SHRI DAVARA UNIVERSITY NAYA RAIPUR (C.G.)
MASTER OF SCIENCE IN MICROBIOLOGY

SINGLE EXIT POST GRADUATE PROGRAMME CURRICULUM PER NEW EDUCATION POLICY-2020

ONE YEAR POST GRADUATE PROGRAMME FOR FOUR YEAR GRADUATION,

TWO YEAR POST GRADUATE PROGRAMME FOR THREE YEAR GRADUATION,

(SINGLE EXIT AFTER 1ST YEAR TWO SEMESTERS FOR AWARD OF POST GRADUATE DIPLOMA IN CHHATTISGARH)

(EFFECTIVE FROM THE SESSION: 2024-25)

Master of Science in Microbiology
Semester-II
2024-25

Program Outcomes

On completion of program students will be able to-

1.Get ability to apply the process of science by formulating hypotheses and design experiments based on the scientific method.

2.Analyze and interpret results from a variety of microbiological methods.

3.Use quantitative reasoning by using mathematical calculations and graphing skills to solve problems in microbiology.

4.Communicate and collaborate with other disciplines by effectively communicating the fundamental concepts of microbiology in written and oral format.

5.Identify credible scientific sources to interpret and evaluate the evidences

6.Understand the relationship between science and society by recognizing and discussing logical, scientific and ethical issues in microbiology.

7.Prepare and view specimens for examination using light microscopy.

8.Use pure culture and selective techniques to isolate microorganisms. Identify microorganisms (media-based, molecular and serological).

9.Estimate the number of microorganisms in a sample by suitable enumeration technique.

10.Use appropriate microbiological and molecular lab equipment and methods.

11.Practice safe microbiology, using appropriate protective, biosafety and emergency procedures.

12.Document and report on experimental protocols, results and conclusions.

13.Basic knowledge about microbiology, biophysical techniques, biochemistry, cell biology, molecular biology, cancer biology, metabolic disorders etc.

14.To create awareness to become conscious citizens with a sense of responsibility towards their surrounding irrespective of any man made differences.

Master of Science in Microbiology
Semester-II
2024-25

Faculty of Science

Shri Davada University, Raipur

Master of Science in Microbiology

Semester-II

Examination Scheme

(Effective from the session: 2024-2025)

S.N.	Course Code	Th/ Pr	Subject	Type of Course	Teaching Hours/ Week			TC	Examination Scheme				Total Marks
									Theory		Practical		
					L	T	P		EX	IN	EX	IN	
1.	MBSC-201T	Th	Microbiology-V Immunology	Core	4	-	-	4	70	30	-	-	100
2.	MBSC-202T	Th	Microbiology-VI Microbial Physiology and Metabolism	Core	4	-	-	4	70	30	-	-	100
3.	MBSC-203T	Th	Microbiology-VII- Microbial Genetics	Core	4	-	-	4	70	30	-	-	100
4.	MBSC-204T	Th	Microbiology-VIII- Microbial Enzyme Technology	Core	4	-	-	4	70	30	-	-	100
5.	MBSC-205P	Pr	Lab course: III (Combining Microbiology VI and VII)	Core	-	-	4	2	-	-	35	15	50
6.	MBSC-206P	Pr	Lab Course: IV (Combining Microbiology VIII and IX)	Core	-	-	4	2	-	-	35	15	50
7.	MBSC-207T	Th	Research Methodology	Skill Enhancement	2	-	-	2	35	15	-	-	50
	Total Contact hr per week: 26			**Total Credit**				**22**	**Total Marks**				**550**

Master of Science in Microbiology
Semester-II
2024-25

<table>
<tr><td>Course Title</td><td colspan="5">MICROBIOLOGY-V IMMUNOLOGY</td></tr>
<tr><td>Course Code</td><td colspan="5">MBSC-201T</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>4</td><td>-</td><td>-</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Studied the detailed course of biochemistry semester I</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• To impart through knowledge of Immunology.
• To train the students to pursue further education.
• To be familiar with Immunological tools.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT I
Introduction to immune system – Innate and acquired immunity. Structure and functions of primary and secondary lymphoid organs. Cells involved in immune responses – Lymphoid cells (B-lymphocytes, T-lymphocytes and Null cells), mononuclear cells (phagocytic cells and their killing mechanisms), granulocytic cells (neutrophils, eosinophils and basophils), mast cells and dendritic cell.
UNIT II
Nature of antigen and antibody – Immunogenicity vs antigenicity, factors influencing immunogenicity, epitopes, haptens, adjuvants and mitogens. Classification, fine structure and functions of immunoglobulins, antigenic determinants on immunoglobulins, isotypic, allotypic and ideotypic variants.
UNIT III
Generation of Diversity in Immune system – Clonal selection theory - concept of antigen specific receptor. Organization of immunoglobulin genes: generation of antibody diversity, T-cell receptor diversity. Immune effector Mechanisms – Kinetics of primary and secondary immune responses, complement activation and its biological consequences, cytokines and co-stimulatory molecules: role in immune responses, Antigen processing and presentation. Cell signaling – Role of MAP kinases.
UNIT IV
Major histocompatibility complex (MHC) genes and products – Polymorphism of MHC genes, role of MHC antigens in immune responses, MHC antigens in transplantation. Measurement of antigen–antibody interactions – Agglutination, precipitation and opsonization, gel diffusion</td></tr>
</table>

	(Ouchterlony double immunodiffusion and Mancini's Radial immunodiffusion), immunoblotting, RIA, ELISA and ELISPOT. Tolerance vs activation of immune system – Immune tolerance, hypersensitivity (Types I, II, III, IV). Disorders of immune system – Autoimmunity, congenital immunodeficiencies, acquired immunodeficiencies.
Course Outcomes	• Understanding of the fundamentals of Immunology and key principles of it. • Awareness of the major issues at the forefront of the discipline. • Ability to dissect a problem in to its key features.
Text Books	**Text Books:** 1. Immunology: Kubey 2. Immunology: A short Course; Eli Benjamin, Richard Coico 3. Fundamentals of Immunology: William Paul
References Books	**Reference Books:** 1. Essentials of Immunology (6th Edition): Ivan Riot- Blackwell Scientific Publications, Oxford, 1988. 2. Antibodies- A laboratory Manual: Harlow and David Lane (1988), Old Spring harbor Laboratory. 3. Immunology: Roitt, Brostoff and Male 4. Immunology: C.A. Janeway and Paul Travers. 5. Immunology: Weir, D.M. 1992. Immunological techniques: I. R. Tizard, Immunology, An Introduction, 1995, 4th edition – Saunder's.

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<table>
<tr><td>Course Title</td><td colspan="5">MICROBIOLOGY-VI MICROBIAL PHYSIOLOGY AND METABOLISM</td></tr>
<tr><td>Course Code</td><td colspan="5">MBSC-202T</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>4</td><td>-</td><td>-</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Basic Knowledge of Microbiology</td></tr>
<tr><td>Course Objectives</td><td colspan="5">To develop understanding about microbial metabolism, growth and energy generation.
Gain knowledge of various fermentation pathways, microbial communication and energetics.
Familiarize students with concepts of nitrogen and phosphate assimilation, electron transport chain and transfer of genetic information among microbial communities.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT I
Microbial growth: mathematical expression of growth, growth measurement, efficient growth curve, synchronous growth and continuous culture, effect of environmental factors on microbial growth, nutrients diffusion, active transport, group translocation, solutes, temperature, oxygen relations.
UNIT II
Photosynthetic microorganisms, brief account of photosynthetic pigments, Oxygenic and anoxygenic photosynthesis, cyclic and non-cyclic photophosphorylation, fixation of CO_2 - Calvin cycle -C3 & C4 pathway. Chemolithotrophy: sulphur, iron, hydrogen, nitrogen oxidations; Methanogenesis - luminescence. Electron transport.
UNIT III
Aerobic respiration, EMP, ED and HMP pathway. TCA cycle- amphibolic reactions. Glyoxalate cycle. Mechanisms of substrate – level and oxidative phosphorylation. Respiratory electron transport in mitochondria and bacteria. Anaerobic respirations: Introduction, sulphate, nitrate, carbonate respirations and their ecological significance. ETC in some anaerobic bacteria. Catalase, SOD, Pasteur Effect. Fermentation.
UNIT IV
Lipid metabolism – Biosynthesis of glycerol’s, phospholipids and glycolipids. Oxidation of saturated and unsaturated fatty acids. Microbial metabolism of aromatic and aliphatic hydrocarbons, Nucleotide metabolism – Biosynthesis of purine and pyrimidine nucleotides-salvage and de novo pathways.
Protein metabolism: Biosynthetic pathways of amino acids and their regulation with emphasis on tryptophane and histidine. Porphyrin biosynthesis; catabolism</td></tr>
</table>

	of amino acids (transamination, deamination). Degradation of proteins-proteases, exo & endo peptidases.
Course outcomes	After going through this unit, students will be able to: • Master aseptic techniques and be able to perform routine culture handling tasks safely and effectively • Comprehend the various methods for identification of unknown microorganisms • Understand the microbial transport systems and the modes and mechanisms of energy conservation in microbial metabolism – Autotrophy and heterotrophy • Know the various Physical and Chemical growth requirements of bacteria and get equipped with various methods of bacterial growth measurement.
Text Books	**Text Books** 1. Microbial Physiology and Metabolism: D.R. Caldwell. 2. Microbiology: Lansing M. Prescott, John P. Harley and Donald A. Klein 3. Microbiology-Essentials and applications: Larry McKane and Judy Kandel. 4. Microbial Physiology: A.G. Moat and J.W. Foster.
Reference books	**Reference books** 1. Microbiology: M.J. Pelczar (Jr), E.C.S. Chan and N.R. Kreig. 2. Fundamental principles of Bacteriology: A. J. Salle. 3. The Physiology and Biochemistry of Prokaryotes: D. White. **4.** Microbial Physiology: S. Ram Reddy and S. M. Reddy

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<table>
<tr><td>Course Title</td><td colspan="5">MICROBIOLOGY VII: MICROBIAL GENETICS</td></tr>
<tr><td>Course Code</td><td colspan="5">MBSC-203T</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>4</td><td>-</td><td>-</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Basic Knowledge of Microbiology</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• Understanding of fundamental concepts in microbial genetics.
• Insight into genetic methods used to investigate interesting biological problems.
• Insight into current, exciting topics in microbial genetics and related fields.
• Experience in reading and evaluating scientific articles.
• 5) Understanding of how microbial genetics has advanced science and society.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT I
Nucleic Acids: Structure, physical and chemical properties of DNA and RNA, extrachromosomal DNA- profile, function and evolution.
UNIT II
DNA replication, damage and repair, spontaneous and induced mutation, reversion of mutation.
UNIT III
Transposition: Structure of transposons, replicative and non-replicative transposition, transposon mutagenesis. Bacterial conjugation: F Factor, Hfr Transfer, Gene mapping; Transduction: Generalized and specialized transduction.
UNIT IV
Genetic recombination; Molecular models and mechanism, Gene conversion. Gene expression and regulation: Operons and regulons, repression and activation of Lacoperon, feed back inhibition and regulation of virulence genes in pathogenic bacteria. Signal transduction in microbes.

Genetic Engineering: Introduction, vectors, restriction enzymes, cloning of restriction fragments, DNA ligase, insertion of DNA in to vector, detection of recombinant molecules, Applications of genetic engineering: Restriction</td></tr>
</table>

	mapping, site directed mutagenesis, production of proteins from cloned genes, and some other applications.
Course Outcomes	• On completion of the course, the student should be able to: • explain the processes behind mutations and other genetic changes • identify and distinguish genetic regulatory mechanisms at different levels • solve theoretical and practical problems in genetic analysis particularly concerning genetic mapping and strain construction • identify genes and mutations in non-annotated sequence data from databases by means of relevant bioinformatics programs • plan basic experiments in microbial genetics concerned with clarifying phenotypes and their relationship with the genotype • use common methods in microbial genetics
Text Books	**Text Books** 1. Text book of Microbiology: Pelczar, Creig and Chan 2. Text book of Microbiology: Pawar and Daginwalla. Vol I & II 3. General Microbiology: Stanier *et al*.,
Reference Books	**Reference books** 1. Microbial genetics: Maylor, Cronan and Freifelder 2. Microbiology: Presscott *et al*., 3. Microbiology: Talaro & Talaro

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Course Title	**MICROBIOLOGY VIII: MICROBIAL ENZYME TECHNOLOGY**				
Course Code	**MBSC-204T**				
Course Credits	**L**	**T**	**P**	**TC**	
	4	**-**	**-**	**4**	
Prerequisites	**Basic Knowledge of Microbiology**				
Course Objectives	This course provides the theory and knowledge relevant to the enzymology principles including fundamental properties of enzymes, enzyme catalytic mechanisms and enzyme kinetics. Techniques employed in enzymes purification and characterization are also emphasized in this course.				
Course Contents	**UNIT I** Enzymes from microbial sources, large scale production of enzymes, recovery of enzymes, enzyme purification methods - enzyme precipitation, separation by chromatography, enzyme reactors. **UNIT II** Immobilized enzymes: Physical and chemical methods of immobilization, immobilization supports, kinetics of immobilized enzymes. Enzyme catalysis in apolar medium, reverse micellar entrapment of enzymes and its applications. **UNIT III** Application of enzymes: synthesis of chemicals using enzymes, food technology and medicine. Enzymes in diagnostic assays. **UNIT IV** Enzyme electrodes, immunogens techniques. Commercial products of microbes: Antibiotics, biopolymers, biosensors, biopesticides, Production of biofuels. Microbial toxins: Types, biochemical and molecular basis of toxin production, implications. Genetically engineered microbes, anti-HIV, anticancer, antifungal, ant plasmodial, anti-inflammatory compounds.				
Course Outcomes	• Distinguish the fundamentals of enzyme properties, nomenclatures, characteristics and mechanisms • Apply biochemical calculation for enzyme kinetics				

	• Compare methods for production, purification, characterization and immobilization of enzymes • Discuss various application of enzymes that can benefit human life • Discover the current and future trends of applying enzyme technology for the commercialization purpose of biotechnological products. • Plot graphs based on kinetics data
Text Books	**Text Books** 1. Industrial Microbiology: Casida, L E. 2. Industrial Microbiology: Patel, A. H. 3. Industrial Microbiology: Miller, B. M. and Litsky. 4. Industrial Microbiology: Prescott and Dunn. 5. Microbial Technology: Peppler, J. H. and Perlman, D.
Reference Books	**Reference books** 1. Biochemistry of Industrial Microorganisms: Rainbow and Rose 2. Economic Microbiology Vol. I-V: Rose. 3. Microbial Enzymes and Biotechnology: Fogarty W. M. and Kelly, C. T. 4. Comprehensive Biotechnology All volumes Ed. Murray Moo-Yong. 5. Biotechnology (A text book of industrial Microbiology) Ed. Cruger & Cruger. **6.** Advances in Applied Microbiology Ed. Perlman Series of volumes.

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Course Title	**LAB COURSE: III (COMBINING MICROBIOLOGY V AND VI)**				
Course Code	**MBSC-205P**				
Course Credits	**L**	**T**	**P**	**TC**	
	4	**-**	**-**	**4**	
Prerequisites	**Basic Knowledge of Theory**				
Course Objectives	To understand the microbial growth kinetics and understanding different physiological phenomenon • To deliver hands-on experience of various enzymatic assays and determination of kinetic parameters • To give basic understanding of microbial genetic manipulations • To understand working of different laboratory equipments used in microbiological laboratories				
Course Contents	1. Agglutination reaction. 2. Radial Immunodiffusion. 3. ELISA. 4. Purification of IgG from the serum by ammonium sulphate, acetone precipitation and dialysis. 5. SDS-PAGE of denatured protein samples and determination of molecular weight of unknown proteins. 6. Poly Acrylamide Gel Electrophoresis of native proteins. 7. Western Blotting of proteins. 8. Antibiotic sensitivity test of blood and urine culture. 9. VDRL test. 10. HBs-AG test. 11. Determination of growth curve and generation time. 12. Estimation of microbial enzymes-amylase, invertase, protease, celllulase, lipase, catalase and phosphatase. 13. Iodine number of fatty acids. 14. Estimation of protein by Lowry's method.				

	15. Effect of different concentrations of heavy metal on bacterial growth.
Course Outcomes	Develop capability to quantify enzymes and determine kinetic parameters along with microbial genetic modification strategies • Develop capability to perform different gene transfer methods in microbes • Hand on training of the general equipments used in microbiology laboratory • Comprehend the major spectrophotometric and titrimetric approaches of quantification in biological and environmental samples.
Text Books	**Text Books** 1. Immunology: Kubey 2. Immunology: A short Course; Eli Benjamin, Richard Coico 3. Fundamentals of Immunology: William Paul 4. Microbiology: Lansing M. Prescott, John P. Harley and Donald A. Klein 5. Microbiology-Essentials and applications: Larry McKane and Judy Kandel.
Reference Books	**Reference books** 1. Immunology: Roitt, Brostoff and Male a. Immunology: C.A. Janeway and Paul Travers. 2. Microbial Physiology and Metabolism: D.R. Caldwell. 3. Microbial Physiology: A.G. Moat and J.W. Foster. 4. Microbiology: M.J. Pelczar (Jr), E.C.S. Chan and N.R. Kreig. **5.** Fundamental principles of Bacteriology: A. J. Salle.

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Course Title	**LAB COURSE: IV (COMBINING MICROBIOLOGY VII AND VIII)**				
Course Code	**MBSC-206P**				
Course Credits	**L**	**T**	**P**	**TC**	
	4	**-**	**-**	**4**	
Prerequisites	**Basic Knowledge of Theory**				
Course Objectives	• To understand the microbial growth kinetics and understanding different genomic phenomenon • To understand working of different laboratory equipments used in microbiological laboratories.				
Course Contents	1. Isolation of Genomic DNA from Bacteria species 2. Isolation of Plasmid DNA. 3. Molecular size determination of DNA. 4. Restriction digestion and ligation of DNA. 5. Determination of K_m and V_{max}.				
Course Outcomes	• Develop capability to quantify enzymes and determine kinetic parameters along with microbial genetic modification strategies • Develop capability to perform different gene transfer methods in microbes • Hand on training of the general equipments used in microbiology laboratory				
Text Books	**Text Books** 1. Text book of Microbiology: Pelczar, Creig and Chan 2. Text book of Microbiology: Pawar and Daginwalla. Vol I & II 3. General Microbiology: Stanier *et al*., 4. Industrial Microbiology: Miller, B. M. and Litsky. 5. Industrial Microbiology: Prescott and Dunn. 6. Microbial Technology: Peppler, J. H. and Perlman, D.				

Reference Books	**Reference books** 1. Microbial genetics: Maylor, Cronan and Freifelder 2. Microbiology: Presscott *et al*., 3. Microbiology: Talaro & Talaro **4.** Biochemistry of Industrial Microorganisms: Rainbow and Rose

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<table>
<tr><td>Course Title</td><td colspan="5">RESEARCH METHODOLOGY</td></tr>
<tr><td>Course Code</td><td colspan="5">MBSC-207T</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>2</td><td>-</td><td>-</td><td>2</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Basic Knowledge of Theory</td></tr>
<tr><td>Course Objective</td><td colspan="5">The course aims to enable the students learn the concepts of Research techniques and it's applicability in the various minor and major researches. Fundamentals of research with specific reference to quantitative research methods would facilitate the students towards exploring the area of their interest.</td></tr>
<tr><td>Course Outcome</td><td colspan="5">The paper focuses on the theoretical aspect of sampling methods, types of scientific methods and their usage in researches. It also enhances the students' knowledge about the stages of conductive research methods.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT-I Research: An Introduction

a) Types of Scientific Methods: Hypothetic-Deductive and Inductive Research
b) Types of Research: Basic vs. Applied, Quantitative vs. Qualitative Research
c) Principles of a Good Research

UNIT-II The Research Process

a) Stages of conducting a Research
b) Problem and Hypothesis: Definition, Types
c) Variables: Types, Operational definition

UNIT-III Behavioral Research I

a) Control of Extraneous Variables
b) Laboratory experiments, Field Experiments</td></tr>
</table>

	c) Field study, Survey **UNIT-IV Behavioral Research II** a) Research: Causality and It's criteria b) Threats to Internal and External Validity c) Non-Experimental Research: Co-relational Research, Survey Research, Archival Research **Sampling and Ethical Issues** a) Sampling Issues: Representativeness and Adequacy b) Sampling Strategies: Probability and Non-probability Sampling, Sampling Errors c) Demand Characteristics and Ethical issues in Research
Books Recommended:	Aronson, E. and Ellsworth D.C., Carlsmith, J.M., Gonzales, M.I. (1990). Methods of research in Social Psychology. MeGraw Hill International Edition Breakwell, G.M., Hammond, Sand Schow, C.F. (Edited) (1995). Research Methods in Psychology. Sage Publications. Ebnes, D.G. Kantowitz, B.M., Roediger, H.L, (1989). Research Methods in Psychology, West Publishing Company Greenberg, Jand Folger, R (1988). Controver sial Issues in Social Research Method. New York. Springerverlag Katz, D. and Festinger, L. (1953). Research Methods in Behavioral Sciences. Holt, Rinehart and Winston, Inc Kerlinger, F.N. (1964). Foundations of Behavioral Research. Holt, Rinehart and Winston, Inc Mohsin, S. M. (1984). Research Methods in Behavioral Sciences. Orient Longman Ltd

	Schaugneassey, J J., Zechmeister, B (1990). Research Methods in Psychology. Mc Grawhill Publishing Company. New Delhi Sommer and Sommer. R (1997). A Practical Guide to Behavior al Research. Oxford University Press Weiner, B.J., Brown, D.R., Michels, K.M. (1991). Statistical Principles in Experimental Design Mc GrawHill, Inc, New York, Toronto,

SHRI DAVARA UNIVERSITY RAIPUR

SHRI DAVARA UNIVERSITY NAYA RAIPUR (C.G.)

MASTER OF SCIENCE IN MICROBIOLOGY

SINGLE EXIT POST GRADUATE PROGRAMME CURRICULUM PER NEW EDUCATION POLICY-2020

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(EFFECTIVE FROM THE SESSION: 2024-25)

SHRI DAVARA UNIVERSITY RAIPUR

Program Outcomes

On completion of program students will be able to

1. Get ability to apply the process of science by formulating hypotheses and design experiments based on the scientific method.

2. Analyze and interpret results from a variety of microbiological methods.

3. Use quantitative reasoning by using mathematical calculations and graphing skills to solve problems in microbiology.

4. Communicate and collaborate with other disciplines by effectively communicating the fundamental concepts of microbiology in written and oral format.

5. Identify credible scientific sources to interpret and evaluate the evidences

6. Understand the relationship between science and society by recognizing and discussing logical, scientific and ethical issues in microbiology.

7. Prepare and view specimens for examination using light microscopy.

8. Use pure culture and selective techniques to isolate microorganisms. Identify microorganisms (media-based, molecular and serological).

9. Estimate the number of microorganisms in a sample by suitable enumeration technique.

10. Use appropriate microbiological and molecular lab equipment and methods.

11. Practice safe microbiology, using appropriate protective, biosafety and emergency procedures.

12. Document and report on experimental protocols, results and conclusions.

13. Basic knowledge about microbiology, biophysical techniques, biochemistry, cell biology, molecular biology, cancer biology, metabolic disorders etc.

14. To create awareness to become conscious citizens with a sense of responsibility towards their surrounding irrespective of any man made differences.

SHRI DAVARA UNIVERSITY RAIPUR

Faculty of Science

Two Years M. Sc. Programme

Scheme of Teaching and Examination

M. Sc. First Semester Microbiology

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2022-2023)

SN	Course Code	Course Title	Hours/Week			Credits	Maximum Marks			Sem End Exam Duration (Hrs.)
			L	**T**	**P**		Continuous Evaluation	Sem. End Exam	Total	
1.	MBSC-101T	Microbiology I: Cell and Molecular Biology	4	-	-	4	30	70	100	3
2.	MBSC-102T	Microbiology II: Microbiology	4	-	-	4	30	70	100	3
3.	MBSC-103T	Microbiology III: Biochemistry & Biophysics	4	-	-	4	30	70	100	3
4.	MBSC-104T	Microbiology IV: Bioanalytical Techniques	4	-	-	4	30	70	100	3
5.	MBSC-105P	Lab course: I (Combining Microbiology I and II)	-	-	4	2	15	35	50	5
6.	MBSC-106P	Lab Course: II (Combining Microbiology III and IV)	-	-	4	2	15	35	50	5
7.	MBSC-107T	Computer Application and Bioinformatics	-	-	2	2	15	35	50	2
TOTAL						**22**			**550**	

SHRI DAVARA UNIVERSITY RAIPUR

Course Title	**Microbiology I: Cell and Molecular Biology**				
Course Code	**DUMBC101T**				
Course Credits	**L**	**T**	**P**	**Details**	
	4			**4**	
Prerequisites	**Basic Knowledge of Cell and Molecular Biology**				
Course objectives	**To understand the basics of Cell Biology and Molecular Biology**				
Course Contents	**Unit: 1** Structural organization of the cell: specialized plant cell types, structure and function of cell wall, biogenesis, growth. Cytoskeleton: organization and role of Microtubules and Microfilaments, motor movements. Plasma membrane: structure, models and functions, sites for ATPases, structure of Plasmodesmata and role in the movement of molecules. **Unit: 2** Chloroplast: structure, genome organization and expression, functions, nucleo-chloroplastic interactions. Mitochondria: structure, genome organization, biogenesis, functions. Plant Vacuoles: as storage organelle, Tonoplast membrane, ATPases, as transporters. Golgi apparatus. Lysosomes, Endoplasmic Reticulum. **Unit: 3** Structure and functions of Nucleus: The nuclear envelope, structure of the Nuclear pore complex (NPC) and its role in Nucleo - cytoplasmic exchange. The concept of a gene as a unit of inheritance. The chemical nature of the gene, Structure of DNA: A, B, and Z forms, Watson-Crick model, DNA supercoiling, Organization of the genome. **Unit: 4** Functions of Nucleic Acids: DNA Replication in prokaryotes and eukaryotes: basic features of DNA replication in vivo and in vitro, role of DNA polymerases and other enzymes, the complex replication apparatus. Transcription in prokaryotes and eukaryotes. RNA Processing in eukaryotes, RNA splicing. Promoters and transcription factors. Types of RNA molecules. Interrupted genes in eukaryotes: exons and introns. Translation and the Genetic code: synthesis of protein, mechanism of translation- initiation, elongation and termination. Genetic code- properties, codon assignment and Wobble hypothesis. Structure and role of tRNA, Protein sorting, targeting of proteins to organelles. Gene expression: Regulation of gene expression in prokaryotes (operon and other models) and in eukaryotes.				
Course outcomes	1. Students will aware about basic concepts of cell, cell structure and genome organization of eukaryotic cell (plant cell). 2. Students will know the Genome structure and mechanism of transport in Chloroplast, Golgi complex, other organelles and trafficking between nucleus and cytoplasm. 3. Students will attentive about the structure of nucleus and importance of nucleic acids, gene and genome the role of different manipulative enzymes in DNA functions 4. Students will acquaint with the knowledge of DNA replication and Transcription 5. Students will know the mechanism of Genetic code in translation and regulation of gene expresssion in prokaryotes and eukaryotes and its applications.				

Text and References	1. Molecular Biology of the Gene (1987) Watson J. D., Hopking N.,Robast J. and Steiz, J. 2. Gene IX: Lewine Benjamin. 3. The Biochemistry of the nucleic acid (1996) Adams et al 4. Microbial Genetics: David Fridflelder. 5. Molecular cell Biology (1999) Lodish, H., Baltimore, D., Berk, A, Zipursky SL, Paul M and Darnell J.

SHRI DAVARA UNIVERSITY RAIPUR

SHRI DAVARA UNIVERSITY RAIPUR

Course Title	**Microbiology II: Microbiology**				
Course Code	**DUMBC102T**				
Course Credits	**L**	**T**	**P**	**Details**	
	4			**4**	
Prerequisites	**NIL**				
Course objectives	To acquaint the students with various aspects of basic and applied Microbiology				
Course Contents	**UNIT –I** History of Microbiology, Discovery of the microbial world. Isolation of micro-organisms from various sources (air, soil, water etc.), Inoculation technique, pure culture techniques, Culture collection and maintenance of pure culture. Methods of sterilization and Enrichment culture techniques. **UNIT- II** Bacterial identification, nomenclature and classification, New approaches to bacterial taxonomy /classification including ribotyping and ribosomal RNA sequencing. Brief account of bacteria and cyanobacteria, Rickettsia's, Chlamydia's and Mycoplasmas, Archaea; Archaebacteria and extremophilic microbes – their biotechnological potentials. **UNIT -III** The definition of growth, growth curve, measurement of growth and growth yields. Different modes of nutrition in bacteria, Sulfate reduction, Nitrogen metabolism – nitrate reduction, nitrifying and denitrifying bacteria, Nitrogen fixation and Microbes used as biofertilizer. **UNIT -IV** Viruses: General introduction, morphology and composition, ultrastructure and classification. General account of Plant viruses (TMV, Gemini Virus), Animal viruses (baculoviruses), Bacteriophages: Lambda, φX 174, cyanophages, Lytic cycle in T even phages and its regulation; lysogeny and its regulation in lambda phage; Viroid's and Prions. Basic design of a fermenter; biosensors; bioremediation.				
Course outcomes	1. This is a basic course offered to the students of other disciplines and student after studying the course will be having knowledge of microbes and their importance, application in day to day life. 2. Explain the theoretical basis of the tools, technologies and methods common to microbiology 3. Demonstrate practical skills in the use of tools, technologies and methods common to microbiology. 4. Gaining knowledge and hands on experience on general microbiological concepts like staining, enrichment and isolation of microbes. 5. Apply the scientific method and hypothesis testing in the design and execution of experiments. 6. Understand about knowledge about major families of viruses detailed account of various viral pathogenesis, symptoms, epidemiology, transmission, diagnosis, prevention and control deep insights about plant viruses & Animal virus.				

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Text and References	1. Pelczar et al., (1998): Microbiology. Tata McGraw-Hill, New Delhi 2. Prescott et al., (1996): Microbiology (WMC Brown Publishers, USA) 3. Tortora GJ, Funke BR, Case CL. Microbiology: An introduction 8th Edition.San Francisco: Pearson Publishers, 2004.

Course Title	**Microbiology III: Biochemistry**				
Course Code	**DUMBC103T**				
Course Credits	**L**	**T**	**P**	**Details**	
	4			**4**	
Prerequisites	**NIL**				
Course objectives	The students will understand the significance of biochemistry and chemistry of various macromolecules that interact to maintain and perpetuate the living systems.				
Course Contents	**UNIT-I** Introduction: Biochemical basis of life. Significance of macromolecules Carbohydrates, proteins, lipids and nucleic acids. **UNIT II** Chemistry and Metabolism of Carbohydrates - Structure and function of monosaccharides, Oligosaccharides and Polysaccharides Metabolism of carbohydrates Glycolysis, Citric acid cycle, HMP pathway and Glycogenolysis. **UNIT III** Classification and chemistry Lipids: Structure and functions of triglycerides, phospholipids, glycolipids, Significance of PUFA, Cholesterol and its derivatives. Metabolism of fatty acids oxidation, fatty acid biosynthesis, endogenous synthesis of triacylglycerols, phospholipids cerebrosides, gangliosides,cholesterol. **UNIT IV** Classification of Proteins and their functions: Essential and nonessential Aminoacids structure and properties of amino acids, general degradation of amino acids transamination, oxidative deamination, decarboxylation, disposal of ammonia Urea cycle, structure of proteins primary secondary and tertiary structures. Biocatalysts: Enzymes classification, Mechanism of action / allosteric enzymes / Isoenzymes / Coenzymes and cofactors. Nucleic acids: Structure and function of DNA and RNA Purine and Pyrimidine bases structure, degradation and synthesis, inborn errors of nucleotide metabolism.				

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Course outcomes	1. Knowledge about the molecular biology of life. 2. Understanding the enzymes and how they catalyze reactions as well as enzyme kinetics. 3. Intellectual about the structures of amino acids, their chemical properties and their organization into polypeptides and proteins. 4. Review about the structure of fundamental monosaccharide's and polysaccharides. 5. Knowledge about the structure and biological function of nucleotides and lipids. 6. Understanding the synthesis of biomolecules and their role in metabolic pathways along with their regulation 7. Understanding scientific basics of the life processes at the molecular level. 8. Explain and provide the inter-relationships of biomolecules and their consequences for interpreting & solving clinical problems. 9. This particular paper will help in understanding the basic biochemistry involved in the course including buffers, carbohydrate, lipid, proteins, enzymes.
Text and References	1. Lehninger, A. L. et al., 1993. Principles of Biochemistry, Worth Publishers.Inc. USA. 2. Stryer, I., 1988. Biochemistry (2nd Edition), W.H. Freeman & Co., NewYork. 3. Murray, R.K., Granner, B.K., Mayes. P.A., Rodwell, V.W., Harper'sBiochemistry Prentice Hall International, 29th edition, 2012.

Course Title	**Microbiology IV: Bioanalytical Techniques**				
Course Code	**DUMBC104T**				
Course Credits	**L**	**T**	**P**	**Details**	
	4			**4**	
Prerequisites	**NIL**				
Course objectives	To develop the skills of the applications of basic and advanced techniques employed in quantitative and qualitative analysis of biomolecules.				

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Course Contents	**Unit-I** Principles and applications, simple, compound, phase-contrast and fluorescent microscopes. Electron microscopy: SEM and TEM. Centrifugation Techniques: Principles, type of centrifuges, density gradient centrifugation in isolation of cells, cell organelles and biomolecules. **Unit-II** Electromagnetic spectrum, Beer Lambert's Law. Photometry, UV/VIS Spectrophotometry, Infrared spectroscopy, Atomic absorption spectroscopy, ESR and NMR spectroscopy. Mass spectroscopy (LC-MS, GC-MS). Fluorescent spectroscopy. Applications of different Spectroscopic techniques in Biology. **Unit-III** Introduction and types of chromatography, paper, thin layer, gas, Gel permeation, ion-exchange, HPLC, FPLC and affinity chromatography and instrumental details of each. Applications of Chromatographic techniques in Biology. **Unit-IV** Paper and gel electrophoresis, Polyacrylamide gel electrophoresis (native and SDS), Agarose gel electrophoresis, Blotting- Southern, Western and Northern blotting, Immunoblotting, Immunoelectrophoretic, DNA finger printing and ELISA. Nature and types of radiations, preparation of labelled biological samples. Detection and measurement of radioactivity, GM counter, Scintillation counter, Autoradiography, Flow cytometry. Safety measures in handling radioisotopes. RIA, non radiolabelling.
Course outcomes	1. Gaining knowledge and hands on experience on analytical techniques including chromatography, microscopy, enzymology, electrophoresis etc. 2. Beneficial to various scientific areas including life sciences, chemicalsciences, material sciences and environmental science. 3. Provide scientific understanding of analytical techniques and detailinterpretation of results. 4. Understand the working principles, construction and applications ofthe instruments often used in the studies related to various disciplinesof Biological Sciences. 5. This particular course deals with the working of various advanced techniques in Microbiology and Molecular Biology. Student will know the use of various advanced techniques for application in the field of diagnostics. 6. Understanding the principle and uses of microscope, spectroscopy and chromatography . 7. Knowledge about electrophoretic separation of bio molecules,centrifugation and radioactive measurement.
Text and References	1. Nuclear Magnetic Resonance: Williams 2. Biochemical Techniques theory and practice : White R 3. Analytical Chemistry: Christion G. D. 4. A Biologist Guide to Principle and Techniques: Willson K. and Gounding K.H. 5. An Introduction to Practical Biochemistry: Plummer D. T.

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Course Title	**Lab course: I (Combining Microbiology I and II)**				
Course Code	**DUMB105P**				
Course Credits	**L**	**T**	**P**	**Details**	
			4	**2**	
Prerequisites	**NIL**				
Course objectives	To understand the practical approach of basics of Cell Biology, Molecular Biology and Microbiology				
Course Contents	1. Different media composition and preparation used in Microbiology. 2. Preparation of Slants and Plate Culture. 3. Different inoculation techniques. 4. Isolation and enumeration of microbes from air, water, soil and sewage. 5. Staining of microbes: Gram staining, Acid-fast staining, Cotton blue staining. 6. Hanging drop technique for motility of bacteria. 7. Study of Mitosis and Meiosis. 8. Effect of pH, temperature, light and nutrient source on the growth of microorganisms. 9. Bacterial growth curve by measuring the turbidity.				
Course outcomes	1. An understanding between different stages of cell cycle. 2. The safe methods for isolation, subculture, and maintenance of bacterial and fungal specimens. 3. An understanding of fundamental stains, basic staining techniques, and related bacterial and fungal physiology. 4. An understanding of the uses of various media and testing protocols. 5. Student will be equipped with the knowledge to handle microbes and basic instrumentation used in microbiological laboratory. Various basic techniques to isolate, characterize the microbes morphologically will be known to them.				
Text and References	1. Practical Biochemistry by Plumer 2. Biotechnology: Labrotary Techniques by Aneja				

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Course Title	**Lab Course: II (Combining Microbiology III and IV)**				
Course Code	**DUMB106P**				
Course Credits	**L**	**T**	**P**	**Details**	
			4	**2**	
Prerequisites	**NIL**				
Course objectives	To impart knowledge of methods and techniques for biomolecules separation, quantification and purification.				
Course Contents	1. Carbohydrates: Qualitative analysis, quantitation of glucose and ribose. 2. Amino acids and proteins: Qualitative analysis, quantitation of proteins and amino acids. 3. Quantitation of free and bound phosphate. 4. Quantitation of vitamin C. 5. Fats: Acid number, saponification and iodine values. 6. Paper chromatography of Amino acids. 7. Verification of Lambert Beer's Law. 8. Gel chromatography for separation of a mixture of molecules.				
Course outcomes	1. Student will be equipped with the knowledge to handle microbes and basic instrumentation used in microbiological laboratory. 2. Various basic techniques to isolate, characterize the microbes morphologically will be known to them. 3. Understanding safe laboratory practices and perform basic molecular biology techniques 4. Understanding the principle and uses of microscope, spectroscopy and chromatography. 5. Knowledge about electrophoretic separation of bio molecules, centrifugation and radioactive measurement.				
Text and References	1. Practical Biochemistry by Plumer 2. Biotechnology: Labrotary Techniques by Aneja				

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Course Title	**Computer Application and Bioinformatics**				
Course Code	**DUMB107T**				
Course Credits	**L**	**T**	**P**	**Details**	
			2	**2**	
Prerequisites	**NIL**				
Course objectives	The basic objective is to give students an introduction to the basic practical knowledge of computer and techniques of bioinformatics.				
Course Contents	**Unit I:** Computer Basics, Introduction to computer networks, LAN, MAN, WAN & Internet, Internet applications. Introduction to MS office, working with documents, worksheets and presentations. **Unit II:** Concepts of Programming languages, Introduction to 'C' language, flowcharts and algorithms, introduction to data structure and database concepts, Object oriented concepts. **Unit III:** Database concepts: Introduction, Key features, History; Database management systems, Types of database management systems, Structured Query language; Index: Introduction and forms; Biological Database: Introduction and Types.				

	Unit IV: Bioinformatics: Introduction, Bioinformatics databases, Importance of Bioinformatics; Analytical approaches, Components of Bioinformatics, Useful sites for researchers, Commercial use of bioinformatics; Bioinformatics in Life Sciences, Biocomputing, Bioinformatics in the area of genomics, Technical and legal issues, Role of Bioinformatician. DNA sequence analysis: Gene structure and DNA sequences, Features of DNA structure analysis, DNA libraries and ESTs, Effect of EST data on DNA databases; Pair wise and multiple sequence alignment techniques; Phylogenetics; Analysis of Gene expression: Overview of microarray analysis, Micro arrays as tools for Gene expression analysis
Course outcomes	1. To give students knowledge of and competence in use of bioinformaticalmethods central to conduction of molecular biological research projects. 2. Emphasis on bioinformatics related to exploration of proteins andincludes analyses of sequences, database searches, sequencecomparison, visualization and analysis of protein structures, andintroduction to phylogenetic analyses. 3. Give an introduction to analysis of DNA sequences, genes and genomes,gene expression and systems biology. 4. To give students a basic competences in the use of bioinformaticaltools. 5. Emphasizes the learning of bioinformatical tools in light of the student'sknowledge of molecular biology. 6. Study the meaning and structure of biological information available inthe existing databases.

Text and References	1. Arthur M Lesk. 2005. Introduction to Bioinformatics(Ed:2). Oxforduniversity press, New York. 2. Attwood, T.K. and Parrysmith, D.J. 2001. Introduction to Bioinformatics.Pearson Education (Singapore) Pvt. Ltd., New Delhi. 1. Andreas D. Baxevanis and B. F. Francis Ouellette. 2005. Bioinformatics- A Practical guide to the analysis of Genes and Proteins (Ed:3). JohnWiley & Sons, Inc., Publications, US. 2. David W Mount. 2004. Bioinformatics: sequence and Genomeanalysis(Ed:2). Cold Spring Harbor Laboratory Press, Cold Spring Harbor,New York. 3. Rastogi, S.C., Menderatta, M. and Rastogi, P. 2004. Bioinformatics -concepts, skills and applications. CBS Publishers & Distributors, NewDelhi