

CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS)

Nationally Accredited with 'A' Grade by NAAC

ISO 9001:2015 Certified

TIRUCHIRAPPALLI

PG AND RESEARCH DEPARTMENT OF MICROBIOLOGY



M.Sc., MICROBIOLOGY

SYLLABUS

2023 -2024 and Onwards



CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS)
PG AND RESEARCH DEPARTMENT OF MICROBIOLOGY

VISION

Our vision is to encourage eminent research work through the conception of an attractive and vibrant environment to achieve goals of our department.

MISSION

- To impart relevant, ultimate, principle-oriented education and practical expertise in the field of Microbiology.
- To strive to provide quality education conjugated with innovative technology so as to be able to gain technical and educational expertise locally, nationally, internationally.
- Our prime focus is to enrich the ambitions of our students, staff and steer with constructive collaboration towards excellence.

PROGRAMME EDUCATIONAL OBJECTIVES(PEOs)

PEOs	Statements
PEO1	LEARNING ENVIRONMENT To facilitate value-based holistic and comprehensive learning by integrating innovative learning practices to match the highest quality standards and train the students to be effective leaders in their chosen fields.
PEO2	ACADEMIC EXCELLENCE To provide a conducive environment to unleash their hidden talents and to nurture the spirit of critical thinking and encourage them to achieve their goal.
PEO3	EMPLOYABILITY To equip students with the required skills in order to adapt to the changing global scenario and gain access to versatile career opportunities in multidisciplinary domains.
PEO4	PROFESSIONAL ETHICS AND SOCIAL RESPONSIBILITY To develop a sense of social responsibility by formulating ethics and equity to transform students into committed professionals with a strong attitude towards the development of the nation.
PEO5	GREEN SUSTAINABILITY To understand the impact of professional solutions in societal and environmental contexts and demonstrate the knowledge for an overall sustainable development.

PROGRAMME OUTCOMES FOR M.Sc. Microbiology PROGRAMME

PO NO	On completion of M.Sc., Microbiology, the students will be able to
PO1	Scientific Management and Career Opportunities: Master the scientific and applied aspects of the subject for employment opportunities.
PO2	Explore Creativity and Intelligence: Employ novel ideas with conceptual thinking to secure self-discipline and independence to foster scientific attitude by exploration of Science.
PO3	Team Building and Scientific Temperament: Inculcate training, internships and team spirit with leadership skills through academic projects and transmit complex scientific and technical information and contribute to the scientific community.
PO4	Innovative Learning and Technological Advancement: Perceive research in the specialized areas and to engage in life-long learning to keep pace with emerging trends in academics, research and technology.
PO5	Personality Development with Social Responsibility: Achieve ethical, social and holistic values with social responsibility to develop a healthy life.

PROGRAMME SPECIFIC OUTCOMES FOR M.Sc. MICROBIOLOGY

PSO NO.	Students of M.Sc., Microbiology will be able to	POs Addressed
PSO 1	Understand the applied sciences to engage them life long learning to foster their successful carrier and educational goals.	PO1 PO5
PSO 2	Focus perceptive in the subject of Microbiology to apply its principles and its applications by adding broad range of scientific knowledge.	PO2 PO3
PSO 3	Acquire contextual knowledge on basis and modern concepts in current areas with contemporary technologies and multidisciplinary domains	PO3 PO4
PSO 4	Instill to work independently identify appropriate resources; enable individual, institutional and national values to understand the impact of innovation and applications.	PO4 PO1
PSO 5	Ability to imbibe moral and ethical values to formulate effective research grants and experimental designs	PO5 PO2



Cauvery College for Women (Autonomous), Trichy-18
PG & Research Department of Microbiology M.Sc., Microbiology
Learning Outcome Based Curriculum Framework (CBCS-LOCF)
 (For the Candidates admitted from the Academic year 2023-2024 onwards)

Semester	Course	Title	Course Code	Inst./ Hrs/Week	Credit	Hrs	Marks		Total
							Int.	Ext.	
I	Core Course – I (CC I)	General Microbiology and Microbial Diversity	23PMB1CC1	6	5	3	25	75	100
	Core Course – II (CC II)	Biological Macromolecules	23PMB1CC2	6	5	3	25	75	100
	Core Course – III (CC III)	Molecular Biology and Microbial Genetics	23PMB1CC3	6	5	3	25	75	100
	Core Practical – I (CP)	General Microbiology and Microbial Diversity, Biological Macromolecules, Molecular Biology and Microbial Genetics(P)	23PMB1CC1P	8	5	3	40	60	100
	Discipline Specific Elective Course – I(DSE)	A. Biological Instrumentation	23PMB1DSE1A	4	3	3	25	75	100
		B. Microalgal Technology	23PMB1DSE1B						
		C. Molecular Taxonomy and Phylogeny	23PMB1DSE1C						
TOTAL				30	23				500
15 Days INTERNSHIP during Semester Holidays									
II	Core Course- IV (CC)	Bacteriology and Mycology	23PMB2CC4	6	5	3	25	75	100
	Core Course – V(CC)	Immunology and Immunotechnology	23PMB2CC5	6	5	3	25	75	100
	Core Choice Course – I (CCC)	A. Microbial Metabolism	23PMB2CCC1A	5	4	3	25	75	100
		B. Microbial Physiology	23PMB2CCC1B						
		C. Microbial Growth and nutrition	23PMB2CCC1C						
	Core Practical–II (CP)	Bacteriology, Mycology, Immunology and Immunotechnology (P)	23PMB2CC2P	9	5	3	40	60	100
	Discipline Specific Elective Course – II (DSE)	A. Medical Microbiology	23PMB2DSE2A	4	3	3	25	75	100
		B. Public Health Microbiology	23PMB2DSE2B						
		C. Medical Parasitology	23PMB2DSE2C						
Internship	Internship	23PMB2INT	-	2	-	-	100	100	
Extra Credits Course	SWAYAM	As Per UGC Recommendation							
TOTAL				30	24	-	-	-	600

Semester: I	Internal Marks: 25		External Marks: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HRS./WEEK	Credits
23PMB1CC1	GENERAL MICROBIOLOGY AND MICROBIAL DIVERSITY	CORE	6	5

Course Objectives

To enable the students to understand the history, biology of microorganisms, growth and control of microbes the diversity of microbes

Prerequisites

Basic knowledge and concepts of microbiology

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Define and understand the history and principles of Microscopy	K1, K2
CO2	Analyze and explain bacteria, fungi, algae, protozoa and virus	K3, K4
CO3	Determine and apply pure culture techniques and sterilization methods.	K3, K4
CO4	Evaluate and categorize microbial biodiversity and kingdom concepts	K4, K5
CO5	Criticize and manage Extremophiles and conservation of microbial diversity.	K5, K6

Mapping of CO with PO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	1	3	2	3	3	2
CO2	2	2	2	2	2	3	2	3	2	2
CO3	2	3	1	2	3	3	2	3	2	2
CO4	3	2	3	2	2	3	2	3	2	1
CO5	3	3	3	3	2	3	2	3	3	2

“1” – Slight (Low) Correlation

“3” – Substantial (High) Correlation

“2” – Moderate (Medium) Correlation

“-“ indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	History and Scope of Microbiology. Microscopy– Principles and applications. Types of Microscopes - Bright field, Dark-field, Phase-contrast, Fluorescence microscope, Transmission electron microscope (TEM) and Scanning electron microscope (SEM). Sample preparation for SEM & TEM. Atomic force, Confocal microscope. Micrometry – Stage, Ocular and its applications.	20	CO1, CO2, CO3	K1, K2, K3, K4
II	Bacteria – Size, shape and arrangements, cell wall of Gram positive and Gram negative bacteria, Structure and function of flagella, fimbriae and pili, gas vesicles, chlorosomes, carboxysomes, magnetosomes and phycobilisomes. General characteristics and nature of Archaeobacteria, Cyanobacteria, Mycoplasma, Rickettsiae, Chlamydia, Spirochaetes, Actinobacteria, Protozoa, Algae, Fungi, lichens and Viruses.	20	CO1, CO2, CO3, CO4	K1, K2, K3, K4, K5
III	Microbial techniques - Safety guidelines in Microbiology Laboratories. Sterilization, Disinfection and its validation. Staining methods–Simple, Differential and Special staining. Pure cultures techniques, Maintenance and preservation of pure cultures. Growth and nutrition - Nutritional requirements, Growth curve, Kinetics of growth, Batch culture, Synchronous growth, Measurement of growth and factors affecting growth.	15	CO1, CO2, CO3, CO4,	K1, K2, K3, K4, K5,
IV	Microbial Biodiversity - Introduction to microbial biodiversity, kingdom concepts- Haeckel's three kingdom concept, Whittaker's five kingdom concept, Carl Woes three domain system, Cavalier - smith eight kingdom concept. Major characteristics used in microbial taxonomy – morphological, physiological, metabolic, serological and molecular. Bacterial classification (outline) according to Bergey's manual of systemic Bacteriology. Basic understanding of classification of algae-Fritch, fungi-Alexopoulos, viruses- ICTV and protozoa.	20	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6,
V	Extremophiles- Thermophiles, Mesophiles, Psychrophiles, Acidophilic, Alkalophilic and Halophilic microorganisms- habitats and biotechnological applications. Conservation of microbial biodiversity.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	Self Study for Enrichment (Not included for End Semester Examinations) Giant bacteria, Cultivation of Anaerobic organisms. Modern methods and Nomenclature of microbial taxonomy	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Dave Wessner, Christine Dupont, Trevor Charles, Josh Neufeld. Microbiology (3rd Edition), Wiley, 2020.
2. Bhagwan Rekadwad. Microbial Systematics: Taxonomy, Microbial Ecology, Diversity (1st Edition), CRC Press, 2020.
3. Michael J. Le Boffe, Burton E. Pierce. Microbiology: Laboratory Theory & Application (1st Edition), Morton Publishing Company, 2019.
4. Jeffrey C. Pommerville. Fundamentals of Microbiology (12th Edition), Jones & Bartlett Learning, 2021.
5. Bhagwan Rekadwad. Microbial Systematics: Taxonomy, Microbial Ecology, Diversity (1st Edition), CRC Press, 2020.
6. Anita Pandey, Avinash Sharma. Extreme Environments: Unique Ecosystems – Amazing Microbes (1st Edition), CRC Press, 2021.
7. Ravi V. Durvasula and D. V. Subba Rao. Extremophiles: From Biology to Biotechnology (1st Edition), CRC Press, 2018.

Reference Books

1. Gerard Tortora, Berdell Funke, Christine Case, Derek Weber, Warner Bair. Microbiology: An Introduction (12th Edition), Pearson, 2020.
2. Barry Chess. Talaro's Foundations in Microbiology: Basic Principles (7th Edition), Mc Graw Hill, 2020.
3. Lourdes Norman-McKay. Microbiology: Basic and Clinical Principle, (1st Edition), Pearson, 2018.
4. Joanne Willey, Kathleen Sandman, Dorothy Wood. Prescott's Microbiology (12th edition), Mc Graw Hill, 2022.
5. Richa Salwan and Vivek Sharma. Physiological and Biotechnological Aspects of Extremophiles (1st Edition), Academic Press, 2020.
6. Satyanarayana, T, Johri, B. N. Microbial Diversity: Current Perspectives and Potential Applications (1st Edition), Dream tech Press, 2021.
7. Masrura Alam and Biprakash Tiwary. Extremophiles: Diversity, Adaptation and Applications, Bentham Science Publishers, 2023.

Web References

1. <https://microbenotes.com/category/basic-microbiology/>
2. <https://microbiologyinfo.com/>
3. <https://www.biologydiscussion.com/notes/microbiology-notes/notes-microbiology-biology/34235>
4. <https://www.britannica.com/science/microbiology>
5. <https://byjus.com/neet/classification-of-microorganisms-notes/>
6. <https://microbenotes.com/microbiology-of-extreme-environments/>

Pedagogy

Power point presentations, Group Discussion, Seminar, Quiz, Assignment, Brain Storming Activity.

Course Designer

Dr. S. Jenny

SEMESTER I	INTERNAL MARKS :25		EXTERNAL MARKS: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDIT
23PMB1CC2	BIOLOGICAL MACROMOLECULES	CORE COURSE – II (CC II)	6	5

Course Objective : This course is designed to provide comprehensive knowledge to the students regarding the structure and functions biological molecules.

Prerequisites

To Comprehend and analyze the basics of biological molecules.

Course Outcome:

COs	CO Statement	Knowledge level
CO1	Define the structure and functions biological molecules.	K1
CO2	Recite the interrelationship between various biomolecules and consequences of any deviation from normal.	K1
CO3	Critique knowledge about the structure and functions of blood, hormones and phytohormones.	K4
CO4	Generalize the basic idea of metabolic regulators' characteristic features.	K6
CO5	Expand the interrelationships among biological energy, functions and health.	K6

Mapping with Programme Outcomes:

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	S	S
CO2	S	S	S	S	M
CO3	S	S	M	L	M
CO4	S	S	S	S	M
CO5	S	M	M	M	M

“1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation

“3” – Substantial (High) Correlation “-“ indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	Carbohydrate: Definition, sources, classification, structure of glucose, biological significance, digestion and absorption. Proteins: Definition, sources, classification and structure of proteins (Primary, secondary, tertiary), Amino acids– structure- classification - essential and nonessential, protein and non-protein amino acids.	18	CO1, CO2, CO4, CO5	K1, K2, K3, K4, K5
II	Lipids: Definition, sources, classification, structure, properties and functions, Fatty acids- saturated, unsaturated and essential fatty acids. Nucleic acids: Definition, structure, forms and functions of DNA. Types, structure and functions of RNA (mRNA, tRNA, rRNA).	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	Hormones: Definition, classification of hormones, Human- Endocrine glands – Pituitary, thyroids, Para thyroid, pancreas, adrenal, testis and ovary. Phytohormones: Structure and functions of auxin, gibberellins, cytokinins and abscissic acid.	18	CO1, CO2, CO3, CO4	K2, K3, K4, K5
IV	Vitamins – Definition, sources, deficiency syndromes and functions of Fatsoluble vitamins (A, D, E and K) and Water-soluble vitamins (B complex and C). Minerals Zn, Ca, Iodine, Fe, and Mg.	18	CO1, CO2, CO3, CO4	K2, K4, K5, K6
V	Blood: Introduction, origin, composition, characterization, functions and coagulation of blood. General account and secondary metabolites. Major and accessory microbial pigments – chlorophylls, carotenoids, phycobilins and anthocyanins.	18	CO1, CO4, CO5	K1, K2, K3, K4, K5
VI	Self-Study for Enrichment (Not included for End Semester Examinations) Diseases associated with deficiency of endocrine hormones- hypo and hyper secretions. Life style diseases and metabolic diseases. Diet biochemical- health. Food as drug.	-	CO1, CO2, CO3, CO4	K2, K3, K4, K5

Text Books:

1. Chandrabhan Verma, Dakeshwar Kumar Verma (2023). Handbook of Biomolecules, Fundamentals, Properties and Applications 1st Edition. Elsevier publishers.
2. Shikha Kaushik and Anju Singh (2023) Biomolecules from Genes to Proteins. De Gruyter.
3. Ambika Shanmugam (2016). Fundamentals of Biochemistry for Medical students. 8th Edition, Wolters Kluwer (India) Pvt Ltd.
4. Rafi (2014). Textbook of Biochemistry for medical students, 2nd edition, Universities Press, (India) Pvt. Ltd, Hyderabad, India.
5. Charlotte W Pratt and Sathyanarayana U and Chakrapani U (2013) Biochemistry, 4th edition, Elsevier publishers.

Reference Books:

1. Prof. P.K. Gupta (2022). Biomolecules and cell biology. 1st Edition. Rastogi Publications.
2. Devasena (2021). Biomolecules. Mjp Publishers.
3. Dr. Swapnil Yadav (2020). Biomolecules and Cell Biology. Mahaveer Publications.
4. Lubert Stryer; Jeremy Berg; John Tymoczko; Gregory Gatto (2019). Biochemistry, 9th Edition. Macmillan Publication.
5. Mohammad Fahad Ullah (2016). Illustrated Notes on Biomolecules. Partridge Singapore.

Web links:

1. <https://byjus.com/biology/biomolecules/>
2. <https://en.wikipedia.org/wiki/Biomolecule>
3. <https://www.sciencedirect.com/topics/engineering/biomolecule>
4. <https://ncert.nic.in/textbook/pdf/lech205.pdf>
5. <https://ncert.nic.in/textbook/pdf/kebo109.pdf>

Pedagogy

Power point presentations, Group discussion, Seminar, Quiz, Assignment, Brain storming activity.

Course Designer

Dr.P.F.Steffi

Semester : III	Internal Marks: 25		External Marks: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
23PMB1CC3	MOLECULAR BIOLOGY AND MICROBIAL GENETICS	CORE COURSE-III (CC III)	6	5

Course Objective

- To impart the current updated knowledge on molecular genetics of prokaryotes.
- To understand the Genetic replication and repair mechanisms
- To learn about gene transfer mechanisms and their importance in natural evolution
- To provide the required fundamental details on prokaryotic and eukaryotic molecular genetics.

Prerequisites

To obtain basic knowledge in the field of molecular biology.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Explain about molecular genetics of prokaryotes.	K2
CO2	Illustrate transcription and translation.	K3
CO3	Summarize about organization of gene in prokaryotes and eukaryotes.	K4
CO4	Illustrate fundamental details on gene transfer mechanisms.	K5
CO5	Discuss about the processes behind mutations and other genetic changes.	K6

Mapping of CO with PO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3	3	3	3	3	3
CO2	2	3	2	3	3	3	3	3	3	3
CO3	3	2	3	3	2	3	3	3	3	2
CO4	3	3	3	3	3	3	3	3	2	3
CO5	3	3	3	2	3	3	2	3	3	3

“1” – Slight (Low) Correlation

“2” – Moderate (Medium) Correlation

“3” – Substantial (High) Correlation “-“indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	Identification of genetic material (Griffith, Avery and Hershey and Chase experiments). Organization of genetic material: Bacteria – Eukaryotes: nucleus and nucleosomes, lamp brush and giant chromosomes. DNA replication - Meselson – Stahl experiment, Molecular mechanisms of DNA Replication – bidirectional and rolling circle replication. Differences between prokaryotic and eukaryotic replication. Pi X 174 replication. Plasmids – types, structure and replication. Inhibitors of DNA replication - DNA repair – mechanism of excision repair, SOS repair and mismatch repair.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
II	Process of transcription – initiation, elongation – termination. Synthesis of mRNA in prokaryotes and eukaryotes. RNA splicing. Synthesis of rRNA and tRNA. RNA processing – capping and polyadenylation. Inhibitors of transcription. Genetic code, process of translation – initiation, elongation and termination. Signal sequences and protein transport. Inhibitors of translation.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	Organization of Genes in Prokaryotes and Eukaryotes - Introduction - Operon concept, lac, trp, arabinose operons, promoters and repressors. Regulation of gene expression – Transcriptional control – promoters, terminators, attenuators and anti-terminators; Induction and repression; The lac operon – catabolite repression; trp operon, two component regulatory system. Translational control – ribosome binding, codon usage, antisense RNA; post-transcriptional gene silencing – RNAi.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	Transformation – competence cells, regulation, general process; Transduction – general and specialized; Conjugation – Discovery, mechanism of F+ v/s F-, Hfr+ v/s F-, F' v/s F-, triparental mating, self-transmissible and mobilizable plasmids, pili.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	Types and molecular basis of mutation– Agents of mutation - Importance of mutations in evolution of species. Discovery of insertion sequences, complex and compound transposons – T10, T5, and retroposon – Nomenclature- Insertion sequences – Mechanism – Transposons of E. coli, Bacteriophage and Yeast. Isolation, analysis and detection methods of Mutants. Uses of Mutants. Importance of transposable elements in horizontal transfer of genes and evolution. Mobile genetic Elements – IS elements.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

VI	Self Study for Enrichment (Not included for End Semester Examination) Discuss gene-therapy workflow from production to qualitycontrol	-	CO1, CO2, CO3, CO4, CO5	K1 K2, K3, K4, K5, K6
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Text Books

1. Krishnaiah G.R. (2019). Microbial Genetics & Molecular Biology (1st edition) Blue Rose Publisher
2. Verma P. S. and Agarwal A. K. Cell Biology, (2018). Genetics, Molecular Biology, Evolution and Ecology S. Chand Publishing.
3. Primrose S.B. and Twyman R.M. (2016). Principles of Gene Manipulation and Genomics (8th edition) Wiley-Blackwell Publisher.
4. Gerald Karp, Janet Iwasa, (2015). Wallace Marshall Karp's Cell and Molecular Biology: Concept and Experiments (8th edition) Wiley Publisher.
5. David Freifelder, John E. Cronan and Stanley R Maloy (2014). Microbial Genetics (2nd edition) Jones & Bartlett Publishers.

Reference Books

1. Hartl, Daniel L. (2019). Genetics: Analysis of genes and genomes. (9th Edition) Jones & Bartlett Learning.
2. Peter Snustad D and Michael J. Simmons, (2015). Principles of Genetics (7th Edition) Wiley.
3. Bruce Alberts, Alexander D. Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, Peter, (2014). Walter Molecular Biology of the Cell (6th Edition) Garland Science, W. W. Norton & Company.
4. Krebs J. E., Kilpatrick T. and Goldstein E. S. Lewins, (2014). Genes IX Viva Books Pvt Ltd. 2014
5. Larry Snyder, Joseph E. Peters, Tina M. Henkin, Wendy Champness, (2014). Molecular Genetics of Bacteria (4th Edition) ASM Press.

Web References

1. <https://books.google.co.in> > books
2. <http://www.freebookcentre.net/Biology/Molecular-Biology-Books.html>
3. http://www.freebookcentre.net/medical_text_books_journals/genetics_ebooks_online_texts_download.html
4. <https://www.nature.com/scitable/ebooks/>
5. http://www.digitalbookindex.org/_search/search010biolmolecularcellbiologya.asp

Pedagogy

Chalk and talk, Power Point Presentation, Quiz, Assignments, Group Discussions, Seminar, and Assignment.

Course Designer

Ms.S.Sathya

Semester: I	Internal Marks: 40		External Marks: 60	
COURSE CODE	COURSE TITLE	CATEGORY	HRS./WEEK	CREDITS
23PMB1CC1P	GENERAL MICROBIOLOGY AND MICROBIAL DIVERSITY, BIOLOGICAL MACROMOLECULES, MOLECULAR BIOLOGY AND MICROBIAL GENETICS (P)	CORE PRACTICAL	8	5

Course objective

To educate hands-on skills on the first-line experimental methods of General Microbiology and Microbial Diversity, Biological Macromolecule, Molecular Biology and Microbial Genetics.

Prerequisites

The stakeholders will acquire a strong basic knowledge in common microbiology laboratory procedures.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Understand fundamental techniques of microscopy, staining and sterilization.	K1, K2
CO2	Illustrate the preparation of bacterial growth media, plating and growth measurement techniques.	K2, K3
CO3	Analyze and quantify the biological macromolecules.	K2, K3, K4
CO4	Interpret DNA extraction and gene transfer mechanisms, analyze and identify by gel electrophoresis.	K3, K4, K5
CO5	Discuss isolation of mutants and separation of proteins.	K4, K5, K6

Mapping of CO with PO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2	3	3	3	3	3
CO2	3	3	2	3	3	3	3	2	3	3
CO3	3	3	3	3	3	3	2	3	3	2
CO4	3	2	3	2	3	3	3	3	2	3
CO5	3	3	3	3	2	3	3	3	3	3

“1” - Slight (Low) correlation

“2” - Moderate (Medium) correlation

“3” - Substantial (High) correlation

“-” - indicates there is no correlation

Syllabus

I. General Microbiology and Microbial Diversity

1. Washing and cleaning of glass wares: Sterilization methods – moist heat, dry heat, and filtration.
2. Light microscopic techniques: Wet mount to show different types of microbes and hanging drop method.
3. Staining techniques - Simple staining, Gram's staining, Acid fast staining, Meta chromatic granule staining, Spore and Capsule staining.
4. Media Preparation: Preparation of liquid, solid and semisolid media.
5. Preparation of Agar deeps, Slants and Plates and Biochemical test media.
6. Pure culture techniques: Spread Plate, Pour plate, and Streak plate.
7. Fungal slide culture technique.
8. Direct counts – Total cell count, Turbidometry and Viable count method.
9. Determination of Bacterial growth curve.
10. Effect of physical and chemical factors on growth.

II. Biological Macromolecules

1. Preparation of buffer (Tris, Phosphate, Acetate buffer).
2. Determination of (H⁺) ion concentration.
3. Carbohydrate reducing sugars - Anthrone method/Benedicts method.
4. Estimation of Aminoacids - Ninhydrin method.
5. Protein–Lowry's method/Biuret method/ Bradford assay.
6. Estimation of Nucleic acid - DNA (diphenyl amine method) and RNA (Orcinol method).

III. Molecular Biology and Microbial Genetics

1. Isolation of Plasmid and genomic DNA from *E. coli*.
2. Characterization of DNA/plasmid by agarose gel electrophoresis and molecular weight determination.
3. Isolation of antibiotic resistant microbes.
4. Isolation of mutants by spontaneous mutation – Gradient plate technique.
5. Replica plating technique.
6. Transformation: Competent cell preparation.
7. Separation of proteins by polyacrylamide gel electrophoresis (SDS-PAGE)
8. Demonstration of PCR.

Reference Books:

1. Dubey R.C. and Maheshwari D. K. (2023). *Practical Microbiology*, 4th Edition. S. Chand Publisher.
2. James G. Cappuccino and Chad T. Welsh. (2023). *Microbiology: A Laboratory Manual, Global Edition*, 11th Edition. Pearson Education, Publication.
3. Collee J. G., Fraser A.G., Marmion B. P. and Simmons A. (2023). *Mackie & McCartney Practical Medical Microbiology*. 14th Edition Reprint. Elsevier.
4. [Saha R.](#) (2022). *Microbiology Practical Manual*, 2nd edition. CBS Publishers & Distributors.
5. Prem Prakesh Sharma and Abhay Dashora. (2021). *Practical: Fundamentals of Genetics*. 1st Edition. Himanshu Publications.
6. Sinha K P. (2020). *Manual of Practical Biochemistry*, 1st Edition. Scientific Book Company.
7. Rafi Mohammed. (2020). *Manual of Practical Biochemistry*, 3rd Edition. Orient Blackswan Pvt. Ltd.
8. Brown T.A. (2020). *Gene Cloning and DNA Analysis: An Introduction*. 8th Edition. John Wiley and Jones, Ltd.
9. Soundravally Rajendiran, Pooja Dhiman. (2019). *Biochemistry Practical Manual*, 1st Edition. Elsevier.
10. Ashwani Kumar, Gakhar S K and Monika Miglani. (2019). *Molecular Biology: A Laboratory Manual*. Dreamtech Press.

Web References

1. <https://ttk.elte.hu/dstore/document/893/book.pdf>
2. https://webstor.srmist.edu.in/web_assets/downloads/2021/18BTC103J-lab-manual.pdf
3. <https://microbenotes.com/gene-cloning-requirements-principle-steps-applications/>
4. <https://www.slideshare.net/PatriciaCosta17/practical-handbook-of-microbiology>
5. https://www.researchgate.net/publication/320508474_Molecular_Biology_Laboratory_manual

Pedagogy

Chalk and talk, Power Point Presentation, Demo Video and Group Discussions.

Course Designer

Dr. N. Jeenathunisa

Semester: I	Internal Marks: 25		External Marks: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HRS./WEEK	Credits
23PMB1DSE1A	BIOLOGICAL INSTRUMENTATION	ELECTIVE COURSE-I	4	3

Course Objectives

To educate the students with the basic principles of biological instruments so as to develop their research aptitude and career prospects.

Prerequisites

Basic understanding of experimental protocols on biological research.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Explain the principles and working mechanisms of laboratory instruments.	K1, K2
CO2	Discuss chromatography techniques and molecular biology techniques.	K3, K4
CO3	Illustrate molecular techniques in biological applications.	K4, K5
CO4	Acquire knowledge on spectroscopic techniques	K5, K6
CO5	Demonstrate the use of radio isotopes in various techniques.	K5, K6

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	2	3	2	2	3	1
CO2	3	3	3	2	2	3	2	3	2	3
CO3	3	3	2	2	3	3	2	3	2	2
CO4	3	2	3	2	2	3	2	3	2	1
CO5	3	3	3	3	2	3	2	3	3	3

“1” – Slight (Low) Correlation

“3” – Substantial (High) Correlation

“2” – Moderate (Medium) Correlation

“-“ indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	Basic laboratory Instruments. Aerobic and anaerobic incubator – Biosafety Cabinets - Fume Hood, pH meter, Lyophilizer, Flow cytometry. Centrifugation techniques: Basic principles of centrifugation: Principles, methodology and applications of differential, rate zonal and density gradient centrifugation	12	CO1, CO2, CO3, CO4	K1, K2, K3, K4
II	General principles of chromatography - Chromatographic Performance parameters; Types- Thin layer chromatography, Paper Chromatography, Liquid chromatography (LPLC & HPLC), Adsorption, ion exchange, Gel filtration, affinity, Gas liquid (GLC). Two dimensional chromatography.	12	CO1, CO2, CO3, CO4	K1, K2, K3, K4, K6
III	Electrophoresis: General principles - moving boundary electrophoresis - two dimensional electrophoresis- Principle and applications - Disc gel, Agarose gel, SDS – PAGE, Immuno electrophoresis. PCR and its application-Thermocycler. Auto analyzer, Next-generation sequencer and Molecular Docking. Blotting techniques -Southern, northern and western blotting.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K6,
IV	Spectroscopic techniques: Principle, simple theory of absorption of light by molecules, electromagnetic spectrum, instrumentation and application of UV-visible, Raman, FTIR spectrophotometer, spectrofluorimetry, Atomic Absorption Spectrophotometer, NMR, GC-MS.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6,
V	Radio isotopic techniques: Principle and applications of tracer techniques in biology. Radioactive isotopes - radioactive decay; Detection and measurement of radioactivity using ionization chamber, proportional chamber, Geiger- Muller and Scintillation counters, auto radiography and its applications.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	Self Study for Enrichment (Not included for End Semester Examinations) DNA Finger printing, RFLP, RAPD and AFLP application.	-	CO1, CO2, CO3, CO4, CO5	K4, K5, K6

Text Books

1. Gurdeep R. Chatwal and Sham K. Anand. (2022). Instrumental Method of Chemical Analysis. Himalaya Publishing House.
2. Kour H. (2021.) Instrumental Methods of Chemical Analysis. Pragati Prakashan.
3. Mitchell G. H. (2017). Gel Electrophoresis: Types, Applications and Research. Nova Science Publishers Inc.
4. Mohammad Raies, Asima Hamid, Gulzar Ahmad, Holme D and Peck H. (2019). Analytical Biochemistry. Book Enclave.
5. Jayaraman J. (2020). Laboratory Manual in Biochemistry. (2nd Edition). New Age International (P) Ltd., Publishers.

Reference Books

1. Kaur H (2021) Spectroscopy. Pragati Prakashan.
2. Douglas A. Skoog, James Holler, Stanley R. Crouch. (2020). Principles of Instrumental Analysis (7th edition). Cengage India Private Limited.
3. Raymond P.W. Scott. (2020) Techniques and Practice of Chromatography. CRC Press.
4. Gurumani N. (2019). Research Methodology for Biological Sciences. (Kindle Edition) MJ Publishers.
5. Ponmurugan P. and Gangathara P. B. (2021). Biotechniques. (1st Edition). MJP Publishers.

Web References

1. <https://norcaloa.com/BMIA>
2. <http://www.biologydiscussion.com/biochemistry/centrifugation/centrifuge-introduction-types-uses-and-other-details-with-diagram/12489>
3. <https://www.watelectrical.com/biosensors-types-its-working-and-applications>.
4. <http://www.wikiscales.com/articles/electronic-analytical-balance/>
5. <https://study.com/academy/lesson/what-is-chromatography-definition-types-uses>.

Pedagogy

Power point presentations, Group Discussion, Seminar, Quiz, Assignment, Brain Storming Activity.

Course Designer

Dr. N.Sathammai Priya

Semester: I	Internal Marks: 25		External Marks: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HRS./WEEK	Credits
23PMB1DSE1B	MICROALGAL TECHNOLOGY	ELECTIVE COURSE- I	4	3

Course Objectives

To enable the students to understand the Principles and techniques of microalgae

Prerequisites

Basic knowledge and concepts of microalgal Technology

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Define and understand the different groups of algae	K1, K2
CO2	Analyze and explain about the cultivation and harvesting of algae	K3, K4
CO3	Determine and apply commercial applications of various algal products	K3, K4
CO4	Evaluate and categorize microalgae for environmental applications	K4, K5
CO5	Criticize and manage microalgae as alternate fuels	K5, K6

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	1	3	2	3	3	2
CO2	2	2	2	2	2	3	2	3	2	2
CO3	2	3	1	2	3	3	2	3	2	2
CO4	3	2	3	2	2	3	2	3	2	1
CO5	3	3	3	3	2	3	2	3	3	2

“1” – Slight (Low) Correlation

“2” – Moderate (Medium) Correlation

“3” – Substantial (High) Correlation

“-“ indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	Introduction to Algae- General characteristics. Classification of algae according to Fritsch. Salient features of different groups of algae. Distribution -Freshwater, brackish water and marine algae. Identification methods. Economically important microalgae.	12	CO3	K3, K4
II	Cultivation of freshwater and marine microalgae - Growth media. Isolation and enumeration of microalgae. Laboratory cultivation and maintenance. Outdoor cultivation - Photobioreactors - construction, types and operation; raceway ponds - Heterotrophic and mixotrophic cultivation - Harvesting of microalgae biomass.	12	CO1, CO2, CO3, CO4	K1, K2, K3, K4, K5
III	Microalgae in food and nutraceutical applications - Algal single cell proteins. Cultivation of <i>Spirulina</i> , <i>Chlorella</i> and <i>Dunaliella</i> . Microalgae as aquatic, poultry and cattle feed. Microalgal biofertilizers. Value-added products from microalgae. Pigments - Production of microalgal carotenoids and their uses. Phycobiliproteins - production and commercial applications. Polyunsaturated fatty acids as active nutraceuticals. Microalgal secondary metabolites - Pharmaceutical and cosmetic applications. Macroalgae-seaweeds as a source of polysaccharides.	12	CO1, CO2, CO3, CO4,	K1, K2, K3, K4, K5,
IV	Microalgae in environmental applications. Phycoremediation - Domestic and industrial waste water treatment. Sequestration of carbon dioxide. Scavenging of heavy metals by microalgae. Negative effects of algae. Algal blooms, algicides for algal control.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6,
V	Microalgae as feed stock for production of biofuels - Carbon-neutral fuels. Lipid-rich algal strains - <i>Botryococcus braunii</i> . Drop-in fuels from algae - hydrocarbons and biodiesel, bioethanol, biomethane, biohydrogen and syngas from microalgae biomass. Life cycle analysis of algae biofuels.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	Self Study for Enrichment (Not included for End Semester Examinations) Bio-remediation – waste water treatment- organic manure for sustainable agriculture.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Sharma O.P. (2021). Algae. Tata McGraw-Hill Education

2. Shekh A., Schenk P., Sarada R. (2021). Microalgal Biotechnology. Recent Advances, Market Potential and Sustainability. Royal Society of Chemistry.
3. Asraful Alam., Jing-Liang Xu. Microalgae Biotechnology for Food, Health and High Value Products. (2020). Springer.
4. Bhagwan Rekadwad. Microbial Systematics: Taxonomy, Microbial Ecology, Diversity (1st Edition), CRC Press, 2020.

Reference Books

1. Gerard Tortora , Berdell Funke, Christine Case, Derek Weber, Warner Bair. Microbiology: An Introduction (12th Edition), Pearson, 2020.
2. Barry Chess. Talaro's Foundations in Microbiology: Basic Principles (7th Edition), Mc Graw Hill, 2020.
3. Satyanarayana, T, Johri, B. N. Microbial Diversity: Current Perspectives and Potential Applications (1st Edition), Dream tech Press, 2021.
4. Lele. S.S., Jyothi Kishen Kumar (2018). Algal bio process technology. New Age International P(Ltd)

Web References

1. <https://www.classcentral.com/course/algae-10442>
2. https://onlinecourses.nptel.ac.in/noc19_bt16/preview
3. <https://freevideolectures.com/course/4678/nptel-industrial-biotechnology/46>
4. <https://nptel.ac.in/courses/103103207>
5. <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/microalgae>

Pedagogy

Power point presentations, Group Discussion, Seminar, Quiz, Assignment, Brain Storming Activity.

Course Designer

Dr. R. Nithyatharani

Semester: I	InternalMarks:25		ExternalMarks:75	
COURSECODE	COURSE TITLE	CATEGORY	HRS./WEEK	Credits
23PMB1DSE1C	MOLECULAR TAXONOMY AND PHYLOGENY	ELECTIVE COURSE -I	4	3

Course Objectives:

To gain knowledge about combination of molecular and statistical techniques.

Course Outcome and Cognitive Level Mapping

COs	CO Statement	Cognitive level
CO1	Define and Understand the basics of taxonomy	K1, K2
CO2	Analyze the Chemotaxonomy	K3, K4
CO3	Determine and Explain the DNA hybridization	K3, K4
CO4	Evaluate and categorize the Sequence alignment	K4, K5
CO5	Criticize and manage Sequence alignment	K5, K6

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	3	2	3	2	2	1
CO2	3	3	2	3	3	2	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	2	3	2	2	3	2	2	2	3
CO5	3	3	3	3	3	3	3	3	3	3

“1” – Slight (Low) Correlation

“2” – Moderate (Medium) Correlation

“3” – Substantial (High) Correlation

“-“ indicates there is no correlation

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	Introduction to Microbial Taxonomy Introduction to microbial taxonomy – biological classification – Three Domain Concept, morphological taxonomy, biochemical taxonomy, molecular taxonomy, numerical taxonomy – basic concepts of taxonomy. Positive and negative aspects of each taxonomical method	12	CO1, CO2, CO3	K1, K2, K3, K4
II	Chemotaxonomy Chemotaxonomy – aspects, significance- primary – proteins, nucleic acid, chlorophyll, polysaccharides and secondary constituents- phenolic compounds, flavonoids, terpenoids. Finger printing, Isozyme typing, pigments & polyamines. Molecular Phylogeny-use of proteins and fatty acids.	12	CO1, CO2, CO3, CO4	K1, K2, K3, K4, K5
III	Molecular taxonomy Molecular taxonomy – G + C content, DNA – DNA hybridization, DNA- RNA hybridization, Plasmid profiles, RFLP, RAPD, AFLP, STRR & LTRR.- PCR, Real Time-PCR, PFGE (Pulse Field Gel Electrophoresis); Indirect analysis - SDS PAGE, Western blotting, ELISA, 2D-gel electrophoresis. DNA sequencing – Sanger's Dideoxy sequencing and automated sequencing.	12	CO1, CO2, CO3, CO4,	K1, K2, K3, K4, K5,
IV	Types of rRNA Types of rRNA, Importance of 16S rRNA in microbial identification and taxonomy. Methods of 16S rRNA / rDNA fingerprinting, Isolation of DNA, amplification of 16S rDNA using PCR, Cloning, transformation, Blue-white screening, Plasmid isolation, Dot Blot/Southern blot hybridization using specific probes. Sequencing of 16S rDNA using chain termination method.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6,
V	Introduction to Sequence alignment Introduction to Sequence alignment. Substitution matrices, Scoring matrices – PAM and BLOSUM. Submission of rDNA sequences in GenBank – BankIt & Sequin guidelines. NCBI, EMBL, PDB, DDBJ – retrieving sequences. In silico RNA structure prediction, Restriction enzyme patterns. Ribosomal Database Project - Designing primers, probes and in silico PCR. Evolutionary analysis: distances, Cladistic and Phenetic methods. Sequence comparison, alignment and database searching – ClustalW, FASTA & BLAST. DNA barcoding	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

VI	Self Study for Enrichment (Not included for End Semester Examinations) Field trip and Hands on training on algae sample collection, monitoring algal diversity.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
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Text Books

1. Andréa D, Baxevanis BF, Francis O. (2004). Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. 3rd Edition. Wiley Publications.
2. Brendan Wren and Nick Dorrell. (2002). Functional Microbial Genomics (Volume 33) (Methods in Microbiology), Academic Press, UK.
3. Brown TA. (2006). Genomes, John Wiley and Sons, Pvt. Ltd., Singapore.

Reference Books

1. Campbell A, Heyer. 2004, Discovering Genomics, Proteomics and Bioinformatics, Pearson Education, New Jersey
2. Huson DH and Scornavacca C. (2012). Dendroscope: An Interactive Tool for Rooted Phylogenetic Trees and Networks. Syst. Biol: 1–7.
3. Kenneth WA. (1996). Microbial Genome Methods - Boca Raton : CRC Press, Masatoshi N and Sudhir
4. K. (2000). Molecular Evolution and Phylogenetics - Oxford University press, Inc.
5. Molecular Phylogeny of Microorganisms. (2010). by Aharon O and Thane P. Academic Press,

Web References

1. <https://www.youtube.com/watch?v=8IJRzcPC9wg>
2. <https://www.youtube.com/watch?v=ZWnKemKaEWA>
3. <https://www.youtube.com/watch?v=vqeZBEJyXx4>

Pedagogy

Power point presentations, Group Discussion, Seminar, Quiz, Assignments.

Course Designer

Dr.V.Aruna

Semester: II	Internal Marks: 25	External Marks: 75		
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
23PMB2CC4	BACTERIOLOGY AND MYCOLOGY	CORE COURSE	6	5

Course Objectives

To understand the basic information on bacterial and fungal disease. Important knowledge on host and parasitic infections. Create knowledge on the infection caused by the organism. To understand the pathogenesis of bacterial and fungal diseases.

Prerequisites

Apply their acquired knowledge on laboratory techniques on diagnosis of bacterial and fungal disease.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Determine the host – parasite relationship	K2, K3, K4
CO2	Diagnose the various bacterial pathogens	K3, K4
CO3	Illustrate the <i>Chlamydia trachomatis</i>	K4, K5
CO4	Describe and Classify the various fungi and its Characterization	K5, K6
CO5	Discuss the fungal diseases	K1, K6

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	2	3	2	2	3	2
CO2	3	3	2	2	2	3	3	2	3	3
CO3	3	3	3	2	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	2

“1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation

“3” – Substantial (High) Correlation “-” – indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	Introduction to normal flora: Indigenous normal microbial flora of human body. General attributes and virulence factors of bacteria causing infections. Host Parasite relationships – Nonspecific host immune mechanisms. Ground rules for collection and dispatch of clinical specimens for microbiological diagnosis and discarding of clinical Specimens.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3, K4 K5, K6
II	Bacteriology: Morphology, cultural characteristics, pathology, laboratory diagnosis and prevention, Control and treatment of diseases caused by the Following organisms: <i>Staphylococci aureus</i> , <i>Streptococci pyogens</i> , <i>Pneumococci</i> , <i>Neisseriae (Gonococci & Meningococci)</i> , <i>Corynebacterium diptheriae</i> , <i>Mycobacterium tuberculosis</i> , <i>M. leprae</i> , <i>Clostridium tetani</i> ,	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5 K6
III	Bacteriology: Morphology, classification, cultural characteristics, pathogenicity, pathology, Laboratory diagnosis and prevention, Control and treatment of diseases caused by the Following organisms: <i>Salmonella</i> , <i>Shigella dysenteriae</i> , <i>Vibrio cholerae</i> , <i>E.coli</i> , <i>Pseudomonas aeruginosa</i> , <i>Haemophilus influenza</i> , <i>Helicobacter pylori</i> , <i>Rickettsia rickettsi</i> , <i>Chlamydiae trachomatis</i> .	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5 K6
IV	Mycology: Classification of medically important Fungi (Morphology, Infection & Reproduction), Immunity to Fungal Infections. Culture Media and Stains in Mycology, Normal fungal flora of human beings, Specimen collection, preservation, Transportation & Identification of Mycological Agent. Biochemical tests for fungal identification, Anti-fungal agents-sensitivity test.	18	CO1, CO2, CO3, CO4, CO5	K1, K2 K3, K4 K5, K6

V	Mycology: Morphology, classification, cultural characteristics, pathogenicity, pathology, Laboratory diagnosis and prevention, Control and treatment of diseases caused by the Following organisms: Pityriasis vesicolor, White piedra, Black piedra, Tinea nigra, Cutaneous Mycosis - Dermatophytes. Subcutaneous Mycosis Mycetoma and Sporotrichosis. Systemic Mycosis-Histoplasmosis and Blastomycosis, Opportunistic Mycosis – Cryptococcus neoformans. Miscellaneous Mycosis-Otomycosis.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5 K6
VI	Self-Study for Enrichment (Not included for End Semester Examinations) Ground rules for collection and dispatch of clinical specimens for microbiological diagnosis and discarding of clinical Specimens.Culture Media and Stains in Mycology, Normal fungal flora of human beings, Specimen collection,	-	CO1, CO2, CO3,	K2 K3 K4 K5

Text Books

1. Michael T. Madigan, John M. Martinko, Kelly S. Bender, Daniel H. Buckley And David A. Stahl, Pearson.(2015). Brock Biology Of Microorganisms, Fourteenth Edition, Pearson, Boston.
2. Joanne, M. Willey, Linda, M. Sherwood, Christopher, J. Woolverton And Chris Woolverton, Mc Graw Hill. (2011). Prescott, Harley, And Klein's Microbiology, Eighth edition.
3. De Vos P. (2012). Bergey's Manual of Systematic Bacteriology: Volume 3: The Firmicutes, Springer, Second Edition, Newdelhi
4. Alexopoulos, C.J, Mims, C.W, Blackwell, M.(2007). Introductory Mycology, Fourth Edition, Wiley & Sons.
5. Aneja, K.R and Mehrotra, R.S. (2018). An Introduction to Mycology, New Age International (P) Ltd., Publishers.

Reference Books

1. Griffiths, A. B. (2019). A Manual of Bacteriology, Forgotten Books.
2. Edgar M Crookshank,(2018). Manual of Bacteriology, Forgotten Books.
3. Arora and Brij Bala Arora. (2019). Medical Mycology, Second Edition, CBS.
4. Hait.(2017). A Textbook of Mycology, New Central Book Agency (NCBA); 1st edition, India.

Web References

1. http://www.rvskvv.net/images/General-Bacteriology_23.04.2020.pdf
2. <https://www.eolss.net/sample-chapters/C03/E5-25-48.pdf>
3. <https://www.vnmv.edu.ua/downloads/microbiology/20131218-135731.pdf>
4. https://www.uobabylon.edu.iq/eprints/publication_1_13183_803.pdf
5. <https://www.microrao.com/micronotes/mycology.pdf>

Pedagogy

Chalk and Talk, Assignment, Seminar and Group Discussion and Quiz.

Course Designer

Dr.E.Priya

Semester: II	Internal Marks:25		External Marks:75	
COURSECODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
23PMB2CC5	IMMUNOLOGY AND IMMUNOTECHNOLOGY	CORE COURSE	6	5

Course Objective

The students will acquire the competency to serve as future teachers, trainers and researchers in the field.

Prerequisites

Understand and critically analyze the literature in the field of Immunology and its technical aspects in the field of Immunology.

Course Outcome and Cognitive Level Mapping.

CO Number	CO Statement	Cognitive Level
CO1	Explain the basics of immunology	K2
CO2	Illustrate the hypersensitivity reaction	K3
CO3	Categorize autoimmunity and autoimmune disease	K4
CO4	Interpret trans plantation and tumor immunology	K5
CO5	Discuss molecular immunology and immune diagnosis	K6

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3	3	3	3	3	3
CO2	2	3	2	3	3	3	3	3	3	3
CO3	3	2	3	3	2	3	3	3	3	2
CO4	3	3	3	3	3	3	3	3	2	3
CO5	3	3	3	2	3	3	2	3	3	3

1-Slight (Low)correlation

2-Moderate (Medium)correlation

3-Substantial (High) correlation

“-”indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	Basic Immunology: History of Immunology, Types of Immunity, Cells and organs involved in immune system (T-cells, B-cells, lymphoid organ, spleen and bone marrow), immune responses – cell mediated and humoral, Antigens, Cytokine, Haptens, adjuvants, Antibodies: their structure and functions, Complement system, Antigen processing cells, Classes of Immunoglobulin (IgA, IgG, IgD, IgM and IgE).	18	CO1, CO2, CO3, CO4	K1, K2, K3, K4
II	Hypersensitivity reaction: IgE-mediated (type-I), Ab-mediated cytotoxic (type-II), Immune complex mediated (type-III) and Delayed type hypersensitivity(type-IV).	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	Autoimmunity and autoimmune disease: Organs specific autoimmune disease – Hashimoto's thyroiditis, Good pastures syndrome, Insulin dependent diabetes mellitus. Systemic autoimmune disease – systemic lupus erythematosus (SLE), Multiple sclerosis, Rheumatoid arthritis.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	Transplantation and Tumor immunology: Transplantation and its classification, Immunologic basis of graft rejection and its Mechanism, Transplantation antigens, tissue typing role of MHC molecules in allograft rejection and immune suppressive therapy. Tumors of the immune system, tumor antigens and immune response to tumors, detection of tumor markers and tumor immunotherapy.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	Molecular Immunology and Immuno diagnosis: Antigen antibody interaction – Precipitation reactions, Agglutination reactions, ABO Blood typing principles. Principles and applications of ELISA, Radio Immuno Assay, western blot analysis, immune electrophoresis- double immuno assay, rocket immune assay, Immuno fluorescence and chemi luminescence Assay.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

VI	Self study for Enrichment (Not included for End Semester Examination) Immunological memory, Non-allergic hypersensitivity, Nutrition and autoimmunity, Advances in tumor immunology and fluorescence activated cell sorting (FACS) Analysis.	-	CO1, CO2, CO3, CO4, CO5	K1 K2, K3, K4, K5, K6
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Text Books

1. Coico R. and Geoffrey S. (2015) *Immunology: A Short Course. 7th Edition.* Wiley-Blackwell.
2. Singh R.P.(2015) *Immunology and Medical Microbiology. 2nd Edition.* Kalyani Publishers, New Delhi.
3. Talwar C.P. and Gupta S. K. (2017) *Hand Book of Practical and Clinical Immunology.* CBS Publishers & Distributors.
4. Shyamasree G. (2021) *Immunology and Immunotechnology. 2nd Edition.* Books & Allied Pvt. Ltd.
5. Gupta.S.K. and Goswami. B. (2021) *Immunology for MBBS.* APC Books.
6. Misbah S.A., Spickett G.P. and Dalm V.A.S.H. (2022) *Chapel and Haeney's Essentials of Clinical Immunology. 7th Edition.* Wiley-Blackwell.

Reference Books

1. Sudha G. and Shubhangi S. (2013) *Textbook of Basic and Clinical Immunology.* Universities Press (India) Pvt. Ltd.
2. Rich R., Fleisher T., Shearer W., Schroeder H., Frew A. and Weyand C. (2018) *Clinical Immunology: Principle sand Practice.* Elsevier.
3. Abbas A.K., Lichtman A.H. and Pillai S. (2019) *Basic Immunology (Functions and Disorders of the Immune System). 6th Edition.* Elsevier.
4. Punt J. (2019) *Kuby Immunology. 8th Edition.* Mac millan Learning.
5. Ian C Clift. (2020) *Clinical Immunodiagnostics: Laboratory Principles and Practices.* Jones & Bartlett Publishers.
6. Chakravarty A.K. (2021) *Immunology and Immunotechnology.* Oxford University Press.

Web References

1. <https://www.jaypeedigital.com/eReader/chapter/9788184480610/ch1>
2. <https://www.ncbi.nlm.nih.gov/books/NBK562228/>
3. <https://www.healthline.com/health/autoimmune-disorders>
4. <https://www.slideshare.net/MMASSY/transplantation-and-tumor-immunology>
5. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7474384/>

Pedagogy

Chalk and talk, PowerPoint Presentation, Quiz, Assignments, Group Discussions, Seminar, Assignment.

Course Designer

Dr.V.Aruna

Semester: II	Internal Marks: 25	External Marks: 75		
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
23PMB2CCC1A	MICROBIAL METABOLISM	CORE CHOICE COURSE	5	4

Course Objectives

This course deals with how to make microbes differentiate based on the metabolism and describe how microbes do catabolism to get energy and metabolism to build structure.

Prerequisites

Basic knowledge on Physiological processes of Microbes.

Course Outcome and Cognitive Level Mapping

CONumber	CO Statement	Cognitive Level
CO1	Define and understand the basic concepts of metabolism	K1,K2
CO2	Explain and analyze about the growth phases of Microbial populations	K3, K4
CO3	Analyze about Microbial respiration	K3, K4
CO4	Criticize about bacterial photosynthesis	K5, K6
CO5	Assess about microbial biosynthesis	K5, K6

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2	2	3	3	2	2
CO2	3	2	3	2	3	3	3	3	3	2
CO3	3	2	2	2	3	3	2	2	2	2
CO4	2	2	2	3	2	3	2	2	2	2
CO5	2	3	2	2	3	3	3	3	3	2

“1” – Slight (Low) Correlation

“3” – Substantial (High) Correlation

“2” – Moderate (Medium) Correlation

“-” indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	Metabolism -Definition - Anabolism versus Catabolism. Metabolic pathways – Linear, irreversible and branched metabolic pathways. Mechanisms of enzyme reaction – the role of ATP, reducing power and precursor metabolites in metabolism. Biochemical mechanisms of generating ATP. Components of electron transport chains - NAD, NADP, FAD, FMN, Coenzyme-Q, Cytochromes.	15	CO1, CO2, CO3	K1, K2, K3, K4,
II	Microbial Growth - Phases of growth, Growth kinetics - batch culture, continuous culture and synchronous culture - induction of synchrony. Factors affecting growth - nutrition, aeration, temperature and pH. Physiological adaptation to extreme environmental conditions. Nutritional types - types based on carbon, energy and electron sources. Measurement of cell numbers, cell mass	15	CO1, CO2, CO3, CO4	K1, K2, K3, K4, K5
III	Respiration - Aerobic respiration: glycolysis, Pentose Phosphate pathway, TCA cycle. Glyoxylate cycle. Respiratory electron transport in mitochondria and bacteria. Anaerobic respirations: sulfate, nitrate, carbonate respirations and their ecological significance.	15	CO1, CO2, CO3, CO4	K1, K2, K3, K4, K5
IV	Bacterial Photosynthesis - Brief account of photosynthesis – oxygenic and anoxygenic photosynthesis. fixation of CO ₂ - Calvin cycle - C ₃ -C ₄ pathway. Chemo lithotrophic oxidations - Sulfur, Iron, Hydrogen and Nitrogen oxidations. Methanogenesis, Basic aspects of bioenergetics – entropy, enthalpy, equilibrium constant, artificial electron donors, inhibitors, uncouplers, energy bond, phosphorylation.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

V	Microbial Biosynthesis -Biosynthesis of Peptidoglycan, Amino acids, Fatty acids, Vitamins – Biosynthesis of Poly Hydroxy Alkanoate (PHA) and Poly Hydroxy Butyrate (PHB)	15	CO1, CO2, CO3, CO4 , CO5	K1, K2, K3, K4, K5, K6
VI	Self Study for Enrichment (Not included for End Semester Examinations) Bioluminescence: Bioluminescent bacteria and its importance. Biochemistry of Luciferin- Luciferase along with the lux operon (genes).	-	CO1, CO2, CO3, CO4 , CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Satyanarayana, U. and Chakrapani, U. (2013) Biochemistry, Fourth Edition. Book and Allied Pvt, Kolkata.
2. Stryer L. (2010) Biochemistry Seventh Edition. W.H. Freeman and Company, New York.
3. Monika Rustugi (2016). Bacterial Metabolism. Meditech.
4. Anadhi, D. (2014). Introduction to Biochemistry and Metabolism. Pearson Education India

Reference Books

1. Tyrrell Conway, Paul S. Cohen. (2015) Metabolism and Bacterial Pathogenesis. ASM Press.
2. Rabus, R. (Oldenburg) Saier Jr., M.H. (La Jolla, CA. (2022). Microbial Physiology. Karger Publication.
3. Walid EI Sharoud. (2011). Bacterial Physiology: A Molecular Approach. Springer.
4. G.N.Cohen.(2011). Microbial Biochemistry. Springer.

Web References

1. <https://download.e-bookshelf.de/download/0000/5838/44/L-G-0000583844-0002360696.pdf>
2. <https://www.perlego.com/book/2771785/microbial-physiology-pdf>
3. <https://www.slideshare.net/cavoyc/physiology-of-microorganism-1>
4. <https://byjus.com/biology/metabolism/>
5. <https://www.britannica.com/science/metabolism>

Pedagogy

Chalk and Talk, Assignment, Seminar and Group Discussion, Quiz.

Course Designer

Dr.N.Pushpa

Semester : II	Internal Marks: 25		External Marks: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
23PMB2CCC1B	MICROBIAL PHYSIOLOGY	CORE CHOICE COURSE	5	4

Course Objectives

This course will help the students gain knowledge about the Microbial physiology and metabolism by understanding microbial nutrition and growth characteristics.

Prerequisites

Differentiating concepts of aerobic and anaerobic respiration and how these are manifested in the form of different metabolic pathways in microorganisms.

Course Outcome and Cognitive Level Mapping:

CO Number	CO Statement	Knowledge level
CO1	To impart among the learners the fundamental principles of microbial physiology	K1, K2, K4
CO2	To provide the role / functions of various enzymes of bacterial cell.	K1, K2, K3
CO3	To understand the route of a cell to metabolize carbohydrate, protein and fatty acids.	K1, K2, K3
CO4	To highlight the microbial enzymes' profiles and their activity.	K1, K2, K4
CO5	Attain insight about aerobic respiration and Photosynthesis of Green, Purple bacteria and Cyanobacteria.	K1, K2, K4

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	3	3	3	3	3	3	3
CO2	2	3	2	3	3	3	3	2	3	3
CO3	3	2	3	3	2	2	3	3	3	2
CO4	3	3	3	3	3	3	3	3	2	3
CO5	2	3	2	2	3	3	2	3	3	2

1- Slight (Low) correlation 2- Moderate (Medium) correlation
3- Substantial (High) correlation “-” indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	Microbial nutrition and growth: Nutritional requirements of microbes - Autotrophs, Heterotrophs, Photoautotrophs, Chemoautotrophs, Copiotrophs, Oligotrophs, Factors influencing microbial growth – pH, temperature, substrate and osmotic condition. Bacterial growth curve & importance of the growth phases – Generation time - Growth measurements – batch, continuous and synchronous. Diauxic growth.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5 K6
II	Bacterial enzymes – classification & nomenclature, properties, kinetics of enzyme action – Michaelis-Menton equation for simple enzymes - coenzymes and cofactors, isozymes. Factors affecting enzyme activity.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	Anabolism – bacterial phototynthesis – oxygenic – anoxygenic, synthesis of carbohydrate – catabolism of glucose – EMP – HMP – ED pathways, TCA cycle – electron transport system, Phosphorylation, oxidative and substrate level phosphorylations.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	Protein metabolism – synthesis and degradation of amino acids – glycine tyrosine, cysteine, serine, glutamine, synthesis of peptides and proteins – urea cycle	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	Lipid metabolism – biosynthesis of fatty acids and cholesterol – oxidation of fatty acids. Anaerobic Respiration – Nitrate, sulphate and methane respiration – Fermentations – alcoholic, propionic, mixed acid, lactic acid fermentation.	15	CO1, CO2, CO3, CO4, CO5	K1 K2, K3, K4, K5
VI	Self Study for Enrichment (Not included for End Semester Examination) Anaerobic respiration with special reference to dissimilatory nitrate reduction (Denitrification; nitrate/nitrite and nitrate/ammonia respiration; fermentative nitrate reduction Fermentation-Alcohol fermentation and Pasteur effect.	-	CO1, CO2, CO3, CO4, CO5	K1 K2, K3, K4, K5, K6

Text Books

1. Moat G, John W. Foster and Michael P. Spector (2002). Microbial physiology. Fourth edition, A John Wiley son, Inc. publication. New Delhi.

3. Dubey RC and Maheshwari DK (2022). A Text of Microbiology. Revised edition, S. Chand and Company Ltd., New Delhi
4. Namita Gupta, Rani Gupta (2021), Fundamentals of Bacterial Physiology and Metabolism, Springer
5. Rajan S and Selvichristy (2019). Exam Oriented Biochemistry. CBS Publishers, New Delhi
6. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited.

References

1. Nelson David L, Albert L Lehninger and Michael M Cox. Lehninger (2008) Principles of biochemistry. Macmillan.
2. Murray RK, Granner DK, Mayes PA and Rodwell VW. (2004) "Harper's Biochemistry, Appleton and Lange: New York, NY.
3. Dubey, R.C. & D.K. Maheshwari. (2022) A Text Book of Microbiology, S. Chand and Company Ltd., New Delhi.

Web links

1. <https://www.elsevier.com/books/bacterial-physiology-and-metabolism/sokatch/978-1-4832-3137-2> 14.
2. [https://bio.libretexts.org/Bookshelves/Microbiology/Book%3A_Microbiology_\(Bru-slind\)/11%3A_Microbial_Nutrition](https://bio.libretexts.org/Bookshelves/Microbiology/Book%3A_Microbiology_(Bru-slind)/11%3A_Microbial_Nutrition)
3. <https://microbiologynotes.org/introduction-to-the-microbial-nutrition/>
4. <https://www.youtube.com/watch?v=SCTMQNmZtdw>
5. <https://www.youtube.com/watch?v=VzAjOPzUIP4>
6. <https://www.youtube.com/watch?v=0OMNyVzLnVc>

Pedagogy

Chalk and talk, Power Point Presentation, Quiz, Assignments, Group Discussions, Seminar, and Assignment.

Course Designer

Dr. S. Jeyabharathi

Semester: II	Internal Marks: 25		External Marks: 75	
COURSE CODE	COURSE TITLE	CATEGORY	Hrs/WEEK	CREDITS
23PMB2CCC1C	MICROBIAL GROWTH AND NUTRITION	CORE CHOICE COURSE	5	4

Course Objective

Understand mechanism of uptake of nutrients in microbial cells. Study the microbial growth and kinetics of growth. Understand influence of environmental factors on microbial growth.

Prerequisite

Basic Knowledge of microbial growth nutrition concepts

Course Outcomes and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Examine the properties of a good culture medium.	K3,K4
CO2	Determine the microorganisms of Pure culture methods	K4,K5
CO3	Evaluate the nutritional categories of microorganisms on the basis of carbon and energy source	K4, K5
CO4	Illustrate the microbial Transport	K5,K6
CO5	Demonstrate the microbial Growth	K6,K5

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	3	3	3	3	2	2	3
CO2	3	3	3	3	2	3	3	3	3	2
CO3	3	2	3	3	2	3	3	3	3	3
CO4	3	3	2	3	3	3	3	3	2	3
CO5	3	3	3	2	3	2	2	3	3	3

“1”- Slight (Low) correlation “2”- Moderate (Medium) correlation

“3”- Substantial (High) correlation “-” indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	Cultivation media: Properties of a good culture medium. General ingredients of culture media and their role. Definition, Concept, Use and Types of different culture media – Living and Non - living media, Synthetic, Non-synthetic, Natural, Selective, Differential, Enriched, Enrichment, Assay, Minimal, Maintenance and Transport Medium and Buffers in culture medium.	15	CO1 CO2 CO3 CO4	K1 K2 K3 K4 K5
II	Pure culture methods: Definitions - pure culture, mixed culture, consortium, axenic culture, contamination. Isolation of microorganisms: Principle and method of isolation-streak plate pour plate, spread plate, single cell isolation. Cultivation of anaerobes: Gas Pak Anaerobic jar.	15	CO1 CO2 CO3 CO4	K1 K2 K3 K4
III	Microbial Nutrition: Major bio-elements: carbon, oxygen, hydrogen, phosphorus, and sulfur. Minor bio-elements: manganese, zinc, cobalt, molybdenum, nickel, and copper. Growth factors - temperature, pH, and osmotic pressure. Sources of energy. Nutritional categories of microorganisms on the basis of carbon and energy source.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6.
IV	Microbial Transport: Modes of nutrition: osmotrophic, phagotrophic. Nutrient transport and membrane function- primary and secondary transport, porins, OMP, carrier proteins. Passive diffusion. Facilitated diffusion. Active transport mechanism. Group translocation.	15	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
V	Microbial Growth: Binary fission, Budding, fragmentation and formation of conidiophores. Mathematical expression of growth. Growth curve and diauxic growth. Measurement of growth: cell number, cell mass and cell activity. Different types of bacterial cultures –Batch culture, continuous culture, synchronous culture.	15	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5 K6
VI	Self -Study for Enrichment (Not included for End Semester Examination)	-	CO1 CO2 CO3	K1 K2 K3

	Cultivation of anaerobes: Gas Pak Anaerobic jar, Mathematical expression of growth and OMP.		CO4 CO5	K4 K5
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Text Books

1. Albert G. Moat, John W. Foster, Michael P. Spector (2022). *Microbial Physiology*. Wiley-Liss, Inc.
2. Ram Reddy. S and Reddy S.M.(2022). *Microbial Physiology*. 2nd Edition Scientific Publishers.
3. MeenaKumari S (2016). *Microbial Physiology*. Lightning Source Publisher.
4. Rani Gupta, Namita Gupta (2021). *Fundamentals of Bacterial Physiology and Metabolism*. Springer link.
5. Gerhard Gottschalk (2012). *Bacterial Metabolism*. 2nd edition. Springer.

Reference Books

1. Monika Rustagi (2016). *Bacterial Metabolism*. Medtech Publisher.
2. Byung Hong Kim, Geoffrey Michael Gadd (2021). *Bacterial Physiology and Metabolism*. Lightning Source Publisher.
3. Salle AJ. Fundamental principles of Bacteriology, 7th edition, Tata McGraw- Hill publishing company limited, New Delhi. 1996.
4. Doelle HW. Microbial Metabolism, Academic Press. 2005.
5. Lansing M. Prescott JP, Harley and Donald A Klein. Microbiology, 5th edition, McGraw Hill Company, New York. 2003. Nduka Okafor. (2011). *Environmental Microbiology of Aquatic and Waste Systems*. Springer Dordrecht Heidelberg London

Web References

1. <https://learn.chm.msu.edu/vibl/content/differential/>
2. https://deogiricollege.org/iqac/science/biotech/Pure_culture_techniques.pdf
3. [https://bio.libretexts.org/Bookshelves/Microbiology/Microbiology_\(Bruslind\)/11%3A_Microbial_Nutrition](https://bio.libretexts.org/Bookshelves/Microbiology/Microbiology_(Bruslind)/11%3A_Microbial_Nutrition)
4. <https://onlinelibrary.wiley.com/doi/book/10.1002/3527600728>
5. https://acikders.ankara.edu.tr/pluginfile.php/140179/mod_resource/content/0/07.pdf

Pedagogy

Chalk and talk, Power point presentation, Group Discussion, Seminar, Quiz, Assignment.

Course Designer

Dr.E.Priya

Semester: II	Internal Marks: 40	External Marks: 60		
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
23PMB2CC2P	BACTERIOLOGY, MYCOLOGY, IMMUNOLOGY AND IMMUNOTECHNOLOGY(P)	CORE PRACTICAL	9	5

Course Objectives

To impart knowledge about pure culture, staining & Immuno techniques.

Prerequisites

Basic knowledge and concepts of bacteriological, mycological and immunological techniques.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Analyze the Growth nature of organisms	K4
CO2	Assess the staining techniques	K5
CO3	Evaluate on bacterial identification	K5
CO4	Determine ABO blood grouping	K5
CO5	Compiled view of immune techniques	K6

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	3	3	3	3	2	3
CO2	3	2	3	3	2	2	3	2	3	3
CO3	3	2	2	3	3	3	2	3	3	2
CO4	2	3	3	2	3	3	3	2	3	2
CO5	3	3	2	3	2	3	3	3	2	2

“1” – Slight (Low) Correlation

“2” – Moderate (Medium) Correlation

“3” – Substantial (High) Correlation

“-” indicates there is no correlation

Syllabus

BACTERIOLOGY, MYCOLOGY

1. Staining of clinical specimens - Wet mount, Differential and Special staining methods.
2. Isolation and identification of bacterial pathogens from clinical specimens - cultivation in basal, differential, enriched, selective and special media - Biochemical identification tests.
3. Antimicrobial sensitivity testing - Kirby bauer method and Stokes method.
4. Minimum inhibitory concentration (MIC) test.
5. Minimum bactericidal concentration (MBC) test.
6. Mounting and staining of VAM spores.
7. Examination of different fungi by Lactophenol cotton blue staining.
8. Examination of different fungi by KOH staining.

IMMUNOLOGY AND IMMUNOTECHNOLOGY

1. Preparation of bacterial antigen by homogenization.
2. Latex agglutination – RF, ASO and CRP.
3. Haem agglutination – Blood grouping and TPHA.
4. Immunodiffusion techniques – single radial, double immunodiffusion techniques.
5. Counter immune electrophoresis.
6. ELISA –HbsAg.
7. Preparation of lymphocytes from peripheral blood by density gradient method.
8. Peripheral blood smear and differential staining.
9. Purification of immunoglobulin by ammonium sulphate precipitation method and SDS-PAGE analysis.
10. Immunochromatography: Demonstration

Reference Books

1. Jacquelyn Black, (2015) Microbiology: Principles and Explorations 9th Edition.
2. Abul Abbas Andrew H. Lichtman, Shiv Pillai, (2014) Cellular and Molecular immunology, 8th edition, Elsevier.
3. Power and Dagainawala, (2012), General Microbiology, Himalaya Publishing House.
4. Power and Dagainawala,(2017), General Microbiology, Himalaya Publishing House, **Vol-II.**

5. Kathleen park Talaro,(2014), Foundations in Microbiology, McGraw Hill. Science, 9th Edition.

Web References

1. <https://universe84a.com/immunochromatographic-test/>
2. <https://www.slideshare.net/AhmedRiyadh17/counter-immunoelectrophoresis>
3. https://www.stma.org/sites/stma/files/pdfs/AlanWindham_Microscopic_Identification_of_Turfgrass_Diseases_STMA.pdf
4. <https://www.iitg.ac.in/biotech/BTechProtocols/RadialImmuno.pdf>
5. <https://www.bioted.es/protocolos/RADIAL-IMMUNODIFFUSION-ENG.pdf>

Pedagogy

Chalk and Talk, Assignment, Seminar and Group Discussion and Quiz.

Designer

Ms.S.Sathya

Semester: II	Internal Marks: 25	External Marks: 75		
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
23PMB2DSE2A	MEDICAL MICROBIOLOGY	DISCIPLINE SPECIFIC ELECTIVE COURSE	4	3

Course Objective

Introduce the basic concepts of medical microbiology and Epidemiology Impart basic knowledge on various types of infection, host parasite relationship and virulence factors associated with the pathogen.

Prerequisites

Basic knowledge and concepts of microbial pathogens and various control measures.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Remember the basics of medical microbiology and Epidemiology	K1
CO2	Understand various types of infection	K2
CO3	Apply to know host parasite relationship and virulence factors associated with the pathogen.	K3
CO4	Analyze diseases caused by bacterial and protozoa	K4
CO5	Evaluate on various viral and fungal diseases	K5

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	3	2	3	2	2	1
CO2	3	3	2	3	3	2	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	2	3	2	2	3	2	2	2	3
CO5	3	3	3	3	3	3	3	3	3	3

“1” – Slight (Low) Correlation

“2” – Moderate (Medium) Correlation

“3” – Substantial (High) Correlation

“-“ indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	Introduction to medical microbiology Introduction to medical microbiology, Historical background, Classification of medically important microorganisms, Disease cycle, transmission of pathogen and its routes. Host parasite relationship, pathogenicity and virulence in relation with bacteria, Virus, fungi and parasites. Epidemiology and Public Health: Epidemiological principles in prevention and control of diseases; Endemic, epidemic, pandemic and sporadic diseases; Concepts of mortality/ morbidity rates, incidence and prevalence	12	CO1, CO2, CO3, CO4	K1, K2, K3, K4, K5, K6.
	Infection and its types Infections: types of infection, sources of infection, reservoirs and vectors of infection, predisposing factors. Host-parasite relationship governing the infection and establishment of disease. Normal microflora of the human body: Importance of normal microflora, normal microflora of skin, respiratory tract, gastrointestinal tract, urogenital tract, concept of probiotics; Mode of spread of infection; Respiratory, skin, wound & burn infection, venereal infections, alimentary tract infection, blood born infection and nosocomial infection.	12	CO1, CO2, CO3, CO4,	K1, K2, K3, K4, K5, K6.
III	Bacterial diseases and Protozoan diseases Classification of medically important microorganisms; Classification of pathogenic bacteria. Staphylococcus, Streptococcus, Neisseria; Corynebacterium, Clostridium, Vibrio, Yersinia, Haemophilus, Mycobacterium, Spirochetes,	12	CO1, CO2, CO3, CO4,	K1, K2, K3, K4, K5, K6.

	Bordetella, Rickettsiae, Chlamydia. Protozoandiseases: Causative agents, Symptoms, mode of transmission, prophylaxis and control: Malaria			
IV	Viral and Fungal diseases General properties of viruses Host interactions: Pox viruses; Herpes virus, Hepatitis viruses Picorna viruses, Ortho myxo viruses and Human Immunodeficiency viruses (HIV) Fungal diseases of man, Epidemiology. Dermatophytes, dimorphic fungi, opportunistic fungal pathogens. Description and classification of pathogenic fungi and their laboratory diagnosis, treatment. Superficial mycoses, subcutaneous mycoses, systemic mycoses.	12	CO1, CO2, CO3, CO4, CO5,	K1, K2, K3, K4, K5, K6,
V	Antimicrobial agents Antimicrobial agents: Antibiotics, Antifungal and Antivirals. Antibiotic and chemotherapeutic agents: Sulfur drugs, Antibiotics and their classification, Mode of action, chemical nature of different antibiotics. Antibiotic assay and sensitivity test. Antiviral drugs- Antibiotic/Drug resistance – origin, cause, and clinical implication with special references of multidrug resistant bacteria. Superbugs.	12	CO1, CO2, CO3, CO4, CO5,	K1, K2, K3, K4, K5, K6,
VI	Self Study for Enrichment (Not included for End Semester Examinations) knowledge on various types of infection, host parasite relationship and virulence factors associated with the pathogen.	-	CO1, CO2, CO3, CO4, CO5,	K1, K2, K3, K4, K5, K6,

Text Books

1. Apurba s. Essentials of Microbiology (3rd Edition). jaypee brothers Medical Publishers, 2020.
2. Warren E. Review of Medical Microbiology and Immunology. (17th edition). McGraw Hill/ Medical, 2022.
3. Ananthanarayanan. R. and C.K. Jayaram Panicker. Textbook of Microbiology Orient Longman, 1997.
4. Jawetz Melnick. Medical Microbiology (28th edition). McGraw Hill/ Medical, 2019.
5. Aejaz iqbal. Medical Microbiology (1st edition). Notion Press, 2020.

Reference Books

1. Saumya singh. Medical Microbiology (1st edition), CBS Publishers, 2022.
2. Michael. J. Pelczar, JR, E.C.S. Chan, Noel R. Krieg. Microbiology. TATA McGraw Hill. pp: 673-763, 2020.
3. Arora. Medical mycology (2nd edition). CBS Publishers, 2019.
4. Reena ray gosh. Medical mycology (1st edition). CBS Publishers, 2019.
5. Saravanan P. Virology (1st edition). MJP Publisher, 2021.

Web References

1. <https://www.microbe.net/resources/microbiology/web-resources/>
2. <https://www.omicsonline.org/medicalmicrobiology-diagnosis.phpguides.emich/immunology>
3. https://content.kopykitab.com/ebooks/2017/04/10504/sample/sample_10504.pdf

Pedagogy

Chalk and Talk, Assignment, Seminar and Group Discussion.

Course Designer

Ms. R. Kiruthiga

Semester: II	Internal Marks : 25	ExternalMarks:75		
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
23PMB2DSE2B	PUBLIC HEALTH MICROBIOLOGY	DISCIPLINE SPECIFIC ELECTIVE COURSE	4	3

Course Objectives

This course deals with the microbes related to public health and to gain knowledge about the medically important human microbial pathogens with focus on the diseases caused by them, disease pathogenesis, lab diagnosis, prophylaxis, control measures.

Prerequisites

Basic knowledge about diagnosis and treatment methods for various microbial infections.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Define and examine the basic ideas about microbial association	K1, K4
CO2	Diagnose and analyze various airborne disease	K3, K4
CO3	Determine the water borne diseases and its control	K1, K4
CO4	Evaluate and discuss about the role of microorganisms in food	K3, K5
CO5	Extend the diagnosis hospital acquired Infections	K2, K6

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	3	3	3	3	2	3
CO2	2	3	2	3	3	3	2	3	3	3
CO3	3	2	3	3	3	3	2	3	2	3
CO4	3	2	2	2	2	3	2	2	2	3
CO5	3	2	3	3	2	2	3	3	3	3

“1”–Slight (Low)Correlation

“2”–Moderate (Medium)Correlation

“3”–Substantial (High)Correlation

“-“indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	Introduction to public health: Definition, scope, concept and importance of public health microbiology – roles of microbiologist in public health – microbial association of water, air and soil. Basic concept on pollution and its types.	12	CO1, CO2, CO3	K1, K3, K4
II	Air borne infections: Air and its composition – indoor air and outdoor air. Air borne diseases- (bacterial, fungal and viral), Sources of infection. Methods of enumeration of microorganisms in air–air sanitation.	12	CO1, CO2, CO3, CO4	K1, K3, K4, K5
III	Water borne infections: Kinds of water – water borne diseases (viral, bacterial, protozoan) – methods of enumeration of microorganisms in water – indicator organisms – water treatment control of water borne diseases.	12	CO1, CO2, CO3, CO4	K1, K3, K4, K5
IV	Food borne diseases: Definition and importance of food hygiene – types (spoilage of meat and its products, milk and dairy products, fish and fish products and eggs) – Role of microorganisms in food spoilage and poisoning – food borne diseases – types of food borne diseases.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	Nosocomial infection: Introduction and its types, pathogenicity of nosocomial infection, prevention and control of nosocomial infections. Prophylactic immunization – disposal of infective hospital and laboratory materials– techniques used	12	CO1, CO2, CO3, CO4 CO5	K1, K2, K3, K4, K5, K6

	For the diagnosis of hospital acquired infection.			
VI	Self Study for Enrichment (Not included for End Semester Examinations) Classification of Medically important Microbes.	-	CO1, CO2, CO3, CO4	K1, K2, K3, K4, K5, K6

Text Books

1. Patrick R. Murray, Ken S. Rosenthal, and. Michael A. P. Falle. (2012). Medical Microbiology. Elsevier Health Sciences.
2. Keith Struthers J.(2017). Clinical Microbiology. Taylor & Francis Group.
3. Sastry Apurba. S.(2021). Essentials of Microbiology. Jaypee Brothers Medical Publishers
4. Gerard Tortora (Author), Berdell Funke (Author), Christine Case.(2022).Microbiology An Introduction. Pearson Mastering.

Reference Books

1. Joanne Willey, Christopher J. Woolverton, Linda Sherwood (2011). Prescott's Microbiology. McGraw Hill
2. Park. K. (2017). Parks Text Book of Preventive and Social Medicine.
3. Goering, Hazel Dockrell, Mark Zuckerman, Peter Chiodini. (2018). Mim's Medical Microbiology and Immunology
4. Engelkirk. P.K. and Duben – Engelkirk. J. (2015). Burton's Microbiology for the Health Sciences, 10th Edn. Wolters Kluwer Health.

Web References

1. https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_science_students/ln_intro_ph_final.pdf
2. <https://www.webmd.com/lung/what-are-airborne-diseases>
3. <https://www.health.state.mn.us/diseases/waterborne/basics.html>
4. https://www.who.int/health-topics/foodborne-diseases#tab=tab_1
5. <https://www.osmosis.org/answers/nosocomial-infection>

Pedagogy

Chalk and Talk, Assignment, Seminar and Group Discussion, Quiz.

Course Designer

Dr.V.Aruna

Semester: II	Internal Marks: 25		External Marks: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HRS /WEEK	Credits
23PMB2DSE2C	MEDICAL PARASITOLOGY	DISCIPLINE SPECIFIC ELECTIVE	4	3

Course Objectives

To enable the students to understand the clinically important protozoa, helminths and arthropods and acquire knowledge about the areas in which parasitic infections are endemic.

Prerequisites

Basic knowledge and concepts of clinically important parasites

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Define and understand diagnostic techniques in parasitology	K1, K2
CO2	Analyze and explain clinical significance of <i>Entamoeba histolytica</i>	K3, K4
CO3	Determine and apply the treatment of <i>Leishmania donovani</i>	K3, K4
CO4	Evaluate and categorize the <i>Plasmodium</i> spp.	K4, K5
CO5	Criticize and manage <i>Taenia solium</i>	K5, K6

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	1	3	2	3	3	2
CO2	2	2	2	2	2	3	2	3	2	2
CO3	2	3	1	2	3	3	2	3	2	2
CO4	3	2	3	2	2	3	2	3	2	1
CO5	3	3	3	3	2	3	2	3	3	2

“1” – Slight (Low) Correlation

“3” – Substantial (High) Correlation

“2” – Moderate (Medium) Correlation

“-“ indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	Introduction and classification of parasites: Scope and historical landmarks in Parasitology. Basic principles and nomenclature aspects of parasites. Classification of Parasites – Protozoa and helminthic infection. Laboratory Diagnostic Techniques in Parasites – Direct Identification and Indirect Identification. Concentration methods - flotation techniques and sedimentation techniques	12	CO1, CO2, CO3	K1, K2, K3, K4
II	Amoebae: Morphology, Clinical Significance, Symptoms, Pathogenicity, Lab Diagnosis, Treatment and Prevention - Amoebae: <i>Entamoeba histolytica</i> , <i>Naegleria fowleri</i> , <i>Acanthamoeba</i>	12	CO1, CO2, CO3, CO4	K1, K2, K3, K4, K5
III	Flagellates: Morphology, Clinical Significance, Symptoms, Pathogenicity, Lab Diagnosis, Treatment and Prevention - Flagellates: <i>Giardia lamblia</i> , <i>Trichomonas vaginalis</i> , <i>Trypanosoma</i> , <i>Leishmania</i> .	12	CO1, CO2, CO3, CO4,	K1, K2, K3, K4, K5,
IV	Sporozoans: Morphology, Clinical Significance, Symptoms, Pathogenicity, Lab Diagnosis, Treatment and Prevention - Sporozoans: <i>Plasmodium</i> , <i>Toxoplasma gondii</i> , <i>Cryptosporidium parvum</i> , <i>Cyclospora cayetanensis</i> .	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6,
V	Cestodes and Nematodes: Morphology, Clinical Significance, Symptoms, Pathogenicity, Lab Diagnosis, Treatment and Prevention – <i>Taenia solium</i> , <i>Ancylostoma duodenale</i> and <i>Wuchereria bancrofti</i> .	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	Self Study for Enrichment (Not included for End Semester Examinations) Isolation, identification, clinical manifestations of medically important parasites	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Apurba S Sastry, Sandhya Bhat. (2018). Essentials of Medical Parasitology. 2nd Edition. Jaypee Brothers Medical Publishers.
2. Sougata Ghosh. (2021). Paniker's Text book of Medical Parasitology. 9th Edition. Jaypee Brothers Medical Publishers.

3. Nagoba, B.S. (2020). Medical Microbiology and Parasitology: Prep Manual for Undergraduates, 4th Edition. Elsevier India.
4. Baveja, V. and Baveja, C.P. (2019). Medical Parasitology. 4th Edition. Arya Publishing Company.
5. Sumeeta Khurana, Abhishek Mewara. (2021). Textbook of Medical Parasitology. 1st Edition. Universities Press India Pvt. Ltd

Reference Books

1. Nanda Maheshwari. (2022). Clinical Microbiology & Parasitology for DMLT Students. 4th Edition. Jaypee Brothers Medical Publishers.
2. Arora. D.R. (2020). Medical Parasitology. 5th Edition. CBS Publisher.
3. Shyamasundari, K. and Hanumantha Rao. K. (2021). Medical Parasitology. 1st Edition. MJP Publishers.
4. Rajan, S. and Selvi Christy, R. (2018). Essentials of Microbiology. 4th Edition. CBS Publishers and Distributors Pvt. Ltd.
5. Joanne M. Willey, Kathleen M. Sandman and Dorothy H. Wood (2022). Prescott's Microbiology. 12th Edition. McGraw-Hill Education.
6. Apurba S Sastry and Sandhya Bhat. (2022). Essentials of Medical Microbiology. 4th Edition. Jaypee brothers med Pub Pvt Ltd.

Web References

1. <https://byjus.com/biology/parasites-symbiosis/>
2. https://www.brainkart.com/article/Parasite-and-Host_41024/
3. <https://byjus.com/biology/entamoeba-histolytica-life-cycle/>
4. <https://microbenotes.com/giardia-duodenalis/>
5. <https://www.onlinebiologynotes.com/plasmodium-falciparum-morphology-life-cycle-pathogenesis-and-clinical-disease/>
6. https://www.meduniwien.ac.at/hp/fileadmin/tropenmedizin/Lehre/Helminths_and_Helminthiasis_Kompatibilitaetsmodus.pdf

Pedagogy

Power point presentations, Group Discussions, Seminar, Quiz, Assignment, Brain Storming Activity.

Course Designer

Dr. S. Jenny