

B.Sc. BIOTECHNOLOGY

SEM	Course Code	Part	Course	Course Title	Ins. Hrs /Week	Credit	Marks		Total
							CIA	ESE	
I	20U1LT1/LA1/LF1/LH1/LU1	I	Language – I		6	3	25	75	100
	20UCN1LE1	II	English - I		6	3	25	75	100
	20UBT1CC1	III	Core – I	Essential Biodiversity	5	5	25	75	100
	20UBT1CC2P		Core – II	Essential Biodiversity – Practical	3	2	25	75	100
	20UBT1AC1		Allied –I	Microbiology - I: Bacteriology and Virology	5	4	25	75	100
	20UBT1AC2P		Allied –II	Microbiology - I: Bacteriology and Virology - Practical	3	2	25	75	100
	20UCN1AE1	IV	AEC-I	Value Education	2	2	-	100	100
	TOTAL				30	21			700
II	20U2LT2/LA2/LF2/LH2/LU2	I	Language – II		6	3	25	75	100
	20UCN2LE2	II	English – II		6	3	25	75	100
	20UBT2CC3	III	Core – III	Cytology and Cell Biology	6	5	25	75	100
	20UBT2CC4P		Core – IV	Cytology and Cell Biology - Practical	3	2	25	75	100
	20UBT2AC3		Allied – III	Microbiology – II: Applied Microbiology	4	3	25	75	100
	20UBT2AC4P		Allied –IV	Microbiology – II: Applied Microbiology – Practical	3	2	25	75	100
	20UCN2SE1	IV	Skill Enhancement Course -I @	Soft Skills Development	2	2	-	100	100
	TOTAL				30	20			700
III	20U3LT3/LA3/LF3/LH3/LU3	I	Language– III		6	3	25	75	100
	20UCN3LE3	II	English – III		6	3	25	75	100
	20UBT3CC5	III	Core– V	Genetics and Evolution	4	4	25	75	100
	20UBT3CC6		Core– VI	Genetics and Evolution - Practical	3	2	25	75	100
	20UBT3AC5		Allied– V	Biochemistry - I: Biomolecules	4	3	25	75	100
	20UBT3AC6P		Allied–VI	Biochemistry – I: Biomolecules - Practical	3	2	25	75	100
	20UBT3GE1	IV	Generic Elective – I #		2	2	-	100	100
	20UCN3AE2		AEC-II	Environmental Studies	2	2	-	100	100
	TOTAL				30	21			800
IV	20U4LT4/LA4/LF4/LH4/LU4	I	Language–IV		6	3	25	75	100
	20UCN4LE4	II	English– IV		6	3	25	75	100
	20UBT4CC7	III	Core– VII	Molecular Biology and Recombinant DNA Technology	5	5	25	75	100
	20UBT4CC8P		Core - VIII	Molecular Biology and Recombinant DNA Technology - Practical	3	2	25	75	100
	20UBT4AC7		Allied– VII	Biochemistry - II: Bioenergetics and Metabolism	5	3	25	75	100
	20UBT4AC8P		Allied–VIII	Biochemistry - II: Bioenergetics and Metabolism- Practical	3	2	25	75	100
	20UBT4GE2	IV	Generic Elective – II #		2	2	-	100	100
	20UCN4EA	V	Extension Activities	NCC, NSS, etc.	-	1	-	-	-
	TOTAL				30	21			700
V	20UBT5CC9	III	Core – IX	Plant and Animal Physiology	6	5	25	75	100
	20UBT5CC10		Core – X	Enzymology	5	5	25	75	100
	20UBT5CC11		Core – XI	Immunology	5	5	25	75	100
	20UBT5CC12P		Core - XII	Plant and Animal Physiology, Enzymology, Immunology - Practical	5	5	25	75	100
	20UBT5DE1	IV	DSE – I **		5	4	25	75	100
	20UBT5SE2		Skill Enhancement Course -II @		2	2	-	100	100
	20UBT5SE3		Skill Enhancement Course -III @		2	2	-	100	100
	20UBT5EC1		Extra Credit Course - I	General Intelligence for competitive examinations	-	4*	--	100*	100*
	TOTAL				30	28			700
VI	20UBT6CC13	III	Core– XIII	Plant Biotechnology	5	5	25	75	100
	20UBT6CC14		Core– XIV	Animal Biotechnology	5	5	25	75	100
	20UBT6CC15		Core - XV	Bioinformatics and Biostatistics	5	5	25	75	100
	20UBT6CC16P		Core - XVI	Plant Biotechnology, Animal Biotechnology and Bioinformatics and Biostatistics- Practical	5	5	25	75	100
	20UBT6DE2		DSE – II **		5	4	25	75	100
	20UBT6DE3		DSE – III **		4	4	25	75	100
	20UCN6AE3	IV	AEC-III	Gender Studies	1	1	-	100	100
	20UBT6EC2		Extra Credit Course - II	Biotechnology for competitive examinations	-	4*	--	100*	100*
	20UBTAECA		Extra Credit Course for all	Online Course	-	1*	--	-	-
	TOTAL				30	29			700
	GRAND TOTAL				180	140	-	-	4300

@ Skill Enhancement Courses

SEMESTER	COURSE CODE	COURSE TITLE
V	20UBT5SE2A	Environmental Biotechnology
	20UBT5SE2B	Basics of Forensic Science
	20UBT5SE3A	Industrial Fermentations
	20UBT5SE3B	Molecular Diagnostics

**** Discipline Specific Electives**

SEMESTER	COURSE CODE	COURSE TITLE
V	20UBT5DE1A	Genomics and Proteomics
	20UBT5DE1B	Ecology and Environment Management
VI	20UBT6DE2A	Bioanalytical tools
	20UBT6DE2B	Medical Microbiology
	20UBT6DE3A	IPR, Biosafety and Bioethics
	20UBT6DE3B	Cancer and Stem Cell Biology

Generic Elective for other major department

SEMESTER	COURSE CODE	COURSE TITLE
III	20UBT3GE1	Edible Mushroom Cultivation Technology
IV	20UBT4GE2	Biofertilizer and Organic Farming

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20UBT1CC1	Core – I	ESSENTIAL BIODIVERSITY	5	5	100	25	75

Course Outcomes:

1. Ensure imparting the knowledge on a concept of biodiversity and its advantages.
2. Describe the evolutionary relationship of microorganisms, plants and animal.
3. Demonstrate web resources in biodiversity and its conservation using modern tools.
4. Develop the conservation strategies to the beginners for improvement of natural resources.
5. Appraise the scientific attitude using modern tools for conserving biodiversity.

Unit I Biodiversity and Conservation:

15 hours

Concepts and components of Biodiversity, Genetic diversity, Species diversity, Ecosystem diversity, Biodiversity and climate change, Hot spots and biodiversity in India. Conservation of biodiversity: *In-situ* conservation and *Ex-situ* conservation. Strategies to conserve biodiversity, Organizations involved for conservation - CBD, IUCN, UNESCO, NBPGR, WWF and FAO. #JFM- Joint Forest Management and Chipko movement#.

Unit II Microbial and plant diversity:

15 hours

Microbial diversity: an overview, Whittaker's five kingdom classification. #Origin of earth, Levels of Microbial Biodiversity#, *Plant Biodiversity*: Characteristics and an outline classification of Algae (F.E. Fritsch), Fungi (Ainsworth, 1972), Bryophyta (Rothmaler, 1951), Pteridophyta (Reimer's System, 1954), Gymnosperms (Sporne, 1965), Angiosperm – Artificial & Natural system of classification.

Unit III Animal Diversity:

15 hours

Outline classification of kingdom Animalia; Study of invertebrates upto class level for protozoa, Coelenterata, Platyhelminthes, Aschelminthes, Mollusca, Annelida, and Arthropoda. General classification and characteristics of vertebrates : Fishes, amphibians, Reptiles, Aves and Mammals and # minor phyla#.

Unit IV Insect Diversity:

15 hours

Outline of classification of Insects, characters and types; Apis (Honeybee) – Bombyx (Silkworm) – Termites (White ants) – Lepidoptera (Butterfly) and Musca (House fly), Beetle (Rhinoceros), key pest of paddy. Economic importance of insects. Integrated pest management (IPM). Bio-insecticide and repellants.

Unit V: Modern Tools and Web Resources for Biodiversity Studies:

15 hours

Assessment of mapping of biodiversity; GIS/Remote sensing, GBIF, Catalogue of Life, OBIS, Avibase, Fishbase, Fishnet, UNEP-WCMC, ITIS, FAO, IBIS, Vertnet, ATCC, PCC, NCBI Taxonomy, AVIS, Indian Biodiversity Portal, Western Ghats Biodiversity Portal, #Biodiversity Information System#.

#.....#Self-study portion

Text Books:

- T.B. 1. Gangulee Das and Datta. College Botany (Vol- II). New central Book Agency P. Ltd. 6thEdition, 2007).
- T.B. 2. J.D. Aber and J.M. Melillo, Terrestrial Ecosystems: W.B. Saunders, 2011.
- T.B. 3. Eugene P. Odum, Fundamentals of Ecology, Philadelphia, Saunders, 2003.
- T.B. 4. Ekambaranatha Ayyar, Outlines of Zoology. Vol – I: S. Viswanathan (Printers and Publishers) Pvt.Ltd. Chennai. 2015.

Books for References:

1. M. Ingrowille, Diversity and Evolution of land plants, Chapman and Hall, 2012.
2. E.L. Jordan, and P.S.Verma, Invertebrate Zoology, S. Chand and Company Ltd., New Delhi. 2010.

Web Reference: <https://nptel.ac.in/courses/102104068/>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits			
I	20UBT1CC1	ESSENTIAL BIODIVERSITY					5	5			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓		✓	✓	✓	✓		✓	✓	✓	
CO2	✓	✓	✓		✓	✓		✓	✓	✓	
CO3	✓	✓	✓	✓	✓	✓		✓	✓	✓	
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓	
Number of Matches= 44, Relationship : High											

Prepared by:

1. Dr. J. Sebastin Raj

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Checked by:

1. Dr. T. Nargis Begum

2. Dr. A. Khaleel Ahamed.

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20UBT1CC2P	Core – II	ESSENTIAL BIODIVERSITY– PRACTICAL	3	2	100	25	75

Course Outcomes:

1. Acquire basic knowledge on animal and plant organization.
2. Describe the basic knowledge of evolutionary relationship living organisms.
3. Ensure imparting the knowledge on a concept of biodiversity and its advantages.
4. Analyze the status of endangered flora and fauna.
5. Generate the knowledge through field visit of botanical garden and zoological park.

FAUNA

1. **Study of following specimens:** *Euglena, Noctiluca, Paramecium, Physalia, Metridium, Taenia, Ascaris, Nereis, Aphrodite, Leech, Peripatus, Limulus, Daphnia*, Millipede, Centipede, Beetle, *Chiton, Octopus*.
2. **Dissections/ Virtual demonstration:** Digestive system of Cockroach; Mouthparts, ovary of cockroach; Mosquito mouth parts; Unstained mount of Placoid scales.
3. **Study of following specimens:** *Balanoglossus, Amphioxus, Petromyzon, Pristis, Hippocampus, Salamander* any three common birds, Squirrel and Bat.
4. Study of a few endangered species of amphibians, reptiles, birds and mammals of India.
5. To study the faunal composition (insects and mites) of soil samples (Berley's funnel).
6. To study faunal composition of water samples (Lucky drop method)
7. Report on visit to National Park/Wild life sanctuary/Botanical garden.

FLORA

8. Study through specimens/photographs/slides of
 - a. Key stone species
 - b. Ecads, Ecotypes, Ecophenes
9. Study through permanent slides and specimens (vegetative and reproductive structures) of *Coleochaete, Vaucheria, Polysiphonia, Rhizopus, Penicillium* and *Agaricus; Riccia, Anthoceros, Funaria; Selaginella, Pteris; Cycas, Pinus, Gnetum*
10. Study of their characteristic features of any one flower for each family
 - a. Malvaceae /Fabaceae/ Cruciferae/ Ranunculaceae (any one family)
 - b. Compositae
 - c. Euphorbiaceae,
 - d. Poaceae/Liliaceae (any one family)

Text Books:

1. Gangulee Das and Datta. College Botany (Vol- II). New central Book Agency P. Ltd. 6th Edition, 2007.
2. J.D. Aber, and J.M. Melillo, Terrestrial Ecosystems: W.B. Saunders, 2010.
3. Eugene P. Odum, Fundamentals of Ecology, Philadelphia, Saunders, 2013.
4. Ekambaranatha Ayyar, Outlines of Zoology. Vol – I: S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai. 2015.

Books for References:

1. P. C. Vasishta, A.K. Sinha and Anilkumar, Botany for degree students, 2015.
2. M. Ingrowille, Diversity and Evolution of land plants, Chapman and Hall, 2012.

Web Reference: <https://nptel.ac.in/courses/102104068/>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits			
I	20UBT1CC2P	ESSENTIAL BIODIVERSITY- PRACTICAL					3	2			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓		✓	✓	✓	✓		✓	✓	✓	
CO2	✓	✓	✓		✓	✓		✓	✓	✓	
CO3	✓	✓	✓	✓	✓	✓		✓	✓	✓	
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓	
Number of Matches= 44, Relationship : High											

Prepared by:

1. Dr. J. Sebastin Raj

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1. Dr. T. Nargis Begum

2. Dr. A. Khaleel Ahamed.

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20UBT1AC1	Allied – I	MICROBIOLOGY I – BACTERIOLOGY & VIROLOGY	5	4	100	25	75

Course Outcomes:

1. Develop an understanding on the different aspects of Bacteria, fungi, Virus and its history.
2. Relate, identify and discriminate among Prokaryotic and Eukaryotic organisms.
3. Explain the properties, structure and cultivation of Bacteria and Virus.
4. Describe the theory behind the practical parts in this course.
5. Analyze the different aspects of viral, bacterial diseases and research findings in the areas of Bioinformatics in microbial technology.

UNIT I

15 hours

History and Classification: History of Microbiology, Concepts of Domain: Haeckel's three kingdom, #Whittaker's five kingdom#, Cavalier-Smith's six kingdom and outline of Bergey's Manual of Systematic Bacteriology. Early development of Virology, Nomenclature and Taxonomy of Eukaryotic viruses, Principles of virus taxonomy. Classification of Fungi (Alexopoulos), Microscope – Bright field, Dark field, Phase contrast.

UNIT II

15 hours

Structure and Organization: Overview of Prokaryotic & Eukaryotic cell structure - Inclusion bodies – Endospores - Cell wall – Flagella & Pili – Glycocalyx. General properties of viruses, Structure of viruses, Capsids, Viruses with capsids of complex symmetry, viral envelopes, Classification of Bacterial and Archaeal viruses; #virulent double stranded DNA phages – Lytic and Lysogenic cycle#.

UNIT III

15 hours

Cultivation of Bacteria and Virus: Macronutrients and micronutrients, nutritional types of microorganisms and growth factors. Culture media - chemical and physical types; functional types; #Isolation of pure culture#; Growth curve and Mathematics of Growth; Measurement of microbial growth – cell number and cell mass. Cultivation of viruses, Virus purification and assays.

UNIT IV

15 hours

Bacterial / Viral Detection & Antimicrobial agents: Staining techniques: Acid-Fast Staining, Capsule Staining and Flagella Staining, Antimicrobial Susceptibility Testing – Kirby-Bauer method, Etest, Multidrug-resistant organisms. Viral assay – focus forming, endpoint dilution (TCID₅₀), Tunable resistive pulse sensing, and fluorescent-antibody assay. #Antibacterial drug: penicillin and cephalosporin#. Antiviral drug: Acyclovir and Tamiflu.

UNIT V

15 hours

Disease and Treatment: Airborne diseases – Diphtheria and Mycobacterium tuberculosis; Food-borne and waterborne diseases – Typhoid Fever, Staphylococcal Food Poisoning, cholera and Botulism; Influenza (Flu), AIDS; Viroids and virusoids; Prion diseases. #Control of Microorganisms#; Bioinformatics in microbial Biotechnology.

#.....# **Self Study portion**

Text Books:

1. M. Joanne, Willey, M. Linda, Sherwood and J. Christopher, Woolverton, Prescott, Harley, and Klein's Microbiology, 7th edition, McGraw Hill, Colin Wheatley/Janice Roerig-Blong, 2008.
2. Stuart Hogg, Essential Microbiology, John Wiley & Sons, Ltd, 2005.
3. Uma Shankar Singh and Kiran Kapoor, Microbial Biotechnology, Oxford Book Company, 2010.

UNIT I Part I Section 1.1 -1.3, Part VII Section 19.4, 19.6 – 19.7, Part VI Section 16.1, 16.7, 18.1 **T.B-1**

UNIT II Part I Chapter 3 **T.B-2** & Part VI Section 16.2 – 16.4, Section 17.1 – 17.2 **T.B-1**

UNIT III Part II Section 5.1 – 5.8 Section 6.2 – 6.3, Part VI Section 16.5, 16.6, **T.B-1**

UNIT IV Part X Chapter 34, **T.B-1** & Part V Chapter 14 **T.B-2**

UNIT V Part X Section 38.1 – 38.4, Section 37.1 – 37.6, Part II Section 7.4 – 7.6 T.B-1; Chapter 3 **T.B.3**.

Web References:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1182391/>

<https://nptel.ac.in/courses/102103015/#>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6428495/>

Books for Reference:

1. J.M. Pelczar, E.C.S. Chan, and N.R. Krieg, Microbiology, 5th Edition Tata McGraw Hill Publishing Company, 2006.
2. R. Anantha Narayanan and C.K.J. Panikar, 6th Edition, General Microbiology, Orient Longman Pvt. Ltd., 2002.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code		Title of the Paper					Hours	Credits		
I	20UBT1AC1		MICROBIOLOGY I – BACTERIOLOGY & VIROLOGY					5	4		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓		✓			✓		✓			
CO2	✓		✓	✓	✓	✓		✓	✓	✓	
CO3	✓		✓	✓		✓		✓	✓		
CO4	✓		✓	✓	✓	✓		✓	✓	✓	
CO5	✓	✓	✓	✓		✓	✓	✓	✓		
Number of Matches= 44, Relationship : Moderate											

Prepared by:

1. Dr. Y. Arsia Tarnam

Checked by:

1. Dr. J. Sebastin Raj
2. Dr. A. Khaleel Ahmed

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20UBT1AC2P	Allied – II	MICROBIOLOGY I – BACTERIOLOGY & VIROLOGY - PRACTICAL	3	2	100	25	75

Course Outcomes:

1. Describe the basic principles of sterilization and media preparation.
2. Differentiate organisms based on structural and biochemical properties.
3. Develop skills associated with isolating and enumerating microorganisms from various sources.
4. Apply knowledge and skills gained in this course to be useful in further research.
5. Develop an understanding on the various aspects of Bacteria and Viruses.

1. Isolation & Enumeration of Microorganism from air.
2. Isolation & Enumeration of Microorganism from water and soil.
3. Pure culture techniques - pour plate; spread plate, streak plate.
4. Staining Techniques – Gram’s staining, Negative staining, Spore’s staining
5. Motility - Hanging drop method
6. Catalase and oxidase test.
7. Biochemical characterization of microorganisms – carbohydrate utilization and IMViC tests.
8. Measurement of Growth - Spectrophotometry
9. Isolation of Bacteriophage (that infect *E. coli*) from sewage
10. Quantitation of phage in sewage sample by phage plaque assay.
11. Demonstration of mechanical transfer of viruses in plants by sap inoculation.
12. Study of virus infected plant samples.
13. Burst size determination - A one step growth curve of Bacteriophage T4

Text Books:

1. Cappuccino and Sherman. Microbiology – A Laboratory Manual. 7th Edition, Dorling Kindersley (India) Pvt. Ltd., New Delhi. 2012.
2. P. Gunasekaran, Laboratory Manual in Microbiology, New Age International (P) Ltd. Publishers, New Delhi. 2008.

Books for Reference:

1. W. Harry, J.R. Seeley, J. Paul, Van Demark and John J Lee, Microbes in Action – A Laboratory Manual of Microbiology. W.H.Freeman and Company, New York. 1997.
2. Kanika Sharma. Manual of Microbiology – Tools and Techniques. 2nd edition, Ane Books Pvt. Ltd., New Delhi. 2009.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code		Title of the Paper			Hours	Credits			
I	20UBT1AC2P		MICROBIOLOGY I – BACTERIOLOGY & VIROLOGY - PRACTICAL			3	2			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓			✓		✓		
CO2	✓		✓	✓	✓	✓		✓	✓	✓
CO3	✓		✓	✓		✓		✓	✓	
CO4	✓		✓	✓	✓	✓		✓	✓	✓
CO5	✓	✓	✓	✓		✓	✓	✓	✓	
Number of Matches= 44, Relationship : Moderate										

Prepared by:

1. Dr. Y. Arsia Tarnam

Checked by:

1. Dr. J. Sebastinraj
2. Dr. A. Khaleel Ahmed

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
II	20UBT2CC3	Core – III	CYTOLOGY AND CELL BIOLOGY	6	5	100	25	75

Course outcome:

1. Gain Information literacy in basic concepts of cell biology and properties of cells.
2. Gain Knowledge in cell cycle, Cellular membranes and matrices.
3. Analyze and interpret the behavior of cells in their microenvironment in multi-cellular organisms with emphasis on cell-cell interactions,
4. Understand the chemical and molecular processes that occur inside cells.
5. Attain mastery in identifying the sub cellular organelles and describing their structure and function

Unit I Fundamentals of cell biology:

18 Hours

History and Discovery of cells, physiological properties of cells, Cell theory, Overview of Prokaryotic and Eukaryotic Cells, Plant and Animal cells, Cell cycle and its regulation; Cell division: mitosis; meiosis, #binary fission#.

Unit II Cellular membranes and matrices:

18 Hours

Membrane models; chemical composition of membranes; transportation across cell membrane- active and passive transport, proton pumps associated (Na-K, Ca-calmodulin); extracellular matrices – structure and function; #cytoskeleton – structure and function#.

Unit III Cellular organelles and its function:

18 Hours

structure and functions of endoplasmic reticulum – smooth & rough; golgi complex; Lysosomes; vacuoles; ribosomes, microbodies, microtubules, microfilaments; centrosome, #cilia and flagella#; Mitochondria – structure and function; chloroplast – structure and function.

Unit IV Nucleic Acids and Cell Signalling:

18 Hours

Structure and function of Nucleus, Nucleolus, DNA and RNA, chromosome structure and function, special type of chromosome. Cell signaling and receptors: Signaling molecules and their receptors; intracellular signal transduction pathways, Structure, #mechanism and action of receptors#.

Unit V Tools and techniques in cell biology:

18 Hours

Microtome, cytochemical staining of cells and tissues, micrometry, Microscopy - Fluorescent Microscope, Electron microscopy - Scanning Electron Microscope, Transmission Electron Microscope, Confocal Laser Scanning Microscope, Atomic Force Microscope.

#.....#Self-study portion

Text Books:

- T.B.1H.** Lodish, Arnold Berk, S Lawrence Zipursky, Paul Matsudaira, David Baltimore, and James Darnell. Molecular Cell Biology, 6th edition, W.H. Freeman and Company, 2013.
- T.B.2** N.Arumugam, Cell Biology, 5rd edition, SARAS Publication, 2017.
- T.B.3** Aruna Sarangi, Principles of Cell Biology, 5th edition, Pacific Publication, Delhi, 2010.

Unit I Chapter IV, pg. 60-75, T.B-2.

Unit II Chapter X, Pg. 443-445, T.B-1.

Unit III Chapter XI-XV, Pg. 167-218, T.B-2.

Unit IV Chapter IV, Pg. 97-120, T.B-3.

Unit V Chapter II, Pg. 16-29, T.B-2.

Books for References:

1. T. A. Brown, Introduction to genetics: A molecular approach. 2nd Edition. Garland Science. 2016.
2. J. D. Watson Tania, A. Baker, Stephen P. Bell, Michael Levine and Richard Losick. Molecular Biology of the Gene. 7th Edition. Benjamin/Cummings Publ. Co., Inc., 2015.
3. Benjamin Lewin. Genes XI. 9th Edition. Jones & Bartlett Learning, 2011.

Web reference:

1. <https://ocw.mit.edu/courses/biology/7-06-cell-biology-spring-2007/>
2. https://swayam.gov.in/nd1_noc20_me04/preview
3. <http://www.di.uq.edu.au/sparqglossary#b>
4. <https://micro.magnet.fsu.edu>
5. <https://cellbiology.med.unsw.edu.au>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits			
II	20UBT2CC3	CYTOLOGY AND CELL BIOLOGY					6	5			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓		✓		✓	✓	✓	
CO2	✓	✓	✓	✓		✓		✓	✓	✓	
CO3	✓	✓	✓	✓		✓		✓	✓	✓	
CO4	✓	✓	✓	✓		✓		✓	✓	✓	
CO5	✓	✓	✓	✓		✓		✓	✓	✓	
Number of Matches= 40, Relationship : High											

Prepared by:

1. Dr. B.Nazeema Banu

Checked by:

1. Dr. J. Sebastin Raj
2. Dr.A.KhaleelAhamed.

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
II	20UBT2CC4P	Core – IV	CYTOLOGY AND CELL BIOLOGY - PRACTICAL	3	2	100	25	75

Course outcome:

1. Explain the structure of cells using microscopy and other analytical techniques.
 2. Develop their skills in the preparation and identification of cell structures and their functions using staining techniques.
 3. Gain expertise in cytochemical methods.
 4. Identify the different stages of mitosis and meiosis
 5. Design experiments to investigate a scientific problem and present advanced knowledge in the specialized fields of cell biology.
1. Microscopy–Observation of a typical plant (onion peel, Hydrilla leaf) and animal cell(Cheek cells with a cotton swab) by Simple and compound microscope.
 2. Measurement of cells using ocular and stage micrometer
 3. Study of structure of cell: Structure observation of Prokaryotic and Eukaryotic cell.
 4. Analysis of transverse sections of stem, root and leaf for parenchyma, collenchyma, sclerenchyma cells
 5. **Cell count** - Experiment on Count of Erythrocytes (Red Blood Corpuscles)
 6. Experiment on Count of Leucocytes (White Blood Corpuscles)
 7. **Cell Staining and Cytochemical methods**-Demonstration of Cellular and sub-cellular components of plant and animal cells.
 8. Staining of fresh tissues like Squamous Epithelium/ Ciliated Epithelium
 9. Experiment on Haemin Crystals.
 10. **Cell division:** Study of different stages of meiosis by temporary preparation/ permanent slides of *Tradescantia* Flower bud.
 11. **Cell division:** Study of different stages of mitosis by temporary preparation/ permanent slides of onion root tips.
 12. **Cell division:** Binary fission of yeast

Books for References:

1. P.Gunasekaran. Laboratory Manual in Microbiology.2nd edition, New Age International, 2007.
2. Zsolt Fazekas, Cell Biology Laboratory Manual, 8th edition, university press, 2011.

Web Reference:

1. <https://www.youtube.com/watch?v=wMgXsrpVrJg>
2. <https://www.youtube.com/watch?v=k1O9jBHgsxs>
3. <https://www.youtube.com/watch?v=5V52RzM84TM>
4. <https://www.youtube.com/watch?v=VJ678ceiiV0>
5. <https://www.youtube.com/watch?v=1wiQsGNg0T0>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits				
II	20UBT2CC4P	CYTOLOGY AND CELL BIOLOGY - PRACTICAL					3	2				
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)						
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	✓	✓	✓	✓		✓		✓	✓	✓		
CO2	✓	✓	✓	✓		✓		✓	✓	✓		
CO3	✓	✓	✓	✓		✓		✓	✓	✓		
CO4	✓	✓	✓	✓		✓		✓	✓	✓		
CO5	✓	✓	✓	✓		✓		✓	✓	✓		
Number of Matches= 40, Relationship : High												

Prepared by:

Dr.B.Nazeema Banu

Checked by:

1. H.F.Seyed Mafiya Haniff
2. Dr.A.KhaleelAhamed.

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
II	20UBT2AC3	Allied – III	MICROBIOLOGY - II APPLIED MICROBIOLOGY	4	3	100	25	75

Course Outcomes:

1. Describe the basics of soil microbes and their role in biogeochemical cycle.
2. Discuss the domains of microbiology and their applications in various industries.
3. Evaluate methods of microbial control and apply the proper methods necessary in a given scenario.
4. Explain about the medical and practical uses of microorganisms for the production of pharmaceutical products.
5. Employ basic laboratory skills for research in microbiology using scientific methods to explore natural phenomena.

Unit I Soil Microbiology:

12 hours

Introduction to soil microorganisms – bacteria (cyanobacteria and actinobacteria), algae, fungi, protozoans, nematodes and viruses. Role of microorganisms in biogeochemical cycling - carbon cycle, nitrogen cycle and sulphur cycle. # Mycorrhiza- Role of Mycorrhizal fungi in plants#. Organic and inorganic nutrients in soil - phosphorous uptake, # nitrogen fixation#, Biofertilizers – definition, importance – types and their application methods.

Unit II Food Microbiology:

12 hours

Food as a substrate for microorganisms – microorganisms important in food microbiology: molds, yeasts and bacteria. Principles and methods of food preservation - high temperature, low temperature, drying, # irradiation and chemical preservatives#. Spoilage of fruits, vegetables, meat, poultry, fish and sea food. Microbes as foods - SCP production.

Unit III Industrial Microbiology:

12 hours

Industrial products derived from microbes: Production of yeast, ethyl alcohol, beer and vinegar. Citric acid production, lactic acid production. Production of antibiotic – penicillin and streptomycin, Vitamin production – riboflavin, # vitamin C and vitamin B12#. Role of microbes in biogas production, petroleum industry and mining.

Unit IV Clinical Microbiology:

12 Hours

Epidemiology of infectious diseases, Hospital acquired infections, Infections of various organs and systems of the human body , Rapid diagnostic techniques for microbial diseases, Vaccinology : principle, methods of preparation, administration of vaccines, Treatment and diagnostic methods of Corona virus, SARS, H1N1, Dengue, Swine Flu, Biological warfare.

Unit V Pharmaceutical microbiology:

12 hours

Probiotics and nutraceuticals – economic and legal considerations in pharmaceutical biotechnology, Vaccine design and production, classification, genetically recombinant vaccines- advantages and disadvantages. Chemical and physicochemical deterioration of pharmaceuticals, Preservation of medicines using antimicrobial agents. Types of sterile pharmaceutical products and its sterilization consideration, # quality control and quality assurance of sterile products#.

#-----#Self study portion

Text books

- T.B. 1 Moshrafuddin Ahmed, Basumatary S.K., Applied Microbiology, MJP Publishers, 2006.
- T.B. 2. Lansing M Prescott, John P Harley and Donald A Klein, Microbiology, 7th Edition, Mc Graw Hill publishers, New York, 2007.
- T.B. 3 A. H. Patel, Industrial Microbiology, Lakshmi publications, New Delhi, 2005.
- T.B. 4 Hugo and Russells, Pharmaceutical Microbiology, edited by Stephen P. Denyer, Norman A. Hodges, Sean P. Gorman, Brendan F. Gilmore, 8th edition, Wiley-Blackwell publications, 2008.

Books for Reference

1. David Greenwood, Richard C.B. Slack and John. F. Peutherer; Medical Microbiology, 7th Edition, Elsevier India Private Ltd., New Delhi,2008.
2. Bernard R. Glick and Jack J. Pasternak.Molecular Biotechnology.Indian edition.Panima Publishing Corporation. 2002
3. R. Y. Stainer, J. L. Ingra Ham, M. L. Wheelis andP. R. Painter. General Microbiology. Macmillan, 1992.

Web Reference

<https://link.springer.com/book/10.1007/0-306-46888-3>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1529671/>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code		Title of the Paper					Hours	Credits		
II	20UBT2AC3		MICROBIOLOGY - II APPLIED MICROBIOLOGY					4	3		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓		✓	✓	✓	✓		✓	✓	✓	
CO2	✓	✓	✓	✓	✓	✓		✓	✓		
CO3	✓	✓	✓	✓	✓	✓		✓		✓	
CO4		✓		✓		✓			✓	✓	
CO5	✓	✓	✓	✓	✓	✓		✓		✓	
Number of Matches= 37, Relationship : High											

Prepared by:

1.Dr. A. Nishanthini

Checked by:

1. H.F.Seyed Mafiya Haniff
2. Dr.A.KhaleelAhamed.

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
II	20UBT2AC4P	Allied – IV	MICROBIOLOGY - II APPLIED MICROBIOLOGY PRACTICAL	3	2	100	25	75

Course Outcomes

1. Technical know-how on versatile techniques in applied microbiology.
2. Proficiency in designing and conducting experiments involving microbes.
3. Demonstrate the safe methods for isolation of bacteria, fungi and determination of their antibacterial and antifungal activity.
4. Illustrate the application of microbes in industries.
5. Apply technical skills necessary to support microbiology research study.

1. Isolation of VAM from the soil.
2. Study of Rhizobium from legume root nodules.
3. Isolation and identification of Actinomycetes.
4. Isolation and identification of bacteria and fungi from fruits and vegetables.
5. Isolation and identification of bacteria and fungi from fermented and stored foods.
6. Isolation of lactic acid bacteria from curd.
7. Detection of Bacteria in milk by
 - Methylene blue reductase test.
 - Phosphatase test.
8. Antibiotic sensitivity test: Kirby Bauer's method.
9. Antifungal tests.
10. Media formulation.
11. Wine production by yeast.
12. Extracellular activities of microorganisms – amylase, cellulase and lipase.

Textbooks

- T.B. 1 James G. Cappuccino and Natalie Sherman. Microbiology: A laboratory Manual. 10th Edition. Benjamin Cummings. 2013.
- T.B. 2. R. H. Baltz, A. L. Demain and J. E. Davies, Manual of Industrial Microbiology and Biotechnology, 3rd edition, ASM Publishers, 2010.

Book for Reference

1. Aneja K.R., Laboratory Manual of Microbiology & Biotechnology, 2nd edition, Scientific International Pvt. Ltd, New Delhi, 2013.

Web Reference

- <https://www.tandfonline.com/doi/full/10.1080/21553769.2015>
- <https://microbiologyonline.org/file/7926d7789d8a2f7b207.pdf>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits				
II	20UBT2AC4P	MICROBIOLOGY - II APPLIED MICROBIOLOGY -PRACTICAL					3	2				
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)						
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓			
CO2	✓	✓	✓	✓	✓	✓		✓	✓	✓		
CO3	✓	✓		✓	✓	✓	✓		✓	✓		
CO4		✓	✓	✓	✓			✓	✓	✓		
CO5	✓	✓	✓	✓				✓	✓	✓		
Number of Matches= 40, Relationship : High												

Prepared by:

1. Dr. A. Nishanthini.

Checked by:

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2. Dr.A.KhaleelAhamed

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
III		Value Added Course	CLINICAL DIAGNOSTIC METHODS			100	-	-

SEMESTER III: VALUE ADDED COURSE - I

CLINICAL DIAGNOSTIC METHODS

Course Code:

Max Marks:100

Hours/week:

Internal Marks:

Credit:

External Marks:

Course Outcomes:

1. Develop fundamental understanding on diagnostic methods performed at laboratories and hospitals for diagnosing human diseases.
2. Learnt various techniques like blood glucose test, blood pressure measurement, blood cells counting, Lipid profile etc.
3. Demonstrate understanding of skills required to diagnose various disorders.
4. Improve awareness about the interface between values, beliefs and ethical decision making in therapeutic settings.
5. Analyse the most commonly encountered pathophysiological state(s) and/or disease mechanism(s), as well as any clinical testing requirements.

UNIT I

8 hours

Introduction to diagnostic methods: Definition –*invitro* diagnostic methods – types, scope and applications. Physical examination – palpation, percussion and auscultation.

UNIT II

8 hours

General Chemistry: Measurement of base compounds in the body –urine routine examination – acidity, sugar, bilirubin, ketones, protein, nitrite, leukocyte esterase and fecal occult blood tests (FOBT).

UNIT III

8 hours

Haematology: Study of the blood -complete blood count, coagulation tests (eg., INR),calcium level test, chloride, sodium, potassium, ESR test, bleeding time and clotting time.

UNIT IV

8 Hours

Microbiology: Manifestation of infection and microbial causes of infection. Microscopic examination, antimicrobial susceptibility, KOH preparation, AFB testing, blood culture and basic metabolic panel.

UNIT V

8 hours

Health conditions and associated tests: Heart disease lipid panel (cholesterol and triglyceride) – troponin, Respiratory disease – blood gas test, Diabetes – glucose and HbA1c, Renal disease – creatinine and BUN.

Text Books:

- T.B. 1. Geoffrey Beckett, Simon W. Walker, Peter Rae, Peter Ashby.,Clinical Biochemistry.7th edition.John Wiley & Sons.Blackwell Publishing, 2006.
- T.B. 2.M. N. Chatterjea, Rana Shinde. Textbook of medical Biochemistry. 6th edition, Jaypee Brothers, Medical Publishers (p) Ltd. New Delhi.

Books for Reference:

1. CA Burtis, ER Ashwood, Tietz Textbook of clinical chemistry.2nd edition.W.B. Saunders Co. 1999.
2. Cynthia C. Chernecky, Barbara J. Berger. Laboratory tests and diagnostic procedures.Elsevier health sciences. 2012.

- Frances TalaskaFishbach, Marshall Barnett Lippincott Williams and Wilkins.A manual of laboratory and diagnostic tests. 2009.

Web References:

- <https://www.thoughtco.com/common-blood-chemistry-tests-608417>.
- <https://advameddx-policy-primer-on-diagnostics-june-2011.pdf>
- <http://www.gutenberg.org/files/47078/47078-h/47078-h.htm>
- <https://digitalcommons.hsc.unt.edu/cgi/viewcontent.cgi?article=1036&context=hmedbks>
- <http://www.chospab.es/biblioteca/DOCUMENTOS/Color Atlas of Hematology Practical and Clinical Diagnosis 2004 Thieme.pdf>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits				
III	Value Added Course	CLINICAL DIAGNOSTIC METHODS					-	-				
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)						
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	✓	✓			✓	✓	✓		✓	✓		
CO2	✓	✓			✓	✓		✓		✓		
CO3	✓	✓	✓		✓	✓			✓	✓		
CO4	✓	✓			✓	✓	✓	✓		✓		
CO5	✓	✓	✓		✓	✓	✓		✓	✓		
Number of Matches= 35, Relationship : High												

Prepared by:

1.H.F.Syed Mafiya Haniff

Checked by:

1.Dr.A.Nishanthini

2.Dr.A.Khaleel Ahamed

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
IV		Value Added Course	HERBAL HEALTHCARE PRACTICES			100	-	-

Course Outcomes

1. Create a comprehensive wellness plan incorporating herbal, dietary and lifestyle recommendations integrating self-awareness and lessons of nature.
2. Demonstrate the ability to critically analyze herbal research and contribute to the current body of herbal literature.
3. Integrate knowledge of raw materials, formulation, and herbal pharmacy for product development purposes
4. Bridge the information gap of evidence-based data and traditional knowledge so as to make rational decisions in developing safe and effective herbal products and formulas.
5. Gain advanced skills in Harvesting and processing of plant material and also in Rationale design, product preparation, and formulation of herbal products.

Unit I:

8 hours

Herbal therapeutics: Introduction to indigenous herbs in medicine, History of herbal medicine, formulations types-decoctions, legium, sooranam, baspam and others.

Unit II

8hours

Herbal formulation for common diseases: Treating common cold, flu, children illness and women illness, Managing diabetics and cardiovascular diseases.

Unit III

8 hours

Herbs in food and nutrition: Herbal food supplements, Nutritional supplements, culinary herbs, the nutritional value of herbs, beneficial use of herbs as a food supplement.

Unit IV

8 hours

Herbal cosmetics and first aid kits: Skin care herbal products-Soap, face Cream, Moisturizers, lip balms, eyeliner and Kajal, Hair care products, herbal first-aid kit specific for home and travel, Common household accidents and their first-aid treatment.

Unit V

8 hours

Herbal gardening:Parameters to check for growing herbs, Outdoor herbal gardening, Indoor herbal gardening, drying and packaging of herbs for marketing.

Text Books:

- T.B. 1. Matthew Wood, The Practice of Traditional Western Herbalism: Basic Doctrine, Energetic, and Classification, 2nd edition, North Atlantic books, 2013
- T.B. 2. David Hoffman, Medical Herbalism: The Science and Practice of Herbal Medicine, Healing Arts, 1st edition, 2003
- T.B. 3. Thomas Easley and Steven Horne, The Modern Herbal Dispensatory: A Medicine-Making Guide, 4th edition, North Atlantic Book, 2016

Books for Reference:

1. Hung OL, Shih RD, Chiang WK, Nelson LS, Hoffman RS, Goldfrank LR. *Herbal preparation use among urban emergency department patients*. Academic Emergency Medicine, 1997
2. Food and Drug Administration (FDA). Overview of dietary supplements. website: www.fda.gov/food/dietarysupplements/consumerinformation, 2010.
3. World Health Organization (WHO). "Traditional Medicine." 2018

Web reference

http://www.who.int/topics/traditional_medicine/en/

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits			
III	Value Added Course	CLINICAL DIAGNOSTIC METHODS					-	-			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓	✓			✓	✓	✓	
CO2	✓	✓	✓	✓	✓			✓	✓	✓	
CO3	✓	✓	✓	✓	✓		✓	✓	✓	✓	
CO4	✓	✓	✓	✓	✓			✓	✓	✓	
CO5	✓	✓	✓	✓	✓			✓	✓	✓	
Number of Matches= 41, Relationship : High											

Prepared by:

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2. Dr.A.KhaleelAhamed