradation of purine nucleotides, Biosynthesis and Degradation of Pyrimidine nucleotide, regulation of purine and pyrimidine metabolism.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lectures	10
5	Photosynthetic microorganisms, photosynthetic pigments, and generation of reducing power by cyclic and non-cyclic photophosphorylation, Electron transport chain in photosynthetic bacteria. Carbon dioxide fixation pathways. Respiration : Components of electron transport chain, free energy changes and electron transport, oxidative phosphorylation, ATP synthase and theories of ATP formation.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Estimation of Blood Glucose by Coupled Enzyme Assay	Experiments	BL4-Analyze	3
II	Sugar Fermentation by Microorganisms	PBL	BL3-Apply	3 DAYS
III	Demonstration of Starch Digestion by Salivary Amylase	Simulation	BL2-Understand	3
IV	Isolation and Fractionation of Egg Lipids by TLC and their Estimation	PBL	BL5-Evaluate	6

Part D(Marks Distribution)

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

Part E

Books	David L. Nelson, Michael M. Cox, W. H. Freeman; Lehninger Principles of Biochemistry, Fifth Edition, , 2008, th Edition
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7545035/
References Books	G.Zubay Biochemistry 3 rd Edition Stryer Biochemistry 9 th Edition DVoet and JG. Voet , J Wiley and Sons. Biochemistry 5 th Edition David Plummer Practical Biochemistry Volume 3 Company.S;Philadelphia, Stipanuk.PA. (4th edition) (2019) Biochemical, physiological, and molecular aspects of human nutrition. Second Edition, Murray, R., Mayes, P., Rodwell, V., Granner, D (2006) Harper's illustrated biochemistry. 26th edition, McGraw-Hill Companies, Columbus, OH.
MOOC Courses	https://nptel.ac.in/courses/104105139
Videos	https://nptel.ac.in/courses/104105139

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

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

Part A

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

Part B

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

Part C

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	Bioinformatics
Course Code	BSMB501 (T)

Part A

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

Part B

Modules	Contents	Pedagogy	Hours
Unit-1	Overview of Bioinformatics, divisions, scope, tasks and future prospects of bioinformatics, bioinformatics as multidisciplinary domain,	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
Unit-2	Databases and search tools: Types of Databases and their applications, National Centre for Biotechnology Information (NCBI), European Bioinformatics Institute (EBI), DNA Databank of Japan (DDBJ), PDB and SWISSPROT.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
Unit-3	Sequence alignment: Types of sequence alignment, Pairwise sequence alignment and its softwares, BLAST , Types and versions of BLAST, FASTA: Types and versions of FASTA	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
Unit-4	Matrices and algorithms: Dot matrix, BLOSUM, PAM, BLAST algorithm, Needleman Wunsch algorithm, Smith Watermann algorithm, Fitch Margoliash algorithm.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
Unit-5	Multiple sequence alignment methods and its softwares, Phylogenetic prediction , Maximum parsimony method, Distance method, Maximum likelihood method	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	Environmental Biotechnology
Course Code	DSE I (T)

Part A

Year	3rd	Semester	5th	Credits	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Specific Elective							
Pre-Requisite/s				Co-Requisite/s				
Course Outcomes & Bloom's Level	<p>CO1- The student will be able to Remember the potential of biodegradation of organic pollutants, taking microbial and physical/chemical environments, as well as the chemical structure of the compound itself, into consideration(BL1-Remember)</p> <p>CO2- Students will understand the phenomenon of phytoremediation for the decontamination of soil and water, wetlands as treatment processes, biofilms/biofilters for vapor-phase wastes, and composting.(BL2-Understand)</p> <p>CO3- Students will learn about the environmental quality evaluation, monitoring, and remediation of contaminated environments(BL3-Apply)</p> <p>CO4- Students will learn about the use of biosensors in environmental analysis, environmental engineering.(BL4-Analyze)</p> <p>CO5- To evaluate the use of environmental methods in Monitoring and social purpose(BL5-Evaluate)</p>							
Coures Elements	Skill Development ✗ Entrepreneurship ✗ Employability ✓ Professional Ethics ✗ Gender ✗ Human Values ✗ Environment ✓		SDG (Goals)	SDG4(Quality education) SDG6(Clean water and sanitation) SDG7(Affordable and clean energy) SDG12(Responsible consumption and production) SDG13(Climate action)				

Part B

Modules	Contents	Pedagogy	Hours
1	Scope :Branches of ecology, Population & Community Ecology Abiotic factors – water, soil, Temperature ,light. Biotic factors. Animal relationship – symbiosis – commensalisms – mutualism –Antagonism – Antibiosis – Parasitism – Predation – competition. Allelopathy: Types & Application	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
2	Ecosystems: Structure, biotic and the abiotic components, trophic organization, Terrestrial and Aquatic Ecosystem, Ecological Pyramids: Types & Function, Energy Flow: Productivity and Ecological Efficiency ,Succession: Types and Uses, Speciation: Types	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
3	Pollution: Types & sources, Air, Water, land ,Noise, Sound, Radioactive Pollution.,Green House gases: Green House effect, Ozone Depletion, Acid Rain, Specific biotechnological applications to: Pollution control, restoration of degraded lands, free cells and immobilized cell technology for wastewater treatment aerobic and anaerobic digestion, biogas from wastes. Biotechniques for air pollution abatement and odor control.	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
4	Recycling of Nutrient Pool in environment by Biogeochemical Cycles and their application, Bioaccumulation & Biomagnification ,Bioremediation: Ex-situ & In-situ Bioremediation, Soil Bioremediation, Microbial Bioremediation, Phytoremediation	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8
5	Uses and values of Biodiversity -A very general account on uses of Bioresources-plant uses: food, timber, medicinal ornamental and other uses- animal uses: food animals (terrestrial and aquatic), non-food uses of animals, Domestic livestock-uses of microbes,Valuing Biodiversity- Instrumental (Goods, Services, and Information and Psychospiritual values) and Inherent or Intrinsic values, ethical and aesthetic values-An outline account on methods of valuing biodiversity. A general account on multilateral treaties- the role of CBD, IUCN, GEF,IBPGR, NBPGR, Environmental Protection Law, Biodiversity Act, Kyoto Protocol	Tutorials, Collaborative, Demonstrations, Project methods Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	1. Analysis of Soil(pH, Moisture, Water holding capacity, Texture)	Experiments	BL3-Apply	2
2	2. Analysis of Water (pH, Turbidity, BOD, COD)	Experiments	BL3-Apply	2
3	3. Study of Vegetation by Quadrat Method	Experiments	BL3-Apply	2
4	4. Study about the surrounding Succession stages	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	A. Scragg Environmental Biotechnology; Pearson Education Limited.
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3352250/
References Books	B.D. Singh Biotechnology: Expanding Horizons Evans GM, Furlong JC Environmental Biotechnology. Theory and Application. Willey and Sons
MOOC Courses	https://nptel.ac.in/courses/102105088
Videos	https://nptel.ac.in/courses/102105088

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

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

Part A

Year	3rd	Semester	5th	Credits	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Specific Elective							
Pre-Requisite/s	define microbes and environmental microbiology.			Co-Requisite/s	explain the distribution of microbes in several different environments, including water, sediments, soil and air.			
Course Outcomes & Bloom's Level	<p>CO1- To define microbes and environmental microbiology.(BL1-Remember)</p> <p>CO2- explain the distribution of microbes in several different environments, including water, sediments, soil and air.(BL2-Understand)</p> <p>CO3- To describe the diversity of microbes in the different environments(BL2-Understand)</p> <p>CO4- To demonstrate how diversity is assessed and identify methodological issues associated with each technique.(BL3-Apply)</p> <p>CO5- To illustrate the ecological importance of microbes and their function in natural ecosystems(BL4-Analyze)</p>							
Courses Elements	Skill Development ✓ Entrepreneurship ✗ Employability ✓ Professional Ethics ✗ Gender ✗ Human Values ✗ Environment ✓		SDG (Goals)	SDG4(Quality education) SDG6(Clean water and sanitation)				

Part B

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

Part C

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

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

Part A

Year	3rd	Semester	5th	Credits	L	T	P	C
					4	0	0	4
Course Type	Theory only							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	Understand the marine ecosystem and familiarize the structure and various habitat of marine environment.			Co-Requisite/s	To realize marine pollution and control measure, bio-corrosion and bioremediation.			
Course Outcomes & Bloom's Level	<p>CO1- To Understand the marine ecosystem and familiarize the structure and various habitat of marine environment. (BL1-Remember)</p> <p>CO2- To comprehend water borne diseases and water borne pathogen (BL2-Understand)</p> <p>CO3- To understand various biotechnology applications of marine microbiology such as biosensor, transgenic, biosurfactant etc. (BL3-Apply)</p> <p>CO4- To realize marine pollution and control measure, bio-corrosion and bioremediation. (BL4-Analyze)</p>							
Courses Elements	Skill Development ✓ Entrepreneurship ✗ Employability ✓ Professional Ethics ✗ Gender ✗ Human Values ✗ Environment ✓		SDG (Goals)	SDG4(Quality education)				

Part B

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

Part C

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(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	<p>CO1- Students will understand various principles, need and prospect of organic farming including the importance of sustainability, biodiversity and ecological balance. (BL2-Understand)</p> <p>CO2- To equip learners with the knowledge and skills necessary to practice sustainable agriculture and the production of healthy, organic food(BL2-Understand)</p> <p>CO3- Students will gain hands on experience through field work, farm visits or practical exercises to apply their knowledge in a real world setting(BL3-Apply)</p> <p>CO4- learners will explore the significance of soil health in organic farming and various methods to enhance soil fertility through composting and crop rotation. (BL4-Analyze)</p> <p>CO5- Students will learn about marketing organic products, understanding consumer demand and the economic aspect of Organic farming(BL6-Create)</p>							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professional Ethics ✗ Gender ✗ Human Values ✗ Environment ✓		SDG (Goals)	SDG2(Zero hunger) SDG3(Good health and well-being) SDG4(Quality education) SDG6(Clean water and sanitation) SDG7(Affordable and clean energy) SDG8(Decent work and economic growth) SDG11(Sustainable cities and economies) SDG13(Climate action) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours
I	History and development, IFOAM Definition and Principle- health, fairness, ecology and care, Methods, advantages and limitations, Need of Organic farming in present context and future prospects- barrier	Lecture methods, group discussions, demonstrations, field work, experiments, ABL, PBL, Trainings	7
II	ORGANIC ECOSYSTEM & THEIR CONCEPT Structure and function, Productivity, Decomposition, Nutrient cycling, Eutrophication, Biological magnification	Lecture methods, group discussions, demonstrations, field work, experiments, ABL, PBL, Trainings	8
III	SOIL □ Definition, Composition of Soil- Soil texture and Types, Soil structure, Soil Profile, Humus & Soil pH, Role of Soil in Organic Farming, Soil factors affecting plant Growth: light, heat, water, humidity, pH and Nutrition, C: N ratio of good fertile Soil	Lecture methods, group discussions, demonstrations, field work, experiments, ABL, PBL, Trainings	7
IV	PLANT NUTRITION □ Structural organization & function of different Plant organ, Plant nutrient- Micro and Macro, Importance & Deficiency, Symptoms, Sources : Organic, Green manure- Method of composting, Benefit & Limitations, oil microorganism: Mycorrhiza, Rhizosphere- Significance	Lecture methods, group discussions, demonstrations, field work, experiments, ABL, PBL, Trainings	8

Part C

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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



Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	Bacteriology, mycology and Virology
Course Code	BSMB 601(T)

Part A

Year	3rd	Semester	6th	Credits	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	characteristics of bacterial cells, cell organelles, cell wall composition and various appendages like capsules, flagella or pili.			Co-Requisite/s	Differentiate a large number of common bacteria by their salient characteristics; classify bacteria into groups.			
Course Outcomes & Bloom's Level	<p>CO1- Describe characteristics of bacterial cells, cell organelles, cell wall composition and various appendages like capsules, flagella or pili (BL1-Remember)</p> <p>CO2- Differentiate a large number of common bacteria by their salient characteristics; classify bacteria into groups. (BL2-Understand)</p> <p>CO3- Describe the nutritional requirements of bacteria for growth; developed knowledge and understanding that besides common bacteria there are several other microbes which grow under extreme environments (BL2-Understand)</p> <p>CO4- Perform basic laboratory experiments to study microorganisms; methods to preserve bacteria in the laboratory; calculate generation time of growing bacteria (BL4-Analyze)</p> <p>CO5- Discuss how fungi and algae are used as biofertilizers in agriculture and as biopesticides. To illustrate creative use of modern tools and techniques for manipulation and analysis of genomic sequences. (BL5-Evaluate)</p>							
Courses Elements	Skill Development ✓ Entrepreneurship ✗ Employability ✓ Professional Ethics ✗ Gender ✗ Human Values ✗ Environment ✓		SDG (Goals)	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
1	Morphology And Ultra Structure of Bacteria, Size, Shape and Arrangement Of Bacteria, Ultra Structure Of Bacterial Cell Wall Of Eubacteria And Archaeobacteria, Relation Of Gram Staining To Cell Wall Of Bacteria, Structure And Function Of Flagella, Fimbriae, Pili, Capsule, Slime Layer, Chemotaxis And Phototaxis, S-Layer And Capsule Types. Structure And Function of Mesosome, Ribosome, Nucleoid, Cytoplasmic Inclusion Bodies. Formation And Structure of Endospore.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
2	Kinetics Of Bacterial Growth, Bacterial Culture Types-Synchronous, Continuous, Arithmetic, Batch Culture, Growth Phase, Growth Kinetics, Measurement of Growth, Environmental Factor Affecting Growth-Temperature, PH, Nutrient Concentration, Osmotic Pressure.	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	7
3	History and development of virology, Nomenclature and classification of virus, Morphological characteristics of virus:-enveloped capsid nucleic acids, Virus related particles viroid, and virusoids, Technique for visualization and enumeration of and enumeration of viral particles. Brief History of Plant Virology, Classification and structure of plant virus. Tobacco mosaic virus, cauliflower mosaic virus, and potato tuber pindle virus. Future Aspects of viruses	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
4	Classification And General Characteristics Of Fungi, Colonial And Morphological Structure Of Fungi, Cell Wall Structure Of Fungi Fungal Nutrition (Carbon, Nitrogen And Oxygen) And Fungal Growth Reproduction Of Fungi: Vegetative, Asexual And Sexual, Heterothallism, Heterokaryosis And Parasexuality In Fungi, Microbial Interactions, Secondary Metabolites, Antimicrobial	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	7
5	Role Of Fungi in Bio-Deterioration, Application of Fungi In Bio Remediation, Fungi As Plant Pathogen, Phosphate Solubilizing Fungi And Their Application, Mushroom Cultivation, Industrially Important Fungal Enzymes.	Audio/Video clips, group discussion, lecture with ppt, Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Mushroom Cultivation	Experiments	BL6-Create	12
2	Isolation of Bacterial Colony by Streaking Plate method	Experiments	BL2-Understand	3
3	Isolation of Bacterial Colony by Pour Plate method	Experiments	BL2-Understand	3
4	Isolation of Bacterial Colony by Serial dilution Plate method	Experiments	BL2-Understand	3
5	Endospore Staining	Experiments	BL2-Understand	3

Part D (Marks Distribution)

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

Part E

Books	Pelczar,M.J.Chan,E.C.S. and Krieg,N.R.(1986).Microbiology, Vth Eds.,Mc .Graw Hill.
Articles	https://www.researchgate.net/publication/313745331_Plant_Pathogenic_Fungi
References Books	Modern Microbial Genetics by U.N.Streips and R.E. Yasbin, 2nd edition; Wiley Publishers;2002.
MOOC Courses	https://nptel.ac.in/courses/102105087
Videos	https://nptel.ac.in/courses/102105087

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	Food and Dairy Microbiology
Course Code	BSMB 602 (T)

Part A

Year	3rd	Semester	6th	Credits	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Explain the interactions between microorganisms and the food environment, and factors influencing their growth and survival.			Co-Requisite/s	Describe the characteristics of foodborne, waterborne, and spoilage microorganisms, and methods for their isolation, detection, and identification.			
Course Outcomes & Bloom's Level	CO1- Explain the interactions between microorganisms and the food environment, and factors influencing their growth and survival. (BL1-Remember) CO2- Explain the significance and activities of microorganisms in food. (BL2-Understand) CO3- Describe the characteristics of foodborne, waterborne and spoilage microorganisms, and methods for their isolation, detection and identification. (BL3-Apply) CO4- Explain why microbiological quality control programmes are necessary in food production. (BL3-Apply) CO5- Explain the effects of fermentation in food production and how it influences the microbiological quality and status of the food product. (BL4-Analyze)							
Courses 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, O ₂ 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, SO ₂ , 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	tutorials, 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	tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visit	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Staining of microorganisms	Experiments	BL3-Apply	2
2	Composition, preparation and sterilization of media	Experiments	BL3-Apply	2
3	Demonstration of techniques for pure culture of microorganisms	Experiments	BL4-Analyze	2
4	Streak plate method	Experiments	BL3-Apply	2
5	Pour plate method.	Experiments	BL3-Apply	2
6	Serial dilution agar plate method	Experiments	BL4-Analyze	2
7	Microbiology testing of milk	PBL	BL4-Analyze	2
8	Serial dilution agar plate method	Experiments	BL4-Analyze	2

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	Agriculture 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	<p>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)</p> <p>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)</p> <p>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)</p> <p>CO4- To identify specific microorganisms important to animals, plants and soil ecosystems, and explain why these microorganisms are significant(BL4-Analyze)</p> <p>CO5- Review and evaluate readings relating to microbiology and agricultural production(BL5-Evaluate)</p>								
Courses 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

(SOS)(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)							
Courses 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 its fertility.	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 development 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

(SOS)(Bsc_Microbiology)

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

Part A

Year	3rd	Semester	6th	Credits	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s	Provide knowledge about Metabolic Mechanisms in Living Beings			Co-Requisite/s	relate with other clinical and research as well as toxicological fields.			
Course Outcomes & Bloom's Level	CO1- To describe the concept of organic mechanisms (metabolism) in animals (BL1-Remember) CO2- Understand about the metabolism of biomolecules and toxicology (BL2-Understand) CO3- To understand the importance of metabolism in life and its applications in other sciences (BL3-Apply) CO4- To provide experimental basis and to enable students to basic concept of metabolism and toxicology (BL4-Analyze) CO5- To evaluate the applications of biological mechanism and toxicology in various fields such as research and development. (BL5-Evaluate) CO6- To apply the understanding of metabolism and toxicology in various levels. (BL6-Create)							
Courses Elements	Skill Development ✓ Entrepreneurship ✗ Employability ✓ Professional Ethics ✗ Gender ✗ Human Values ✗ Environment ✗		SDG (Goals)	SDG4(Quality education)				

Part B

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

Part C

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

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

Part A

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

(SOS)(Bsc_Microbiology)

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

Part A

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

Part B

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

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	To isolate genomic DNA from the animal sample	Experiments	BL3-Apply	6
II	To analyse immunological activity using various assays	PBL	BL3-Apply	7
III	To perform ELISA test	PBL	BL5-Evaluate	6
IV	To perform radial immunodiffusion	Experiments	BL3-Apply	5
V	To analyse the AIDS patients through immunological assays and molecular 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

(SOS)(Bsc_Microbiology)

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

Part A

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

Part B

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

Part C

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

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

Part A

Year	3rd	Semester	6th	Credits	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Generic Elective							
Pre-Requisite/s	Students must have studied food business managemnet in previous semester			Co-Requisite/s	Students should have prior knowledge of economics and basics of management			
Course Outcomes & Bloom's Level	CO1- Communicate with required clarity ensuring that the information communicated is clear and accurate. (BL1-Remember) CO2- Comprehend and apply basic computer working, basic operating system and uses internet services to get accustomed & take benefit of IT developments in the industry. (BL2-Understand) CO3- To demonstrate knowledge of entrepreneurship and identify establishment for supporting the development of businesses/entrepreneurship. (BL3-Apply) CO4- To illustrate procedures to achieve a safe working environment in line with occupational health, safety, environment regulations. (BL4-Analyze) CO5- Comply time management technique in day-to-day work. (BL5-Evaluate)							
Courses 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

(SOS)(Bsc_Microbiology)

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

Part A

Year	3rd	Semester	6th	Credits	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Skill Enhancement Courses							
Pre-Requisite/s	Knowledge of food laboratory equipments and testing protocols			Co-Requisite/s	To study guidelines on good laboratory practices and SOPs and calibration procedure of different instruments.			
Course Outcomes & Bloom's Level	<p>CO1- to learn the regulations and various guidelines on good laboratory practices and SOPs and calibration procedure of different instruments. (BL1-Remember)</p> <p>CO2- to gain the knowledge of the various hazards and safety procedures to be followed in laboratory. (BL2-Understand)</p> <p>CO3- To provide the students a specialized knowledge about implementation of laboratory standard practices, their records and analyze laboratory data with accuracy. (BL3-Apply)</p> <p>CO4- To apply the subject knowledge in minimization of errors related with handling of laboratory accessories and equipment's (BL4-Analyze)</p> <p>CO5- To evaluate the theoretical knowledge of good laboratory practices and its implementation in food industry laboratories to ensure the quality and safety of the foods (BL5-Evaluate)</p>							
Courses Elements	Skill Development ✓ Entrepreneurship ✗ Employability ✓ Professional Ethics ✗ Gender ✗ Human Values ✗ Environment ✗		SDG (Goals)	SDG1(No poverty) SDG2(Zero hunger) SDG3(Good health and well-being) SDG6(Clean water and sanitation) SDG12(Responsible consumption and production)				

Part B

Modules	Contents	Pedagogy	Hours
1	Concept and evolution and scopes of Quality Control and Quality Assurance; Good laboratory practices (GLP) - Introduction, history, definition, principles and WHO guidelines on GLP. Levels of Laboratories,	Lecture method, group discussion, seminar	06
2	General Rules/Protocols for Lab Safety measures, Precaution and Safety in handling of chemicals, laboratory tools, glasswares, food ingredients/raw materials, and instruments; Biosafety in laboratory - Laboratory associated infections and other hazards, assessment of biological Hazards and levels of biosafety, fire prevention methods	Lecture method, group discussion, seminar, Quiz, Illustrate with analogies	07
3	Food laboratory sanitation, Control of rats, rodents, birds, insects and microbes. Cleaning and Disinfection: Physical and Microbiological Approach, cleaning of glasswares and utensils, Basic SOPs for instrument handling and maintenance and raw material/ingredients storage	Quiz, Illustrate with analogies	07
4	Internal and External Audit, Log Book Maintenance, Keeping data records, its analysis by using statistical and mathematical tools. Result analysis and its interpretation; Arrangement of chemicals, reagents, glasswares, etc in laboratory.	Audio/Video clips, group discussion, lecture with ppt, Review Analysis	05
5	Calibration of common food technology instruments: pH meter, spectrophotometer, water bath, moisture analyzer, hot air oven, pipettes, scales and balances, centrifuge, etc.; Quality management in industry and laboratory, Laboratory Design & Layout of food technology laboratory	Audio/Video clips, group discussion, lecture with ppt, Review Analysis	05

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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



Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	Microbial Genetics
Course Code	BSMB 701 (T)

Part A

Year	4th	Semester	7th	Credits	L	T	P	C
					3	0	0	3
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Students should be aware about the cell structures of microorganisms, their growth and development process and genetic behaviour			Co-Requisite/s				
Course Outcomes & Bloom's Level	<p>CO1- The student will deepen the principles in microbial inheritance, diversity and evolution. (BL1-Remember)</p> <p>CO2- The student will understand how genetic diversity is generated and how genetic changes affect the expression of genes, resulting in variation in microbial phenotypes (BL2-Understand)</p> <p>CO3- The student will understand how phenotypic and genetic variation is altered by natural selection, leading to changes in gene and genotype frequencies at the population and pangenome level. (BL2-Understand)</p> <p>CO4- The student will become familiar with common research methods used for the study of microbial genetics, including experimental evolution, sequencing techniques (whole genome sequencing, metagenomics, transcriptomics) and comparative analyses. (BL3-Apply)</p> <p>CO5- learning opportunities in the basic principles of medical microbiology and infectious disease. (BL2-Understand)</p>							
Courses Elements	Skill Development ✗ Entrepreneurship ✗ Employability ✓ Professional Ethics ✗ Gender ✗ Human Values ✗ Environment ✗		SDG (Goals)	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
I	DNA structure, Salient features of double helix, Types of DNA, denaturation and renaturation, topoisomerases; Organization of DNA Prokaryotes, Viruses, RNA Structure	Lecture method, group discussion, demonstration, experiments, ABL, PBL,	8
II	Bidirectional and unidirectional replication, semi- conservative, semi- discontinuous replication. Mechanism of DNA replication: Enzymes and proteins involved in DNA replication –DNA polymerases, DNA ligase, primase, telomerase – for replication of linear ends.	Lecture method, group discussion, demonstration, experiments, ABL, PBL,	9
III	Transcription: Definition, promoter - concept and strength of promoter. Transcriptional Machinery and Mechanism of transcription.,	Lecture method, group discussion, demonstration, experiments, ABL, PBL,	8
IV	Genetic code, Translational machinery, Charging of tRNA, aminoacyl tRNA synthetases, Mechanisms of initiation, elongation and termination of polypeptides, Principles of transcriptional regulation, Mutations and mutagenesis	Lecture method, group discussion, demonstration, experiments, ABL, PBL,	9
V	Transformation - Discovery, mechanism of natural competence. Conjugation - Discovery, mechanism, Hfr and F' strains. Transduction - Generalized transduction, specialized transduction, Prokaryotic transposable elements – Insertion Sequences, composite and non-composite transposons, Replicative and Non replicative transposition, Uses of transposons and transposition.	Lecture method, group discussion, demonstration, experiments, ABL, PBL,	9

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Study of different types of DNA and RNA using micrographs and model / schematic representations.	Experiments	BL2-Understand	2
II	Study of semi-conservative replication of DNA through micrographs / schematic representations.	Experiments	BL2-Understand	2
III	Resolution and visualization of DNA by Agarose Gel Electrophoresis	Experiments	BL4-Analyze	6
IV	Resolution and visualization of proteins by Polyacrylamide Gel Electrophoresis (SDS-PAGE).	PBL	BL3-Apply	6
V	Study the effect of chemical (HNO ₂) and physical (UV) mutagens on bacterial cells.	PBL	BL4-Analyze	5
VI	Study survival curve of bacteria after exposure to ultraviolet (UV) light	PBL	BL4-Analyze	6
VII	Demonstration of Bacterial Transformation and calculation of transformation efficiency.	PBL	BL2-Understand	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

Part E

Books	Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition, Cold Spring Harbour Laboratory press
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9315481/
References Books	Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008) Molecular Biology of the Gene, 6th edition, Cold Spring Harbour Lab. Press, Pearson Publication Becker WM, Kleinsmith LJ, Hardin J and Bertoni GP (2009) The World of the Cell, 7th edition, Pearson Benjamin Cummings Publishing, San Francisco. Karp G (2010) Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons. Inc.
MOOC Courses	https://onlinecourses.swayam2.ac.in/cec22_bt05/preview
Videos	https://onlinecourses.swayam2.ac.in/cec22_bt05/preview

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

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

Part A

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

Part B

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

Part C

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

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

Part A

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

Part B

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

Part C

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

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

Part A

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

Part B

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

Part C

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(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
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)							
Courses 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

(SOS)(Bsc_Microbiology)

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

Part A

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

Part B

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

Part C

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

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

Title of the Course	Microbial Quality Control in Food and Pharmaceutical Industries
Course Code	BSMB 801 (T)

Part A

Year	4th	Semester	8th	Credits	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Disciplinary Major							
Pre-Requisite/s	Student must be aware with the basic laboratory rules and regulations, safety measures and bioethics.			Co-Requisite/s				
Course Outcomes & Bloom's Level	CO1- Students will gain knowledge about the different types of microorganisms and their significance.(BL1-Remember) CO2- To understand Basic concept of microbiological quality control(BL2-Understand) CO3- To Design SOPs and related laboratory infrastructure(BL3-Apply) CO4- To Conduct microbiological quality control(BL3-Apply)							
Courses Elements	Skill Development ✓ Entrepreneurship ✗ Employability ✓ Professional Ethics ✗ Gender ✗ Human Values ✓ Environment ✓		SDG (Goals)	SDG3(Good health and well-being) SDG4(Quality education) SDG8(Decent work and economic growth)				

Part B

Modules	Contents	Pedagogy	Hours
I	Microbiological Laboratory and Safe Practices: Good laboratory practices, Good microbiological practices. Biosafety cabinets – Working of biosafety cabinets, using protective clothing, specification for BSL-1, BSL-2, BSL-3. Discarding biohazardous waste – Methodology of Disinfection, Autoclaving & Incineration.	Lecture method, group discussions, demonstrations, experiments, industrial visits, ABL, PBL	8
II	Determining Microbes in Food / Pharmaceutical Samples: Culture and microscopic methods - Standard plate count, Most probable numbers, Direct microscopic counts, Biochemical and immunological methods: Limulus lysate test for endotoxin, gel diffusion, sterility testing for pharmaceutical products.	Lecture method, group discussions, demonstrations, experiments, industrial visits, ABL, PBL	9
III	Pathogenic Microorganisms of importance in Food & Water: Enrichment culture technique, Detection of specific microorganisms - on XLD agar, Salmonella Shigella Agar, Manitol salt agar, EMB agar, McConkey Agar, Saboraud Agar.	Lecture method, group discussions, demonstrations, experiments, industrial visits, ABL, PBL	8
IV	Ascertaining microbial quality of milk by MBRT, Rapid detection methods of microbiological quality of milk at milk collection centres (COB, 10 min Resazurin assay).	Lecture method, group discussions, demonstrations, experiments, industrial visits, ABL, PBL	9
V	HACCP for Food Safety and Microbial Standards: Hazard analysis of critical control point (HACCP) - Principles, flow diagrams, limitations Microbial Standards for Different Foods and Water – BIS standards for common foods and drinking water.	Lecture method, group discussions, demonstrations, experiments, industrial visits, ABL, PBL	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Design of a quality control Laboratory	PBL	BL3-Apply	3
II	SOP designing and hands on Practice	PBL	BL3-Apply	7
III	Bioburden test, sterility test, environmental monitoring, detection of specific pathogens, personal hygiene Monitoring	PBL	BL4-Analyze	15 days
IV	To learn Good Laboratory Practice (GLP), Major drug and food regulatory agencies	Industrial Visit	BL2-Understand	5

Part D(Marks Distribution)

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

Part E

Books	Harrigan WF (1998)Laboratory Methods in Food Microbiology, 3rd ed. Academic Press. Garg N, Garg KL and Mukerji KG (2010) Laboratory Manual of Food Microbiology I K International Publishing House Pvt. Ltd.
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3624724/#:~:text=Quality%20control%20(QC)%20in%20diagnostic,identification%20and%20antibacteria
References Books	Jay JM, Loessner MJ, Golden DA (2005) Modern Food Microbiology, 7th edition. Springer Baird RM, Hodges NA and Denyer SP (2005) Handbook of Microbiological Quality control in Pharmaceutical and Medical Devices, Taylor and Francis
MOOC Courses	https://nptel.ac.in/courses/112107259
Videos	https://nptel.ac.in/courses/112107259

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(Bsc_Microbiology)

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

Part A

Year	4th	Semester	8th	Credits	L	T	P	C
					2	0	0	2
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Student must know Genetic engineering applications in relation to production of pharmaceuticals and the use of microorganisms in fermentation technology			Co-Requisite/s				
Course Outcomes & Bloom's Level	CO1- To remember the basic concept of enzymes, drug, gene and genome interaction (BL1-Remember) CO2- Understanding the importance of Immobilized enzymes in Pharmaceutical Industries(BL2-Understand) CO3- To apply Genetic engineering applications in relation to production of pharmaceuticals(BL3-Apply) CO4- To understand the Importance of Monoclonal antibodies in Industries(BL2-Understand) CO5- To apply and analyze the Appreciate the use of microorganisms in fermentation technology(BL4-Analyze)							
Courses Elements	Skill Development ✓ Entrepreneurship ✗ Employability ✓ Professional Ethics ✗ Gender ✗ Human Values ✓ Environment ✓		SDG (Goals)	SDG3(Good health and well-being) SDG4(Quality education) SDG8(Decent work and economic growth) SDG9(Industry Innovation and Infrastructure)				

Part B

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

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Isolation of enzymes from natural isolates	PBL	BL3-Apply	1 week
II	production of immobilized enzymes using isolated enzymes	PBL	BL6-Create	7
III	Isolation of genomic DNA	Experiments	BL3-Apply	6
IV	To perform restriction digestion using kit and its visualization using agarose gel electrophoresis	Experiments	BL4-Analyze	7
V	Preparation of culture media and necessary arrangements for production of amino acids	Field work	BL6-Create	30 days
VI	To demonstrate the working of PCR	Industrial Visit	BL2-Understand	5

Part D(Marks Distribution)

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

Part E

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

Course Articulation Matrix

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

Syllabus-2023-2024

(SOS)(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	<p>CO1- Explain the interactions between microorganisms and the food environment, and factors influencing their growth and survival. (BL1-Remember)</p> <p>CO2- Explain the significance and activities of microorganisms in food. (BL2-Understand)</p> <p>CO3- Describe the characteristics of foodborne, waterborne and spoilage microorganisms, and methods for their isolation, detection and identification. (BL3-Apply)</p> <p>CO4- Explain why microbiological quality control programmes are necessary in food production. (BL3-Apply)</p> <p>CO5- Explain the effects of fermentation in food production and how it influences the microbiological quality and status of the food product. (BL4-Analyze)</p>							
Courses 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, O ₂ 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, SO ₂ , 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	tutorials, 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	tutorials, 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

(SOS)(Bsc_Microbiology)

Title of the Course	Human Health and Vaccinology
Course Code	SEC VII (T)

Part A

Year	4th	Semester	8th	Credits	L	T	P	C	
					4	0	0	4	
Course Type	Theory only								
Course Category	Discipline Electives								
Pre-Requisite/s	Student should know about the basic concepts of vaccines, its types and categories.			Co-Requisite/s					
Course Outcomes & Bloom's Level	<p>CO1- To understand to develop novel agents useful in immunotherapy (BL2-Understand)</p> <p>CO2- To understand basic concepts of Human Health and Vaccinology and their types. (BL2-Understand)</p> <p>CO3- To remember about the various disease and their causes, symptoms and preventions and their interaction with human body. (BL1-Remember)</p> <p>CO4- The course aims to provide experimental basis, and to enable students to acquire a specialized knowledge and understanding. (BL3-Apply)</p> <p>CO5- To apply the understanding of Human Health and Vaccinology in evaluation in various Biological Samples for the development of DNA vaccines, recombinant vaccines, edible vaccines, nanoparticles in vaccine delivery systems. and to evaluate the applications of Human Health a Vaccinology in various fields such as research and industries. (BL4-Analyze)</p>								
Courses Elements	Skill Development ✓ Entrepreneurship ✗ Employability ✓ Professional Ethics ✗ Gender ✗ Human Values ✗ Environment ✗		SDG (Goals)	SDG3(Good health and well-being) SDG4(Quality education) SDG12(Responsible consumption and production)					

Part B

Modules	Contents	Pedagogy	Hours
I	Definition and Concept of Public Health, Historical aspects of Public Health, Changing Concepts of Public Health, Public Health versus Medical Care, Unique Features of Public Health, Public Health as a System. Determinants of Health (Social, Economic, Cultural, Environmental, Education, Genetics, Food and Nutrition).	lecture method, collaborative learning, Field visits, ABL	8
II	Indicators of health, Burden of disease, Health promotion, Concept of Prevention, Intervention, Role of different disciplines in Public Health, Scope of Public Health. Historical aspects of epidemiology, Basic concepts, definition and significance, aims of epidemiology, Clinical versus epidemiological approach, Applications and uses of epidemiology,	lecture method, collaborative learning, Field visits, ABL, PBL	9
III	Concept of diseases, Natural history of disease, spectrum of disease, Concept of control, frequency, distribution of disease, Measurements of mortality Measurements of morbidity (prevalence and incidence), Methods of descriptive epidemiology, analytical epidemiology, experimental epidemiology	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
IV	History of Vaccinology, conventional approaches to vaccine development, live attenuated and killed vaccines, adjuvants, quality control, preservation and monitoring of microorganisms in seed lot systems. Instruments related to monitoring of temperature, sterilization, environment	Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments,	8
V	Preservation techniques to maintain good antigen quality, freeze drying, Introduction to newer vaccine approaches namely- subunit vaccines, synthetic vaccines, DNA vaccines, virus like particles, recombinant vaccines, edible vaccines, nanoparticles in vaccine delivery systems.	Tutorials, Collaborative, Demonstrations, videos, PBL	9

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Case Study: Influenza Vaccination	Case Study	BL4-Analyze	15 days
II	How Vaccines Protect Populations I: Understanding Quantitative Concepts in Vaccinology: Susceptibility, R0, Contact Rate, Critical Vaccination Fraction	PBL	BL5-Evaluate	30 days

Part D(Marks Distribution)

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

Part E

Books	Mary-Jane Schneider and Henry Schneider, Introduction to Public Health, Jones and Bartlett Publishers., 2006 (2nd edition),
Articles	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7371956/
References Books	Kirch, Wilhelm, Environmental Biotechnology. Theory and Application. Wiley and Sons, 2008, Volume 1 & 2, Kluwer Academic Publishers. Barry R Bloom, Paul-Henri Lambert, The Vaccine Book. 2002, Academic Press Levine MM, Kaper JB, Rappuoli R, Liu MA, Good MF., The new generation vaccines. 3rd Ed. Informa Healthcare. John Yarnell, Epidemiology and Prevention, 2007, A system Based Approach, Oxford.
MOOC Courses	https://onlinecourses.nptel.ac.in/noc20_hs20/preview https://onlinecourses.nptel.ac.in/noc23_hs05/preview
Videos	https://onlinecourses.nptel.ac.in/noc20_hs20/preview https://onlinecourses.nptel.ac.in/noc23_hs05/preview

Course Articulation Matrix

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

