GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE

RAJNANDGAON, C.G.

SESSION 2024 – 2025

SCHEME OF EXAMINATION

&

SYLLABUS

OF

M.Sc. (MICROBIOLOGY)

UNDER

FACULTY OF LIFE SCIENCES

(Approved by Board of Studies)

DEPARTMENT OF MICROBIOLOGY

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE

RAJNANDGAON, C.G.

Govt. Digvijay Autonomous P.G. College, Rajnandgaon, C.G.

M.Sc. Microbiology

Scheme of Examination and Syllabus

July 2024- December 2024

	Paper No.	Title of The Paper	Marks (External)	Marks (Internal)	Total
FIRST SEMESTER	I	BACTERIOLOGY	80	20	100
	II	VIROLOGY	80	20	100
	III	PHYCOLOGY AND MYCOLOGY	80	20	100
	IV	FUNDAMENTALS OF IMMUNOLOGY	80	20	100
	LC-I	LAB COURSE I (Based on Paper I and II)	100		100
	LC-II	LAB COURSE II (Based on Paper III and IV)	100		100
				TOTAL	600

January 2025 – June 2025

	Paper No.	Title of The Paper	Marks (External)	Marks (Internal)	Total
SECOND SEMESTER	I	MOLECULAR BIOLOGY	80	20	100
	II	MICROBIAL GENETICS	80	20	100
	III	MICROBIAL PHYSIOLOGY	80	20	100
	IV	BIOSTATISTICS AND COMPUTER APPLICATION	80	20	100
	LC-I	LAB COURSE I (Based on Paper I and II)	100		100
	LC-II	LAB COURSE II (Based on Paper III and IV)	100		100
				TOTAL	600

July 2024 – December 2024

	Paper No.	Title of The Paper	Marks (External)	Marks (Internal)	Total
THIRD SEMESTER	I	CELLULAR MICROBIOLOGY	80	20	100
	II	MEDICAL MICROBIOLOGY	80	20	100
	III	FOOD AND DAIRY MICROBIOLOGY	80	20	100
	IV	INSTRUMENTATION AND TECHNIQUES	80	20	100
	LC-I	LAB COURSE I (Based on Paper I and II)	100		100
	LC-II	LAB COURSE II (Based on Paper III and IV)	100		100
				TOTAL	600

January 2025–June2025

	Paper No.	Title of The Paper	Marks (External)	Marks (Internal)	Total
FOURTH SEMESTER	I	ENVIRONMENTAL MICROBIOLOGY	80	20	100
	II	ENZYME TECHNOLOGY	80	20	100
	III	FERMENTATION &MICROBIAL TECHNOLOGY	80	20	100
	IV	PHARMACEUTICAL MICROBIOLOGY/AGRICULTURE MICROBIOLOGY	80	20	100
	LC-I	LAB COURSE I (Based on Paper I and II)	100		100
	LC-II	LAB COURSE II (Based on Paper III and IV)	100		100
				TOTAL	600

Chairperson/ HOD Subject Expert Subject Expert VC Nominee

Educationist Representative Student Nominee

2024-25
SEMESTER PATTERN
M.Sc. MICROBIOLOGY

M.Sc. Examination is in semester pattern, there are four semester exams within two years. In each semester there are four theory papers and two lab courses.

Candidates for the M.Sc. Examination will be required to pass in written as well as in practical examinations separately. It's compulsory for the candidates to attend at least one Microbiological excursion to Hospital/ Food & Beverages Industry/Microbiological Institute (within or outside C.G.) as a part of their training.

There are 16 theory papers and 8 lab course in the complete course. Each student will have to appear in 16 theory paper examination carrying 80 marks (each theory papers) which will be of three hours duration and in 8 practical examination carrying 100 marks each. Each practical examination is based on two theory papers. There will be evaluation of each student continuously through out the semester. There will be 16 internal assessment including oral presentations each of 20-20 marks. Each Student will be required to submit a brief write up on his/her oral presentation. For the academic upliftment of students, they will submit mini project for whole tenure, if assigned.

A Student of M.Sc. IV will have the choice to opt for project work according to their personal willingness in the leu of two theory papers (Paper III & IV) of Semester IV provided he/she has to secure more than 65% marks in aggregate in M.Sc. I semester and M.Sc. II semester. The project has to be carried out in national laboratories and UGC-recognized universities.

Chairperson/ HOD | Subject Expert 22/04/24 | Subject Expert | VC Nominee

Educationist Representative | Student Nominee

DEPARTMENT OF MICROBIOLOGY
GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON

2024-2025

M.Sc. (MICROBIOLOGY)

SYALLABUS AND MARKING SCHEME
FOR
FIRST SEMESTER

PAPER NO.	TITLE OF THE PAPER	MARKS ALLOTED IN				TOTAL
		THEORY		INTERNAL		
		Max.	Min.	Max.	Min.	
1.	BACTERIOLOGY	80	16	20	04	100
2.	VIROLOGY	80	16	20	04	100
3.	PHYCOLOGY AND MYCOLOGY	80	16	20	04	100
4.	FUNDAMENTALS OF IMMUNOLOGY	80	16	20	04	100
5.	LAB COURSE I (Based on Paper I and II)	100	33	-	-	100
6.	LAB COURSE II (Based on Paper III and IV)	100	33	-	-	100
	Total:	520		80		600

Chairperson/ HOD

Subject Expert 22/11/24

Subject Expert

VC Nominee

Educationist Representative

Student Nominee

2024-2025

M.Sc. – MICROBIOLOGY, SEMESTER I

Paper – I: Bacteriology M.M. – 80

Unit – 1

Morphology and ultrastructure of bacteria, morphological types, archaebacteria, Gram negative and positive eubacteria, Actinomycetes and L-forms.

Cell wall synthesis, antigenic properties.

Capsule: types, composition and function.

Cell membranes: structure, composition and properties.

Unit – 2

Structure and functions of flagella, pili, gas vesicles, chromosomes, carboxysomes, magnetosomes, phycobilisomes, endospore.

Cell division, Reserve food material, polyhydroxy butyrate, polyphosphate granules, oil droplets.

Cyanophycean granules and Sulphur inclusions.

Unit – 3

Reproduction in Bacteria: Transformation, transduction and Conjugation.

Cultivation of bacteria: aerobic, anaerobic, shake and still cultures.

Nutritional types, culture media, Growth curve, Growth kinetics, Asynchronous,synchronous, batch, continuous cultures.

Measurement of growth, factors affecting growth.

Unit – 4

Classification of microorganisms: Basis of microbial classification, Haeckel's three kingdoms concept, Whittaker's five kingdom concept, three domain concepts of Carl Woes.

Salient feature of bacterial classification according to the Berge's manual of determinative bacteriology.

Recommended Books

1. A text book of Microbiology – P.Chakraborty, New central book agency(P) Ltd. Kolkata.
2. General Microbiology I & II - C.B. Powar and H. F. Daginawala, Himalaya Publishing House Bombay.
3. Microbiology –B.D. Davis, R. Dulbecco, H.N. Eisen and H.S. Ginsberg, Harper and Row Publishers Philadelphia.
4. Fundamentals of Microbiology and Immunology- Ajith Kumar Banerjee and Nirmala Banerjee, New Central book agency (P) Ltd. Kolkata.
5. A text book of Microbiology – R.C. Dubey and D.K. Maheshwari, S. Chand and Company Ltd., New Delhi.
6. Microbiology: Fundamentals and Applications – S.S. Purohit, Students Edition, Jodhpur.
7. Biology of Microorganisms – T.D. Brock and M.T. Madigan, Prentice Hall Int. Inc
8. Fundamental Principles of Bacteriology – A.J. Salle
9. General Microbiology – R.Y. Steiner, J.L. Wheelies and P.R. Painter, Macmillan Educational Ltd. London.
10. Modern Microbiology – E.A. Brige, W.M.C. Brown, Oxford, England
11. Text book on Principles of Bacteriology, Virology and Immunology – Topley and Wilson, Edward Arnold, London

2024-25

M.Sc.- MICROBIOLOGY SEMESTER I

Paper – II: Virology **M.M. – 80**

Unit – 1

Brief outline of discovery of viruses, classification and nomenclature of viruses.

Distinctive properties of viruses, morphology and ultra-structure, capsids and their arrangements, types of envelopes and their composition, viral genome, their types and structures.

Virus related agents (viroid's, prions).

Unit – 2

Cultivation of viruses: embryonated eggs, experimental animals

Cell culture: primary and secondary cultures, suspension cultures and monolayer cultures and transgenic system

Assay of viruses: physical and chemical methods (protein, nucleic acid, radioactive tracers, electron microscopy), infectivity assay (plaque method, end point method).

Unit – 3

Bacteriophages: structural organization, life cycle:one step growth curve, eclipse phase, phage production, lysogenic cycle, application in bacterial genetics.

Brief details of MI3, Mu, T3 & T4.

Plant Viruses: structural organization, life cycle, (TMV, CMV and PVX), pathogenicity, symptoms, transmission and prevention of plant viral diseases, control of vectors.

Unit – 4

Animal viruses: structural organization, lifecycle, pathogenicity, diagnosis, prevention and treatment of RNA viruses Orthomyxo, Paramyxo, Rota and HIV virus.

DNA viruses; Pox, Adeno and Hepatitis virus.

Viral vaccines (conventional, genetic recombinant, new generation vaccines including DNA vaccines, interferon and antiviral drug.

Recommended Books

1. A text book of Microbiology – P.Chakraborty, New central book agency(P) Ltd. Kolkata.

2. General Microbiology I & II - C.B. Powar and H. F. Daginawala, Himalaya Publishing House Bombay.

3. Microbiology –B.D. Davis, R. Dulbecco, H.N. Eisen and H.S. Ginsberg, Harper and Row Publishers Philadelphia.

4. Fundamentals of Microbiology and Immunology – Ajit Kumar Banerjee and Nirmalya Benerjee, New Central book agency (P) Ltd. Kolkata.

5. A text book of Microbiology – R.C. Dubey and D.K. Maheshwari, S. Chand and Company Ltd., New Delhi.

6. Microbiology: Fundamentals and Applications – S.S. Purohit, Students Edition, Jodhpur.

7. Viruses – K.M. Smith

8. Text book on Principles of Bacteriology, Virology and Immunology – Topley and Wilson, Edward Arnold, London.

M.Sc. -MICROBIOLOGY, SEMESTER I

Paper – III: Phycology and Mycology **M.M. – 80**

Unit – 1

General features of fungi: Classification, Structure and cell differentiation, Reproduction, Heterothallism, Sex hormones, Effect of environment on growth, Prevention of fungal growth.

Salient features of Division Myxomycotina, Mastigomycotina and Zygomycotina. Life cycle and economic importance of representative members.

Unit – 2

Salient features of Division Ascomycotina– Hemiascomycetes, Plectomycetes, Pyrenomycetes, Discomycetes. Life cycle and economic importance of representative members.

Basidiomycotina–Teliomycetes, Hymenomycetes. Life cycle and economic importance of representative members.

Deuteromycetes–Hypomycetes, Coelomycetes, Blastomycetes. Life cycle and economic importance of representative members.

Unit – 3

Fungi and bioremediation, Industrial importance of fungi.

Mycorrhiza – Ectomycorrhiza, Endomycorrhiza, Vesicular Arbuscular Mycorrhiza.

Lichens – General account, classification, structure, reproduction and economic importance.

Unit – 4

Algae – General Characteristics, Distribution, classification and thallus range.

Reproduction and Nutrition in Algae

Pigmentation in Algae. Diatoms and Euglenoids.

Difference between Algae and Fungi.

Recommended Books

1. An Introduction to Mycology – R.S. Mehrotra, and K.R. Aneja 1990, New Age International publishers.

2. Introduction to Mycology (3rd Ed.) – C.J. Alexopoulus and C.W. Mims 1979. Wiley Eastern Ltd.,New Delhi.

3. Fundamentals of Mycology – J.H. Burnettm Publisher: Edward, Arnold Crane Russak.

4. The Fungi – M.Charlile and S.C. Watkinson, Publisher:Academic Press.

5. Fundamentals of Fungi – E. Moore-Landeekeer, Publisher: Prentice Hall.

6. Physiology of Fungi – K.S. Bilgrami and R.N. Verma, Vikas Publication.

7. The Algae: Structure and Reproduction, Vol I and II – F.E. Fritsch, Vikas Publication.

8. A text book of Algae – A.V.S.S. Sambamurthy, I.K. International Publication.

9. Algae Vol. I – G. Smith

2024-25

M.Sc.- MICROBIOLOGY SEMESTER I

Paper – IV: Fundamentals of Immunology **M.M.- 80**

Unit – 1

Immune System and Immunity: History of Immunology.

Structures, composition and functions of cells and organs involved in immune system.

Immune responses: innate immunity, acquired immunity.

Antigens: Structure and Properties, types, iso and allo, haptens, adjuvants, antigen specificity.

Unit – 2

Immunoglobulin: structure, heterogeneity, types and subtypes, properties (Physico-Chemical and biological). Complement: structure, components, properties and functions.

in vitro Methods: agglutination, precipitation, complement fixation, immunofluorescence, ELISA, Radioimmunoassays.

in vivo Method: Skin tests and immune complex tissue demonstrations, applications of these methods in diagnosis of microbial diseases.

Unit – 3

Structure and functions of MHC and the HL-A system.

Tissue transplantation, graft versus host reaction and rejection.

Immunohaematology: blood groups, blood transfusion and Rh incompatibilities.

Autoimmunity: Theories, mechanism and diseases with their diagnosis.

Unit – 4

Hypersentivity Reactions: Antibody mediated, Type 1 (Anaphylaxis), Type II (Antibody dependent cell cytotoxicity), Type III (Immune complex mediated reactions), Type IV (Cell mediated hypersensitivity reaction).

Lymphokines and cytokines: properties, classification, biological functions, receptors and related diseases.

Recommended Books

1. Essentials of Immunology – I.M. Roitt, ELBS, Blackwell Scientific publishers, London.
2. Kube Immunology II-Edition – J. Kube, W.H. Freeman and company. New York.
3. Immunology. Understanding of Immune System – Klaus D.Elgert Wiley – Liss. NY.
4. Text book on Principles of Bacteriology, Virology and Immunology (IX Edi) –Topley &Wilson's (5 volumes) Edward Arnold, London.
5. Immunology – S.S. Lal and Sanjeev Kumar, Rastoogi Publication, Meerut India.
6. Immunology at a glance – J.H.L. Playfair.
7. The chain of Immunology – G. Feinberg and M.A. Jackson.
8. Lecture notes on immunology – I.R. Todd, Blackwell scientific Publications, Oxford.
9. Fundamental Immunology – W.E. Paul, Raven Press, New York.
10. Fundamentals of Immunology – R.M Coleman, M.F. Lombord and R.E. Sicard, 2nd Ed. Brown Publishers.

M.Sc. Microbiology, Semester –I

List of Practicals

Lab Course I: Bacteriology and Virology. **M.M. – 100**

Bacteriology

1. Glassware and media preparation:

a. Glassware preparation and sterilization techniques.

b. Preparation of liquid & solid media, plating, pouring, inoculation and incubation for growth of microorganism

2. Isolation of bacteria from following sources and study their cultural characteristic.

a. Air.

b. Water.

c. Soil.

3. Methods of obtaining pure culture of microorganisms (a) streak plate (b) Pour plate, and(c)spread platemethods

4. Identification of isolated bacteria by Gram staining.

5. Micrometry and camera Lucidadrawings.

6. Motility of bacteria by hanging droptechnique.

7. Identification of isolated bacteria on the basis of biochemical properties.

a. IMViC test

b. TSIA test

c. H2S production test

d. Catalase production test

e. Amylase production test

8. Determination of bacterial growth by Turbidity measurement (Spectrophotometric method).

9. Isolation of Actinomyctes from soil and study their cultural characteristic.

Virology

1. Phage titration.
2. Symptomatologic Study of Viral Diseases (plants and animals).
3. Plaque count.

Mark scheme: Lab Course I

1.	**Bacteriological Technique**	**:20**
2.	**Gram staining**	**:10**
3.	**Biochemical properties**	**:10**
4.	**Virology**	**:20**
5.	**Symptomatological Study**	**:10**
6.	***Viva-voce***	**:10**
7.	**Sessional**	**:20**
Total		**: 100**

2024-25

Lab Course II: Phycology, Mycology and Immunology. **M.M. – 100**

Phycology & Mycology

1. Isolation of Aeromycoflora by Petri plate exposure.
2. Isolation of Rhizospheric fungi by Warcup's method.
3. Isolation of Keratinophilic fungi from soil.
4. Isolation of Coprophilous fungi from dung.
5. Isolation of Storage fungi from food grains.
6. Study the special features of selected fungi.
7. Biomass measurement for fungi.
8. Isolation of green Algae and Cyanobacteria from soil and water samples.
9. Study the special features of selected green algae, cyanobacteria and diatoms.
10. Study the special features and types of lichens.
11. Micrometry and camera Lucida studies of some microbial structures.

Immunology

1. Identification of cells of immune system (DLC).
2. Study of agglutination reaction with blood grouping and Blood examination for Rh factor.
3. Antigen antibody reaction by Double Diffusion technique.
5. Total leucocytes count.
6. Total Hemoglobin count.
7. ELISA.
8. Determination of concentration of given antigen by RID technique.

Mark scheme: Lab Course II

1.	Major Phycology/Mycology	:20
2.	Major (Immunology)	: 20
3.	Study of Fungi	: 10
4.	Techniques	: 20
5.	*Viva –voce*	:10
6.	Sessional	: 20
	Total	: 100

DEPARTMENT OF MICROBIOLOGY
GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON

2024-2025

M.Sc. (MICROBIOLOGY)

SYALLABUS AND MARKING SCHEME
FOR
SECOND SEMESTER

PAPER NO.	TITLE OF THE PAPER	MARKS ALLOTED IN				TOTAL
		THEORY		INTERNAL		
		Max.	Min.	Max.	Min.	
1.	MOLECULAR BIOLOGY	80	16	20	04	100
2.	MICROBIAL GENETICS	80	16	20	04	100
3.	MICROBIAL PHYSIOLOGY	80	16	20	04	100
4.	BIOSTATISTICS AND COMPUTER APPLICATION	80	16	20	04	100
5.	LAB COURSE I (Based on Paper I and II)	100	33	-	-	100
6.	LAB COURSE II (Based on Paper III and IV)	100	33	-	-	100
	Total:	520		80		600

Chairperson/ HOD Subject Expert 22/4/24 Subject Expert VC Nominee

24.4.24 Chabey
Educationist Representative Student Nominee

M.Sc. – MICROBIOLOGY, SEMESTER II

Paper – I: Molecular biology

Unit – 1 **M.M.-80**

Nucleic acid as genetics information carriers: experimental evidence, structure of DNA, melting of DNA.

DNA replication: general principle, various modes of replication, isolation, types and properties of DNA polymerases, proof reading, continuous and discontinuous synthesis.

Exonuclease activity in eukaryotic DNA polymerases.

Super helicity in DNA, mechanism of action of topoisomerases.

Unit – 2

Relationship between replication and cell cycle.

Inhibitors of DNA replication: blocking precursor synthesis, nucleotides polymerization, altering DNA structures.

Structural and functional features of RNA (rRNA, tRNA and mRNA). Initiators and elongator class of tRNA, ribosome binding sites on mRNA and corresponding site on rRNA, peptidyl transferase activity of 23S rRNA.

Unit – 3

Transcription: general principle, basic apparatus, types of RNA polymerases, steps (initiation, elongation and termination), inhibitors of RNA synthesis.

Polycistronic and monocistronic RNAs. Maturation and processing of RNA: methylation, cutting and trimming of rRNA. Capping and Polyadenylation.

Catalytic RNA, splicing of mRNA, group I and group II intron splicing RNAase P.

Basic features of genetic codes. Protein synthesis: steps, details of initiation, elongation, termination, roles of various factors in above steps, inhibitors of proteins synthesis.

Unit – 4

DNA binding proteins, enhancer sequences and controls of transcription. Use of alternate sigma factors, controlling termination, attenuation and anti-termination.

Regulation of genes expression: Operon concept, catabolite repression instability of bacterial RNA, positive and negative regulation, inducers and co repressors.

Negative regulation (*E.coli* lac operon), positive regulation (*E. coli* operon, regulation by attenuation – his and trp operons).

Recommended Books

1. Molecular biology of gene, Watson, Baker, Bell, Gann, Levine, Personal Education LPE.

2. Principles and Techniques of Biochemistry and Molecular Biology, K. Wilson and J. Walker, Cambridge low price Edition.

3. Molecular Biology- Fundamentals of Molecular Biology, A. Upadhyay, Himalaya Publication.

4. Molecular Biology, A.V.S.S. Sambamurthy, Narosa Publication.

5. Essentials of Molecular Biology, Malacinski, M.George and David Freidfelder, Narosa Publication.

6. Biochemistry, C.B. Powar and Chatwal, Himalaya Publication.

7. Principles of Biochemistry, Nelson and Cox.

M.Sc. – MICROBIOLOGY, SEMESTER II

Paper – II: Microbial Genetics

M.M.-80

Unit – 1

DNA damage: types of DNA damage (deamination, oxidation, alkylation, pyrimidine dimers).

Repair pathways (methyl directed mismatch repair, very short patch repairs, nucleotide excision repairs, base excision repairs, recombination repairs, and SOS system).

Gene as a unit of Mutation, types of mutagens, genetic analysis of mutants, types of mutations and their origin. Ame's test.

Unit – 2

Gene as a unit of recombination, molecular nature of recombination.

Gene transfer mechanism: Transformation, Transduction, Conjugation, Transfection, Lysogeny and their applications.

Genetic analyses of Bacteria and Yeast.

DNA library.

Unit – 3

Plasmids and phage vectors their types and uses in genetic analysis as vector for gene cloning, replication of selected plasmids, compatibility.

Recombinant DNA Technology: foreign DNA, Enzymes needed, selection of vectors, Transfer of foreign DNA in to vector, Transfer of recombinant DNA to host cell (Tail ligation and linker used method), selection and screening of recombinant DNA.

Transposons and their uses in genetic analysis. Molecular markers: RFLP, RAPD, SNP and AFLP.

Unit – 4

Polymerase Chain Reaction.

Genetics of phage: genetic recombination in phages, effect of parental ratio, reciprocity.

T4 phage structure, life cycle, genetic map and DNA replication.

λ phageDNA structure, genetic organization and life cycle of λ.

Recommended Books

1. Microbial Genetics – Maloy *et al.* 1994, Jones and Bartlett publishers.

2. Modern microbial genetics – Streips and Yasbin,1991, Niley Ltd.

3. Microbial genetics – S.R. Maloy, J.E. Cronan, and David Freifelder, Iind edition 2006, Narosa publishing house, New Delhi.

4. Microbial Genetics – C.B. Powar, Vol I&II, Himalaya publication.

5. Genetics – P.K. Gupta, Rastogi publication.

6. Biotechnology and Genetics – R. Shetty

7. Genetics – W. Monroe

8. Genetics – N.W. Strickberger 3rd edition.

9. Fundamentals of Genetics – B.D. Singh, Kalyani publication.

10. Fundamental Principles of Bacteriology – A.J. Salle, TMH Edition, New Delhi.

M.Sc. – MICROBIOLOGY, SEMESTER II

Paper – III: Microbial Physiology **M.M.- 80**

Unit – 1

Basic aspects of bioenergetics: entropy, enthalpy, electrons carrier.

Artificial electron donors, inhibitors, energy bond, phosphorylation.

Brief account of photosynthetic and accessory pigments: chlorophyll, bacteriochlorophyll, rhodopsin, carotenoids, phycobiliproteins.

Unit – 2

Autotrophy: Carbohydrate anabolism, oxygenic and an-oxygenic photosynthesis, autotrophic generation of ATP, fixation of CO_2, Calvin cycle, C_3 and C_4 pathway,

Chemolithotrophy, oxidation of sulphur, iron, hydrogen and nitrogen.

Methanogenesis, luminescence.

Unit – 3

Respiratory metabolism: Embden Mayer Hoff Parnas pathway, Entner Doudroff pathway, Glyoxalate pathway.

Krebs cycle, Oxidative and substrate level phosphorylation, Reverse TCA cycle, Gluconeogenesis, Pasteur effects.

Fermentation of carbohydrates: homo and heterolactic fermentation.

Unit – 4

Nitrogen metabolism: Biological nitrogen fixation, mechanism of nitrogen fixation, Ammonia assimilation.

Synthesis and degradation of aromatic amino acids: Tryptophan, Tyrosine, Phenylalanine.

Synthesis of polysaccharides: peptidoglycan, biopolymers as cell components.

1. A text book of Microbiology – P. Chakraborty, New central book agency (P) Ltd. Kolkata.

2. General Microbiology I and II - C.B. Powar and H. F. Daginawala, Himalaya Publishing House Bombay.

3. Microbiology – B.D. Davis, R. Dulbecco, H.N. Eisen and H.S. Ginsberg, Harper and Row, Publishers Philadelphia.

4. Biology of Microorganisms – T.D. Brock and M.T. Madigan, Prentice Hall Int. Inc.

5. General Microbiology – R.Y. Stainer, J.L. Wheelis and P.R. Painter, Macmillan Educational Ltd. London.

6. Modern Microbiology – E.A. Brige, W.M.C. Brown, Oxford, England.

7. Microbial Physiology and Metabolism – D.R. Coldwell, Brown publication.

8. Microbial Physiology – A.G. Moat and J.W. Foster, Wiley publication.

2024-25

M.Sc. MICROBIOLOGY, SEMESTER II

Paper IV: Biostatistics and Computer Application **MM. – 80**

Unit –1

Introduction: Definition, Basic concepts, sample and population, measurement scales, statistical inferences and parameters.

Presentation of data: Tabulation, Frequency distribution, Graphical presentation of data and interpretation.

Measures of central tendency (mean, median, mode), Measures of dispersion (range, mean deviation, standard deviation and error).

Unit – 2

Correlation: Types and Methods, correlation coefficient and its significance.

Regression analysis: linear regression, regression coefficient, uses of regression analysis, difference between correlation and regression.

Experimental designs: Basic concepts, principles, types and significance.

Unit – 3

Tests of significance: Chi-Square, characteristics, applications.

Student's t Test, properties and applications.

Analysis of Variance (ANOVA): Introduction, procedure, multiple comparisons.

Statistical quality control: introduction, types and advantages.

Unit – 4

Introduction to computer: computer applications, basics, organization, PC, Mainframes and Super Computers.

Hardware and Software, MS office, Word processing. Working in Power point, creating presentations.

Introduction to Internet: Basics of internet, e-mailing, search engines- Google and Yahoo.

Recommended books

1. Statistics in Biology – C.I.K. Bliss, Vol.1, Mc Graw Hill, New York.

2. Statistics for Biologists – R.C. Campbell, Cambridge Uni. Press, Cambridge.

3. Microbiological Assay – W. Hewitt, Academic Press, New York.

4. Hand Book for experimental immunology –D.M. Weir, (W. Lutz), Blackwell publication Ltd. Oxford.

5. Practical Statistics for experimental Biologists– A.C.Wardlaw, John Wiley and Sons, New York.

6. Biostatistics, A foundation for analysis in the health science - Wayme W. Daniel, Wiley India Edition.

7. A text book of Biostatistics - B. Annadurai.

8. Research Methodology, Methods and Techniques - C.R. Kothari, New Age International publication

9. Biostatistical analysis – J.H. Zar

10. Introduction to Biostatistics – R.R. Sokal and F.J. Rohaf

11. Fundamentals of Biostatistics – Khan and Khanum, Ukaaz Publication, Hyderabad.

12. Biostatistics – P. Ramakrishnan, Saras publication Kanyakumari.

13. Computers: Concepts and Uses - M. Sumner.

14. Microsoft 2007: Introductory Concepts and Techniques - G.B. Shelly and M.E. Vermaat.

2024-25

M.Sc. MICROBIOLOGY, SEMESTER –II

List of Practicals

Lab Course I: Molecular Biology, Microbial Genetics **M.M. – 100**

Molecular Biology

1. Isolation & Estimation of DNA from plant (Cauliflower/Onion/Leaf).
2. Isolation& Estimation of Genomic DNA from Bacteria (Gram positive/Gram negative).
3. Estimation of total DNA from given sample by DAP method.
4. Estimation of RNA.
5. Isolation of Plasmid DNA from bacteria.
6. Isolation of total protein and protein profile study of microbial culture.

Microbial Genetics

1. Determination of antibiotic sensitivity by Well Diffusion method.
2. Determination of MIC for different antibiotics.
3. Isolation of antibiotic resistant bacterial population by Gradient plate method.
4. Isolation of UV induced Auxotrophic mutants by Replica Plating technique.
5. Study of bacterial Transformation.

Mark scheme: Lab Course I

1.	Isolation Technique	: 20
2.	Estimation	: 10
3.	Antibiotic sensitivity/MIC	: 10
4.	Microbial genetics (major)	: 20
5.	Study of bacteria	: 10
6.	*Viva-voce*	: 10
7.	Sessional	: 20
	Total	: 100

Lab Course II: Microbial Physiology, Biostatistics & Computer Application

M.M. – 100

Microbial Physiology

1. Study of Carbohydrate catabolism by microorganisms.
2. Effect of light on growth and sporulation of fungi.
3. Effect of temperature on growth of bacteria and determination TDP & TDT.
4. Effect of pH on growth of microorganism.
5. Antibiotic sensitivity test.
6. Study the fermentation of carbohydrates (glucose, sucrose & lactose).
7. Enzyme assay – Amylase & Lipase.

Biostatistics and Computer Application

1. Construction of frequency tables by given sample data.
2. Construction of histograms by given sample data.
3. Compare the measures of central tendency from a common data table.
4. Calculate the standard deviation of the given data mean.
5. Compare the sample mean with the population mean by t Test.
6. Determine whether the observed frequencies are similar to expected frequencies by χ^2 test.
7. Estimate and test the given hypothesis about population mean by ANOVA.
8. Computation of correlation coefficient.
9. Graphical presentation of data using a suitable package
10. Preparation of document using a suitable package
11. Preparation of slides using a suitable package.

Mark scheme: Lab Course II

1.	Physiology	: 20
2.	Enzyme Assay	: 20
3.	Biostatistics (Major)	: 20
4.	Computer application (Minor)	: 10
5.	*Viva-voce*	: 10
6.	Sessional	: 20
Total		**: 100**

DEPARTMENT OF MICROBIOLOGY
GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON

2024-2025

M.Sc. (MICROBIOLOGY)

SYALLABUS AND MARKING SCHEME
FOR
THIRD SEMESTER

PAPER NO.	TITLE OF THE PAPER	MARKS ALLOTED IN				TOTAL
		THEORY		INTERNAL		
		Max.	Min.	Max.	Min.	
1.	CELLULAR MICROBIOLOGY	80	16	20	04	100
2.	MEDICAL MICROBIOLOGY	80	16	20	04	100
3.	FOOD & DIARY MICROBIOLOGY	80	16	20	04	100
4.	INSTRUMENTATION AND TECHNIQUES	80	16	20	04	100
5.	LAB COURSE I (Based on Paper I and II)	100	33	-	-	100
6.	LAB COURSE II (Based on Paper III and IV)	100	33	-	-	100
	Total:	520		80		600

Chairperson/ HOD

Subject Expert 22/04/24

Subject Expert

VC Nominee

Educationist Representative

Student Nominee

2024-25

M.Sc. MICROBIOLOGY, SEMESTER –III

Paper – I - CELLULAR MICROBIOLOGY

M.M. – 80

Unit – 1

Emergence of cellular microbiology: Cellular biology underlying prokaryotic and eukaryotic interaction, ultrastructure, genome expression, pathogenicity islands.

Organization of chromosome: Structure of chromosome, centromere and Telomere, chromosome banding.

DNA packaging, Genome evolution in microbes. Phylogenetic trees.

Unit – 2

Eukaryotic signaling mechanisms: Signaling Via G protein, MAP Kinase pathway, insulin signaling, cyclins and cyclin dependent kinase.

Prokaryotic signaling: quorum sensing and bacterial pheromones intracellular signaling.

Unit – 3

Infection andcell:cell interaction Bacterial adherence: basic principle, effect of adhesion on bacteria, effect of adhesion on host cells.

Bacterial invasion of host cells, Survival after invasion. Transport by vesicle formation-Exocytosis, Endocytosis.

Protein toxins: agents of diseases and examples.

Unit – 4

Immune response to bacterial infection: Innate response, complement, acute phase protein.

Macrophages: cytokines and interferon.

Acquired immune response: cell mediated immune response, humoral response.

Cell cycle, Apoptosis, Oncogenes.

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Recommended books

1. Cellular Microbiology – Henderson *et al.* Wiley.
2. Bacterial genomics – De Brujin*et al.* Chapman and Hall.
3. Genetics of Bacterial virulence – Dorman C.J. Blackbell.
4. A textbook of Microbiology-R.C. Dubey and D.K. Maheshwari, S. Chand publication.

M.Sc. MICROBIOLOGY, SEMESTER –III
Paper – II - MEDICAL MICROBIOLOGY

M.M. – 80

Unit – 1

Normal microbial flora of human body: role of the resident flora.

Host microbe interaction, Infection and Infectious Process-Routes of transmission of microbes in the body.

Sources of infection for man, Vehicles or reservoirs of infection. Mode of spread of infection. Pathogenesis: infectivity and Virulence. Four lines of defense mechanism

Unit – 2

Classification of pathogenic bacteria: *Staphylococcus, Streptococcus, Pneumococcus, Neisseria, Corynebacterium, Bacillus, Clostridium, Non-sporing Anaerobes.*

Organisms belonging *to Enterobacteriace, Vibrios.*

Yersinia, Bordetella, Brucella, Mycobacteria, Spirochaetes, Actinomycetes, Rickettsiae, Chlamdiae.

Unit – 3

General properties of viruses. viruses host interactions: pox viruses, herpes virus, adeno viruses, picarno viruses, orthomyxo viruses, paramyxo viruses, arbo viruses, rhabdo viruses.

Hepatitis viruses, oncogenic viruses, human immunodeficiency viruses (AIDS).

Protozoal diseases: Malaria andameabiosis.

Unit – 4

Fungal infections: Dermatophytes, dimorphic fungi, opportunistic fungal pathogens, their description, Classification and Laboratory diagnosis.

Fungal Diseases – Mycoses systemic and subcutaneous, Pneumocystis, Blastomycosis, Dermatophytosis, Aspergillosis.

Nosocomial infection: common types of hospital infections, their diagnosis and control.

Laboratory control and anti-microbial therapy.

Recommended Books

1. Text book of Microbiology – R. Ananthanarayanan and C. K. Jayaram Paniker.

2. Medical Microbiology – Mackie and McCartney.

3. Practical Medical Microbiology. Vol 2– Churchill Livingstone.

4. Microbiology in clinical Practice – D.C. Shanson, Wright PSG.

5. Bailey and Scott's Diagnostic Microbiology – Baron EJ, Peterson LR and Finegold SM Mosby.

6.Microbiology by Presscott and Dunn's, CBS Publishers and Distributors.

7.7.Medical microbiology and infectious diseases. A.I. Braude, W.B. Saunders Co.

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M.Sc. MICROBIOLOGY, SEMESTER –III

PAPER – III FOOD AND DAIRY MICROBIOLOGY

M.M. – 80

Unit – 1

Food as substrate for microorganisms: Important micro-organisms in food microbiology - Molds, Yeasts and Bacteria (General characteristics and importance).

Principles of food preservation: Asepsis (anaerobic conditions, high temperatures, low temperature, drying).

Factors influencing microbial growth in food: Extrinsic and intrinsic factors; Chemical preservatives and food additives, Canning, processing for Heat treatment - D, Z, and F values.

Unit – 2

Contamination and Spoilage: Cereals, sugar products, vegetables, fruits, meat and meat products, Milk and Milk products, Fish and sea foods, poultry-spoilage of canned foods. Detection of spoilage and characterization.
Food control agencies and its regulations.

Unit – 3

Food-borne infections and intoxications: Bacterial and non-bacterial with examples of infective and toxic types (Brucella, Bacillus, Clostridium, Escherichia, Salmonella, Staphylococcus, Vibrio, Yersinia; Nematodes, Protozoa, algae, fungi and viruses).

Application of Microbial enzymes in food industry.

Unit – 4

Food Produced by Microbes: Fermented foods, microbial cells as food (single cell proteins) Bioconversions: Mushroom cultivation, Production of alcohol. Fermented beverages (beer and wine).

Microbiology of fermented milk products (acidophilus milk, yoghurt).

Role of microorganisms in beverages– tea and coffee fermentations. Vinegar Fermentation.

Recommended Books

1. Food and Dairy Microbiology – M.K. Rao, Mangalam publication

2. Food Microbiology – M.R. Adams and M.O. Moss, New Age International Pvt. Ltd.

3. Industrial Microbiology – Jr. L.E. Casida New Age International Pvt. Ltd.

4. Food Microbiology – W. C. Frazier and D.C. Westhoff, Tata McGraw Hill publication.

5. Industrial Microbiology – Prescott and Dunn, CBS Pub. New Delhi.

6. Food biotechnology – V. Mehta, Camus books.

7. Basic Food Microbiology- Banwart George J.

8. Food Microbiology: Fundamentals and Frontiers - Dolle

9. Fundamentals of Dairy Microbiology by Prajapati.

10. Microbiology of Fermented Foods. Vol. I and II. By Brian J. Wood. Elsiever Applied Science Publication.

11. Dairy Microbiology by Robinson. Volume I and II.

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M.Sc. – MICROBIOLOGY, SEMESTER III

Paper – IV - INSTRUMENTATION AND TECHNIQUES M.M. – 80

Unit –1

Microscopy- Phase contrast, Fluorescence microscopy, electron microscopy.

Principle and working of pH meter, Laminar-air flow, trinocular microscope.

Centrifugation: Types of centrifuge machines, preparative and analytical centrifuges, differential centrifugation, density gradient centrifugation.

Unit – 2

Theory, principles and applications of paper chromatography, thin layer chromatography, gel filtration chromatography, ion exchange chromatography, affinity chromatography.

Hydrophobic chromatography, gas liquid chromatography, high pressure/ performance liquid chromatography (HPLC).

Unit – 3

Basic principles of electrophoresis, theory and application of paper electrophoresis, starch gel electrophoresis.

Agarose gel electrophoresis, native and denaturing PAGE, SDS-PAGE, isoelectric focusing.

Polymerase Chain Reaction, RT-PCR.

Unit – 4

Spectroscopic techniques, theory and applications of UV Spectroscopy, Visible Spectroscopy, IR Spectroscopy.

Radio isotopic techniques, principle and application of tracer techniques, Geiger- Muller and Scintillation counters, autoradiography and its applications.

Recommended Books

1. Instrumental Methods of Analysis. 6th Edition by H.H. Willard, L.L. Merritt Jr. and others, 1986. CBS Publishers and Distributors.

2. Instrumental Methods of Chemical Analysis. 1989 by Chatwal G and Anand, S. Himalaya Publishing House, Mumbai.

3. A Biologists Guide to Principles and Techniques of Practical Biochemistry. 1975 by Williams, B.L. and Wilson, K.

4. Spectroscopy. Volume 1. Edited by B.B. Straughan and S. Walker. Chapman and Hall Ltd.

5. Gel Electrophoresis of Proteins- A Practical Approach by Hanes.

6. Chromatography: Concepts and Contrasts- 1988 by James Miller. John Wiley and Sons. Inc., New York.

7. Analytical Biochemistry by Holme.

8. Introduction to High Performance Liquid Chromatography by R.J. Hamilton and P.A. Sewell.

9. Spectroscopy by B.P. Straughan and S. Walker.

10. Practical aspects of Gas Chromatography and Mass Spectrometry 1984 by Gordon M. Message, John Wiley and Sons, New York.

11. Gel Chromatography by Tibor Kremmery. Wiley Publications.

12. Isotopes and radiations in Biology by C.C. Thornburn, Butterworth and Co. Ltd., London.

13. The use of radioactive isotopes in the life sciences by J.M. Chapman and G. Ayrey, George Allen and Unwin Ltd., London.

M.Sc. Microbiology Semester –II

List of Practicals

Lab Course: I - Cellular Microbiology, Medical Microbiology

Cellular Microbiology **M.M.-100**

Study of the cellular nature of isolated bacteria: -

1. Study of chromosome behaviour during mitosis and meiosis (Onion / Garlic root tips,' Onion buds)
2. Study of the effect of chemical agents on chromosomes plant cells.
3. Gram staining.
4. Motility study by hanging drop method.
5. Acid fast staining.
6. Endospore staining.
7. Flagella staining
8. Capsule staining.

Medical Microbiology

1. Isolation and preliminary identification of Normal microbial flora of the skin.
2. Effect of detergents and soaps on the Normal flora of skin.
3. Identification of dermatophytic fungi
4. Isolation and preliminary identification of microbial flora of teeth crevices.
5. Isolation and preliminary identification of microbial flora from saliva.
6. Urine culture and its microbiological analysis.
7. Isolation and preliminary identification of enteric pathogens using TSIA medium.
8. Widal Test
9. IMVIC.

Mark scheme: Lab Course I

1.	Bacteriological Technique/ cellular technique	: 20
2.	Staining technique	: 10
3.	Isolation technique	: 20
4.	Identification	: 10
5.	Enteric pathogens	: 10
6.	*Viva-voce*	: 10
7.	Sessional	: 20
Total		**: 100**

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M.Sc. Microbiology Semester –III

Lab Course: II Food Microbiology & Instrumentation and Techniques

Food Microbiology **M.M.-100**

1. Isolation and preliminary identification of microorganisms from different fermented food.
2. Isolation and preliminary identification of microorganisms from different spoiled fruit and vegetables.
3. Determination of quality of milk samples by Methylene Blue Reductase test.
4. Detection of number of bacteria in milk by SPC method.
5. Production and estimation of lactic acid.
6. Isolation of food poisoning bacteria from contaminated foods, Dairy products.
7. Extraction and detection of aflatoxin for infected foods.
8. Rapid analytical techniques in food quality control using microbial Biosensors.
9. Isolation of Rhizobium from root nodule.

Instrumentation and Techniques

1. Studies on pH titration curves of amino acids/ acetic acid and determination of pKa values and Henderson-Hasselbalch equation.
2. Separation of bacterial lipids/ amino acids/ sugars/ organic acids by TLC or paper chromatography.
3. Verification of Beers Law
4. Determination of absorption maxima
5. Specific test for sugars, amino acids and lipids
6 Protein estimation by Lowry/ Bradford, Biuret and Spectrophotometric method
7. Estimation of sugar by anthrone and Folin-Wu method

8. Study of UV absorption spectra of macro molecules (Protein, nucleic acid, bacterial pigments).
9. Saponification value and iodine number of fat.
10. Estimation of blood cholesterol
11. Demonstration of PCR, DNA sequencer and fermenter.
12. SDS Polyacralamide Gel-Electrophoresis
13. DNA electrophoresis

Mark scheme: Lab Course II

1.	**Food microbiology**	**: 20**
2.	**Qualitative/ Quantitative tests**	**: 10**
3.	**Rapid Test (Quality Control)**	**: 10**
4.	**TLC/ Estimation/Separation**	**: 20**
5.	**Instrumentation/Techniques**	**: 10**
6.	***Viva-voce***	**: 10**
7.	**Sessional**	**: 20**
Total		**: 100**

DEPARTMENT OF MICROBIOLOGY
GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON

2024-2025

M.Sc. (MICROBIOLOGY)

SYALLABUS AND MARKING SCHEME
FOR
FOURTH SEMESTER

PAPER NO.	TITLE OF THE PAPER	MARKS ALLOTED IN				TOTAL
		THEORY		INTERNAL		
		Max.	Min.	Max.	Min.	
1.	ENVIRONMENTAL MICROBIOLOGY	80	16	20	04	100
2.	ENZYME TECHNOLOGY	80	16	20	04	100
3.	FERMENTATION AND MICROBIAL TECHNOLOGY	80	16	20	04	100
4.	PHARMACEUTICAL MICROBIOLOGY/ AGRICULTURE MICROBI OLOGY	80	16	20	04	100
5.	LAB COURSE I (Based on Paper I and II)	100	33	-	-	100
6.	LAB COURSE II (Based on Paper III and IV)	100	33	-	-	100
	Total:	520		80		600

Chairperson/ HOD Subject Expert Subject Expert VC Nominee

Educationist Representative Student Nominee

M.Sc. – MICROBIOLOGY, SEMESTER IV

Paper – I – ENVIRONMENTAL MICROBIOLOGY M.M.– 80

Unit – 1

General concept of biotic and abiotic environment. Composition and structure of environment. Concept of biosphere, communities and ecosystems.

Ecosystem characteristics, structure and function. Food chains, food webs and trophic structures. Ecological pyramids.

Unit –2

Microbiology of wastewater and solid waste treatment: - Waste-types-solid and liquid waste characterization, physical, chemical, biological, primary, secondary and tertiary treatments.

Anaerobic processes: Anaerobic digestion, anaerobic filters and up flow anaerobic sludge.

Bioconversion of Solid Waste and utilization as fertilizer.

Bioaccumulation of heavy metal ions from industrial effluents.

Unit – 3

Microbiology of degradation of xenobiotics in the environment, decay behaviour. Hydrocarbons, substituted hydrocarbons.

Soil pollution, surfactants and pesticides.

Genetically Modified Organisms. Environmental impact assessment and ethical issues.

Unit – 4

Ozone depletion, Global warming, greenhouse effect, greenhouse gases.

Acid rain, their impact and approaches for management.

Biogeochemical cycles: carbon, nitrogen, phosphorus and Sulphur.

Recommended Books

1. Bioremediation by Baker K.H. And Herson D.S. 1994. MacGraw Hill Inc. N.Y.

2. Waste Water Engineering - Treatment, Disposal and Re-use by Metcalf and Eddy, Inc., Tata MacGraw Hill, New Delhi.

3. Pollution: Ecology and Biotreatment by McEldowney, S. Hardman D.J. and Waite S. 1993. - Longman Scientific Technical.

4. Environmental Microbiology edited by Ralph Mitchell. A John Wiley and Sons. Inc.

5. Waste Water Microbiology 2nd Edition by Bitton.

6. Chemistry and Ecotoxicology of pollution. Edited by Des. W. Connell, G.J. Miller. Wiley Interscience Publications.

7. Environmental Biotechnology. Edited by C. F. Forster and D.A., John Wase. Ellis Horwood Ltd. Publication.

8. Advances in Waste Water Treatment Technologies. 1998. Volumes II and I by R. K. Trivedy. Global Science Pub.

9. Biocatalysis and Biodegradation: Microbial transformation of organic compounds. 2000 by Lawrence P. Wacekett, C. Douglas Hershberger. ASM Publications.

10. A Manual of Environmental Microbiology. 2nd Edition. 2001 by Christon J. Hurst (Chief Editor), ASM Publications.

11. Biodegradation and Bioremediation, Academic Press, San Diego.

M.Sc. – MICROBIOLOGY, SEMESTER IV

Paper – II – ENZYME TECHNOLOGY

Unit – 1 **M.M. – 80**

Enzyme classification, Co enzymes Extracellular and intracellular enzymes. Different sources of enzymes.

Enzyme purification. Physical and Chemical methods. Enzyme fractionation by precipitation (using Temperature, salt, solvent, pH).

Enzyme crystallization techniques. Criteria of purity of enzymes.

Unit - 2

Enzyme kinetics: Michaelis Menten equation.

Mechanism of enzyme action: Irreversible, reversible, competitive, non-competitive and un-competitive inhibition.

Allosteric inhibition, types of allosteric inhibition Vitamins and their co-enzymes: structure and functions with suitable examples.

Metalloenzymes and Metal ions as co-factors and enzyme activators.

Unit - 3

Methods viz. adsorption, covalent bonding, entrapment & membrane confinement and their analytical, therapeutic & industrial applications.

Properties of immobilized enzymes.

Unit – 4

Microbial enzymes in textile, leather, wood industries and detergents.

Enzymes in clinical diagnostics. Enzyme sensors for clinical processes and environmental analyses. Enzymes as therapeutic agents.

Recommended Books

1. Methods in Enzymology. Volume 22 - Enzyme purification and related techniques. Edited by William B. Jakoby. Academic Press, New York.

2. Allosteric Enzymes - Kinetic Behaviour. 1982. by B.I. Kurganov. John Wiley and Sons. Inc., New York.

3. Biotechnology. Volume 7 A - Enzymes in Biotechnology. 1983 Edited by H. J. Rehm and G. Reed. Verlag Chemie.

4. Hand Book of Enzyme Biotechnology by Wiseman.

5. Enzymes as Drugs Edited by John S. Holcenberg and Joseph Roberts , John Wiley & Sons New York.

6. Methods of Enzymatic Analysis by Hans Ulrich, Bergmeyer, Academic Press.

7. Methods in Enzymology by W.A. Wood, Academic Press.

8. Advances in Enzymology by Alton Meister, Interscience Publishers.

9. Topics in Enzyme and Fermentation Biotechnology by L.N. Wiseman, John Wiley and Sons.

M.Sc. – MICROBIOLOGY, SEMESTER IV
Paper – III: FERMENTATION & MICROBIAL TECHNOLOGY

M.M. – 80

Unit – 1

Metabolic pathways and metabolic control mechanisms.

Primary and secondary metabolites.

Industrial production of citric acid, lactic acid, enzymes (alpha-amylase, lipase, proteases), acetone, butanol and glutamic acid.

Unit – 2

Microbial production of therapeutic compounds (β-lactam, aminoglycosides, Ansamycins (Rifamycin).

Biotransformation of steroids, vitamin B_{12} and riboflavin fermentation.

Bioreactors types, basic designs and uses. Bio fermenters uses.

Unit – 3

Modern trends in microbial production of bioplastics (PHB, PHA), bioinsectices (thuricide).

Biopolymer (dextran, alginate, xanthan). Bio-fuels.

Biofertilizers (nitrogen fixer Azotobacter, Phosphate solubilizing microorganisms).

Single Cell Protein and production of biological weapons with reference to anthrax.

Unit – 4

Production of bioethanol from sugar, molasses, starch and cellulosic materials.

Downstream processing: Removal of microbial cells and solid matter, precipitation, filtration, centrifugation, disintegration of cells, extraction methods, concentration methods, purification and resolution of mixtures, drying and crystallization.

Intellectual Property Rights (IPR), Patents and Copyrights.

Recommended Books

1. Biotechnological Innovations in Chemical Synthesis. Biotol Publishers / Butterworth Heinemann.

2. Industrial Microbiology by G. Reed (Ed), CBS Publishers (AVI Publishing Co.)

3. Biology of Industrial Microorganisms by A.L. Demain.

4. Genetics and Biotechnology of Industrial Microorgansims by C.l. Hershnergey, S.W. Queener and Q. Hegeman. Publisher. ASM. Ewesis ET. Al. 1998. Bioremediation Principles. Mac Graw Hill.

5. Annual Reports in Fermentation Processes by D. Pearlman, Academic Press.

6. Fundamentals of Biochemical Engineering by Bailey and Ollis.

7. Annual Review of Microbiology by Charles E. Cliffton (Volumes)

8. Biotechnology, A textbook of industrial Microbiology by Creuger and Creuger, Sinaeur associates.

9. Manual of industrial Microbiology and Biotechnology 2nd edition by Davis J.E. and Demain A.L. ASM publications.

M.Sc. – MICROBIOLOGY, SEMESTER IV

Paper – IV – PHARMACEUTICAL MICROBIOLOGY M.M. – 80

Unit – 1

Antibiotics and synthetic antimicrobial agents (Aminoglycosides, β-lactams, tetracyclines, ansamycins, macrolid antibiotics).

Antifungal antibiotics, antitumor substance. Peptide antibiotics, Chloramphenicol, Sulphonamides and Quinolinone antimicrobial agents.

Chemical disinfectants, antiseptics and preservatives.

Unit – 2

Mechanism of action of antibiotics (inhibitors of cell wall synthesis, nucleic acid and protein synthesis).

Molecular principles of drug targeting. Drug delivery system in gene therapy Bacterial resistance to antibiotics.

Mode of action of bacterial killing by quinolinones. Bacterial resistance to quionolinones.

Mode of action of non – antibiotic antimicrobial agents.

Unit – 3

Microbial contamination and spoilage of pharmaceutical products (sterile injectables, non-injectables, ophthalmic preparations and implants) and their sterilization.

New vaccine technology, DNA vaccines, synthetic peptide vaccines, multivalent subunit vaccines. Vaccine clinical trials.

Unit – 4

Financing R&D capital. Government regulatory practices and policies, FDA perspective.

Reimbursement of drugs and biologicals, legislative perspective. Rational drug design. Immobilization procedures for pharmaceutical applications (liposomes).

Biosensors in pharmaceuticals. Application of microbial enzymes in pharmaceuticals.

Recommended Books

1. Pharmaceutical Microbiology – Edt. by W.B.Hugoand A.D. Russell Sixth edition. Blackwell scientific Publications.

2. Analytical Microbiology –Edt by Frederick Kavanagh Volume I and II. Academic Press New York.

3. Quinolinone antimicrobial agents – Edt. by David C. Hooper, John S. Wolfson. ASM Washington DC.

4. Quality control in the Pharmaceutical Industry - Edt. by Murray S. Cooper Vol.2. Academic Press, New York.

5. Biotechnology – Edt. by H.J. Rehman and G. Reed, Vol 4. VCH Publications, Federal Republic of Germany.

6. Pharmaceutical Biotechnology by S.P. Vyas and V.K. Dixit. CBS Publishers and Distributors, New Delhi.

7. Good Manufacturing Practices for Pharmaceuticals Second Edition, by Sydney H. Willig, Murray M. Tuckerman, William S. Hitchings IV. Mercel Dekker NC New York.

8. Advances in Applied Biotechnology Series Vol 10, Biopharmaceuticals in transition. Industrial Biotechnology Association by Paine Webber. Gulf Publishing Company Houston.

9. Drug Carriers in biology and Medicine Edt. by Gregory Gregoriadis. Academic Press, New York.

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ELECTIVE PAPER

M.Sc. – MICROBIOLOGY, SEMESTER IV

Paper – IV – AGRICULTURE MICROBIOLOGY M.M. – 80

Unit 1:

Introduction – Soil as an environment for microorganisms. Classification of soil, physical and chemical properties of soil, structure of soil.

Microbial interactions - mutualism, commensalism, amensalism, synergism, parasitism, predation and competition.

Microbial interactions between plants– phyllosphere, mycorrhizae, rhizosphere and symbiotic association in root nodules. Biofertilizer – VAM, Rhizobium, Azospirillum, Azotobacter, cyanobacteria and Azolla.

UNIT 2:

Some bacterial diseases of agricultural crops- pathogens, symptoms and control measures with reference to paddy, cotton, maize, tomato, citrus, mango and potato.

Plant protection – phenolics – phytoalexins and related compounds. Bioinsecticides – viral, bacterial and fungal- a brief note.

UNIT 3:

Soil microbes and fertility of soil. Roles of microbes in biogeochemical cycles – carbon, nitrogen, phosphorus, Sulphur. Soil microbes and fertility of soil.

Aerobiology – a brief introduction - droplet nuclei – aerosols - air borne transmission of microbes and diseases -assessment of air quality.

UNIT 4:

Aquatic microbiology - factors affecting microbial growth – temperature – pressure – light – salinity - turbidity – pH -inorganic and organic constituents.

Aquatic habitats - freshwater - lakes, ponds and streams; marine habitats - estuaries, sea, hydrothermal vents, saltpans, coral reefs, mangroves and their associated microbial communities; Role of microbes in zonation – food chain and food web.

Recommended Books

1. Alexander M. 1997. Introduction to soil microbiology, John Wiley & Sons, Inc, New York.

2. Mc Elkowney S., Hardman, D.J. and Waite, S. 1993. Pollution Ecology and Biotreatment-Longman Scientific Technical, Harlow, UK.

3. Grant, W.D. and Long, P.L. 1981. Environmental Microbiology. Blalekie Glasgow and London.

4. Madigan, M.T., Martinka, M., Parker, J. and Brock, T.D. 2000. Twelth Edition, Biology Microorganisms, Prentice Hall, New Jerry.

5. Mark Wheelis, 2010. Principles of Modern Microbiology, Jones & Bartlett India Pvt. Ltd., New Delhi.

6. Mehrotra, R.S. 1983. Plant Pathology, Tata McGraw Hill Publishing Company Ltd., New Delhi.

7. Pandy, B.P. 1997. Plant Pathology (Pathogen & Plant Disease), S.Chand & Company Ltd., New Delhi.

8. Ray Chadhuri, S.P. 1977. A Manual of Virus Diseases of Tropical Plants, MacMillan Company of India Ltd., Delhi.

9. Rengaswami, G. and Rajagopalan, S. 1973. Bacterial Plant Pathology – Tamil Nadu Agriculture University, Coimbatore.

10. SubbaRao, N.S. 1995. Soil Microorganisms and Plant Growth, Third Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

M.Sc. Microbiology

Semester –IV

Pharmaceutical Microbiology/ Agriculture Microbiology

List of Practicals

Lab Course: I- Environmental Microbiology, Enzyme Technology **M.M. – 100**

ENVIRONMENTAL MICROBIAL TECHNOLOGY

1. Physical analysis of sewage/industrial effluent by measuring total solids, total dissolved solids and total suspended solids.
2. Analysis of soil-pH, moisture content, water holding capacity, percolation, capillary action.
3. Determination of indices of pollution by measuring BOD/COD of different effluents.
4. Study the effect of heavy metals on bacterial growth.
5. Qualitative of the presence of enzymes(amylase/urease/catalase).
6. Isolation of Rhizobium from root nodules of legumes.
7. Utilization of microbial consortium for the treatment of solid waste [Municipal Solid Waste].
8. Tests for the microbial degradation products of aromatic hydrocarbons /aromatic compounds.
9. Microbial assessment of water quality by SPC and Presumptive test (MPN Index).
10. Isolation of pesticide & herbicide degrading microorganisms.

ENZYME TECHNOLOGY

1. Microbial production, Extraction, purification and Confirmation of alpha amylase
2. Microbial production, Extraction, purification and Confirmation of Lipase
3. Achromic point determination using salivary amylase
4. Quantitative assay of alkaline and acid phosphatase from microorganism
5. Qualitative estimation of extracellular enzymes.
6. Immobilization of cells and enzyme using Sodium alginate and egg albumin and measurement of enzyme activity (amylase/ /Lipase)
7. Determination of molecular weight of enzymes using PAGE technique.

2024-25

Mark scheme: Lab Course I

1.	Exercise on effluents	: 20
2.	Physical analysis of sewage/industrial effluent	:10
3.	Production technique (Enzyme)	: 20
4.	Enzymatic studies	: 20
5.	*Viva-voce*	: 10
6.	Sessional	: 20
	Total	: 100

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M.Sc. Microbiology

Semester –IV

Lab Course: II- Fermentation and Microbial Technology

&

Pharmaceutical Microbiology/Agriculture Microbiology **MLM 100**

FERMENTATION AND MICROBIAL TECHNOLOGY

1. Carbohydrate catabolism by microorganisms (oxidation and fermentation of glucose)
2. Fermentation of carbohydrates.
3. Bacteriological examination of water by multiple-tube fermentation test.
4. Microbial fermentations for the production and estimation (qualitative and quantitative) of
(a) Enzyme: Amylase
(b) Organic acid: Citric acid
5. Production and characterization of citric acid using *Aspergillus niger*.
6. Microbial production of glutamic acid.
7. Experiment on production of alcohol and optimizing parameters for alcohol production in shake flask culture using *Saccharomyces cerevisiae*
7. Experiment on production and optimizing parameters for SCP in shake flask culture.
8. Laboratory scale production of biofertilizers (Nitrogen fixer/Phosphate Solubilizers/siderophore producers).
9. Microbial production of hydrogen gas by algae/bacteria.

PHARMACEUTICAL MICROBIOLOGY

1. Spectrophotometric / Microbiological methods for the determination of Griesofulvin.
2. Bioassay of chloremphenicol by plate assay method or turbidiometric Assay method.
3. Assay of anti-fungal and antibacterial properties of agro-chemicals and fungicides
4.. Treatment of bacterial cells with cetrimide, phenol and detection of Leaky substances such as potassium ions, amino acids, purines, pyrimidines and pentoses due to cytoplasmic membrane damage.
5. To determine MIC, LD 50 of Beta-lactum/aminoglycoside/ tetracycline/ ansamycins.
6. Sampling of pharmaceuticals for microbial contamination and load (syrups, suspensions, creams and ointments, ophthalmic preparations).
7. Antifungal activity of various shampoos for dandruff treatment.

8. Determination of D value, Z value for heat sterilization in pharmaceuticals.

9. Determination of antimicrobial activity of a chemical compound (Phenol, resorcinol, thymol, formaldehyde) to that of phenol under standardized experimental conditions.

AGRICULTURE MICROBIOLOGY

1. Isolation of plant pathogens-Fungi.

2. Isolation of fungal pathogens from leaves.

3. Isolation of fungal pathogens from stems, fruits and other aerial plant parts.

4. Isolation of fungal pathogen from soil.

5. Isolation of plant pathogen-Bacteria.

6. Isolation (purification) of plant viruses.

7. Antimicrobial activity of pathogenic bacteria and fungi

Mark scheme: Lab Course II

1. Carbohydrate catabolism	**: 10**
2. Production technique	**: 20**
3. Assay technique/Isolation Technique	**: 30**
4. Antimicrobial technique	**: 10**
5. *Viva-voce*	**:10**
6. Sessional	**: 20**
Total	**100**

(2024-2025)

Project (Optional)

Project Work	External	Internal	Total
Dissertation	150	50	200
Seminar based on project	80	20	100
Total	**230**	**70**	**300**

1. A Student of IV Semester will have the option to opt for project work in lieu of two theory, Paper III & IV and lab courses II of M.Sc IV semester provided he/she secures at-least 65% or more marks in aggregate in semester I and II Semester.
2. The project has to be carried out in recognized national laborites or UGC recognized universities or any other reputed organization of public and private concern.
3. The valuation of all the projects will be carried out by the external examiner.

The project work should be related to the field of microbiology. The project report should include declaration by the candidate, certificate by the supervisor, acknowledgement, title and introduction along with the following points.

1. Introduction.
2. Review of Literature.
3. Materials and Methods.
4. Results and Discussion.
5. Summary/Conclusion.
6. Bibliography.

Chairperson/ HOD

Subject Expert 22/4/24

Subject Expert

VC Nominee

Educationist Representative

Student Nominee