DEPARTMENT OF MICROBIOLOGY

COURSE CURRICULUM & MARKING SCHEME

M.Sc. MICROBIOLOGY

Semester – I, II, III, IV

SESSION : 2025-26

ESTD: 1958

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG, 491001 (C.G.)

(Former Name – Govt. Arts & Science College, Durg)

NAAC Accredited Grade A^+, College with CPE - Phase III (UGC), STAR COLLEGE (DBT)

Phone : 0788-2212030

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Department of Microbiology

Govt. V.Y.T. P.G. Autonomous College, Durg (C.G.)

Session 2025-26

Learning Outcome Based curriculum for M.Sc. Microbiology

Program Specific Outcome (PSO): M.Sc. Microbiology

The program enables the students –

- To give comprehensive understanding about the diversity of microbes, their organizational units and response towards other life entities
- To inculcate the students to the behavior of microorganisms in terms of physiology, molecular characters and genetic performance
- To make the hypothetical assumptions about the life forms and establish the facts with data interpretation and develop capability of handling of instruments and to build inference for scientific conclusions
- To create employable skills in the field of medical, food, Dairy and industrial microbiology and build the competency in relation with environment consciousness, ethical values and socio-economical aspects
- To be able to analyze problems involving microbes, articulate this with peers/ team members/ other stake holders, and undertake remedial measures

Name and Signatures

Chairperson/ HOD- Dr. Pragya Kulkarni **Subject Expert - Dr. Anita Mahiswar** **Subject Expert - Dr. Sonal Mishra** **VC Nominee – Dr. Prakash Saluja** **Member of Other Department- Dr. G.S. Thakur**	**Industrial Representative- Shri Amitesh Mishra** **Student Nominee – Ms. Yogita Lokhande** **Departmental members** **1. Mrs. Rekha Gupta** **2. Mrs. Neetu Das** **3. Ms. Mrinalini Soni** **4. Ms. K.K. Yashoda**

The Syllabus for M.Sc. Microbiology is hereby approved for the session 2025-26

Semester I

Paper I: Advanced Bacteriology and Virology	**Paper II: Structure and Functions of Biomolecules**
Paper III: Phycology and Mycology	**Paper IV: Advanced Immunology and Immunotechniques**
Lab Course I: Based on Paper I and II	**Lab Course II: Based on Paper III and IV**

Semester II

Paper I: Microbial Physiology and Metabolism	**Paper II: Biostatistics and Computer Application**
Paper III: Cell and Molecular Biology	**Paper IV: Microbial Genetics**
Lab Course I: based on paper I and II	**Lab Course II: Based on paper III and IV**

Semester III:

Paper I: Biophysical Technique, Instrumentation and Bioinformatics	**Paper II: Medical Microbiology**
Paper III A: Food and Dairy Microbiology (Elective)	**Paper III B: Agriculture Microbiology (Elective)**
Lab Course I: Based on Paper I	**Lab Course II: Based on Paper II and III**

Semester IV:

Paper I: Environmental Microbiology	**Paper II: Industrial Microbiology and Fermentation Technology**
Paper III A: Microbial Biotechnology (Elective)	**Paper III B: Microbial Genomics and Proteomics (Elective)**
Lab Course I: Based on Paper I and II	**Lab Course II: Based on Paper III**
Any one elective course to be selected as paper III	**Evaluation of Project Work**

***Project Work**: A project work shall be initiated at the end of semester II for the duration of three months (i.e. June to August) and undertaken in any reputed Institute/ Industry/P.G. departments of University or College.

Evaluation of Project work: The project report duly signed by the supervisor and the Head of the institution where the project is completed shall be submitted to the department during Semester IV. Evaluation of the projects shall be done by external examiner.

Name and Signatures

Chairperson/ HOD- Dr. Pragya Kulkarni

Subject Expert - Dr. Anita Mahiswar

Subject Expert - Dr. Sonal Mishra

VC Nominee – Dr. Prakash Saluja

Member of Other Department- Dr. G.S. Thakur

Industrial Representative- Shri Amitesh Mishra

Student Nominee – Ms. Yogita Lokhande

Departmental members

1. **Mrs. Rekha Gupta**
2. **Mrs. Neetu Das**
3. **Ms. Mrinalini Soni**
4. **Ms. K.K. Yashoda**

GENERAL INSTRUCTIONS FOR STUDENTS

1. The candidate has to obtain minimum 20% marks in each theory paper and internal assessment separately.
2. The candidate has to secure minimum 36% marks as an aggregate in order to pass that semester examination.
3. The internal assessment shall include class test, home assignment and seminar presentation.
4. A. In internal assessment, the marks taken into consideration will be the average of class test and home assignment
   B. The seminar shall be in lieu of home assignment from any one of the theory paper and shall be of 20 marks.
   C. There shall be one seminar in each semester.

EVALUATION PATTERN

- **Theory 80 marks = 04 Credits**
  1. The question paper will be of 80 marks.
  2. Questions will be asked Unit wise in each paper.
  3. The marking scheme for each unit will be as follows –
     a. Very short answer type question (in one or two sentences) – Two from each unit
     b. Short answer type question (in 200-250 words) – One from each unit
     c. Long answer type question (in 400-450 words) – One from each unit
- **Internal Assessment 20 marks = 01 credit**

- Unit test – One class test in each theory paper comprising 20 marks. (containing two short answer type questions of 05 marks each and 05 objective type questions of 02 marks each)
- Home assignments – Two long answer type questions from theory paper containing 10 marks each. The answer should be prepared with the help of standard reference books. (The titles of those books, authors, year of publication and publishers details should be mentioned in an appropriate way, at the end of each assignment).
- Seminar presentations (Power point) – Comprising 20 marks. The marking of seminar shall be in terms of hard copy submission (10 marks) and presentation and open discussion (10 marks).

Marking Scheme

Type of Question	Unit -I	Unit - II	Unit – III	Unit - IV
A Very short (2 questions)	2 X 2 = 4 marks	2 X 2 = 4 marks	2 X 2 = 4 marks	2 X 2 = 4 marks
B Short (1 question)	1 X 4 = 4 marks	1 X 4 = 4 marks	1 X 4 = 4 marks	1 X 4 = 4 marks
C Long (1 question)	1 X 12 = 12 marks	1 X 12 = 12 marks	1 X 12 = 12 marks	1 X 12 = 12 marks

Name and Signatures

Chairperson/ HOD- Dr. Pragya Kulkarni	**Industrial Representative- Shri Amitesh Mishra**
Subject Expert - Dr. Anita Mahiswar	**Student Nominee – Ms. Yogita Lokhande**
Subject Expert - Dr. Sonal Mishra	**Departmental members**
VC Nominee – Dr. Prakash Saluja	1. **Mrs. Rekha Gupta**
Member of Other Department- Dr. G.S. Thakur	2. **Mrs. Neetu Das**
	3. **Ms. Mrinalini Soni**
	4. **Ms. K.K. Yashoda**

DEPARTMENT OF MICROBIOLOGY

GOVT. V. Y. T. P.G. AUTONOMOUS COLLEGE DURG

SYALLABUS AND MARKING SCHEME

FIRST SEMESTER

Session: 2025-26

Paper No.	Title of the Paper	Marks Allotted in Theory		Marks Allotted in Internal Assessment		Total	Credits
		Max	Min	Max.	Min.		
I	ADAVNCED BACTERIOLOGY AND VIROLOGY	80	16	20	04	100	05
II	STRUCTURE AND FUNCTIONS OF BIOMOLECULAES	80	16	20	04	100	05
III	PHYCOLOGY AND MYCOLOGY	80	16	20	04	100	05
IV	ADVANCED IMMUNOLOGY AND IMMUNOTECHNIQUES	80	16	20	04	100	05
V	LAB COURSE I Based on Paper I and II	100	33	-	-	100	04
IV	LAB COURSE II Based on Paper III and IV	100	33	-	-	100	04
	Total	520	-	80	-	600	28

Name and Signatures

Chairperson/ HOD- Dr. Pragya Kulkarni	Industrial Representative- Shri Amitesh Mishra
Subject Expert - Dr. Anita Mahiswar	Student Nominee – Ms. Yogita Lokhande
Subject Expert - Dr. Sonal Mishra	Departmental members
VC Nominee – Dr. Prakash Saluja	1. Mrs. Rekha Gupta 2. Mrs. Neetu Das 3. MS. Mrinalini Soni 4. Ms. K.K> Yashoda
Member of Other Department- Dr. G. S. Thakur	

Session 2025-26
M.Sc. – MICROBIOLOGY
SEMESTER I
PAPER – I
MMB 101 ADVANCED BACTERIOLOGY AND VIROLOGY

Max. M. – 80; Min. M. – 16

Upon successful completion of the course, students will be able –

- **To understand the classification and diversity among bacteria and their respective forms**
- **To identify the nutritional requirements for cultivation of bacteria under laboratory conditions**
- **To acquire an initiative about the viruses, related agents and bacteriophages and their organizations**
- **To get an overview of viral diseases of plants and animals**

Unit –I

- Morphology and ultra-structure 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; Structure and functions of flagella, pili, gas vesicles, chromosomes, carboxysomes, magnetosomes Phycobolisomes, Endospore, Cell division
- Reserve food material, polyhydroxybutyrate, polyphosphate granules, oil droplets, cyanophycin granules and sulphur inclusions.

Unit – II

- Classification of microorganisms: Basis of microbial classification; Haeckel's three kingdoms concept, Whittacker's five kingdom concept, three domain concept of Carl Woese
- Salient feature of bacterial classification according to the Bergey's manual of determinative bacteriology
- Cultivation of bacteria: aerobic, anaerobic, shake & still cultures
- Nutritional types, culture media, Growth curve, Generation time, Growth kinetics, Asynchronous, synchronous, batch, continuous cultures, Measurement of growth, factors affecting growth, Control of bacteria and preservation methods.

Unit – III

- Brief outline on 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 (viroids, prions).
- Bacteriophages: structural organization, life cycle; (one step growth curve, eclipse phase, phage production, burst size), lysogenic cycle; Brief details on life cycle of MI3, Mu, T3, T4, and Lamda P1
- Genetic mapping of phage T4 , genetic organization λ phage

Unit – IV

- Cultivation of viruses: embryonated eggs, experimental animals; Cell culture: primary and secondary cell cultures, suspension cell cultures and monolayer cell 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), bacteriophage typing
- Structural organization, life cycle, pathogenecity, symptoms of: Plant Viruses (TMV, CMV, and PVX) and Animal Viruses (Pox, Herpes, HIV, Influenza, Polio), control of vector

Name and Signatures:

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members:

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 , HimalayaPublishing House Bombay.
3. Microbiology – B.D. Davis, R. Dulbecco, H.N. Eisen and H.S. Ginsberg, Harper and Row Publishers Philadelphia.
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. Stainer, J.L. Wheelis 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
13. An Introduction to Viruses – S.B.Biswas and Amita Biswas, Vikas Publishing house Pvt.Ltd.
14. Virology: Principles and Applications – John Carter and Venetia Saunders, John Wiley and Sons Ltd.

Session 2025-26

M.Sc. – MICROBIOLOGY

SEMESTER I

PAPER – II

MMB 102 STRUCTURE AND FUNCTIONS OF BIOMOLICULES

Max. M. – 80; Min. M. - 16

Upon successful completion of the course, students will be able –

- **To learn the characters and classes of basic building blocks and their biological significance**
- **To be familiar the students with bio-molecular derivatives and their importance**
- **To Study the structure, properties and biological importance of DNA and RNA**
- **To understand conceptual knowledge of properties, structure, function of enzymes, enzyme kinetics and their regulation**

Unit – I

- Carbohydrates: Characters and classification; Monosaccharide -classification, structure and physico-chemical properties, glycosides; Derivatives of monosaccharide – aminosugars, sugar acids and phosphorylated sugars
- Disaccharides- sucrose, lactose and maltose
- Structure, occurrence and biologicalsignificance of polysaccharides (starch, cellulose, chitin, glycogen and peptidoglycan)

Unit – II

- Amino acids: Standard amino acids, nonstandard amino acids, D-amino acids, beta- and gamma-amino acids, Classification of amino acids, Analysis of mixtures of amino acids, Derivatives of amino acids
- Proteins: Classification, organization and specificity of proteins, assemblies of proteins, purification
- Vitamins: Classification- water and fat soluble vitamins, structure and their biochemical properties
- Hormones: Basic mechanism of hormones action, hormones and diseases

Unit – III

- Lipids: Classification of lipids; fatty acids: physico - chemical properties, separation, distribution in nature, characterization and saponification
- Nomenclature, outline structure, properties and functions of glycerides, neutral lipids(waxes, fats and oils) Membrane lipids: phospholipids, spingophospholipids and glycolipids
- Steroids, Plant sterols, Ergosterol, Stigmosterol and Cholesterol
- Structure of purine and pyramidine bases, nucleosides and nucleotides and their nomenclature, Types of RNA and DNA and their structures

Unit – IV

- Enzymes: Nomenclature, classification
- Enzyme kinetics, factors affecting enzyme activity: Effect of pH, substrate concentration, temperature and inhibitors
- Mechanism of enzyme action, Competitive and non-competitive inhibition, Regulation of enzyme activity, allosteric enzymes and feedback mechanisms
- Enzyme assay: General considerations and different methods

Name and Signatures:

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members:

Recommended Books:

1. Principles of Biochemistry- Albert L. Lehninger ,CBSPublisers And Distributors
2. Fundamentals of Biochemistry – Dr. J.L.Jain , Dr. Sanjay Jain, S.Chand Publication
3. Biochemistry- U.Satyanarayana, U.Chakrapani ,Books and Allied (p) Ltd.
4. Color Atlas of Biochemistry- J.Koolman And K.H. Roehm , Thieme Stuttgart, New York
5. Biochemistry- Power AndChattwal, Himalaya Publishing House
6. Biochemistry- Christopher K. Mathews, K.E.VanHolde, Kevin G. Ahern, Pearson Education
7. Practical Biochemistry- Principles And Techniques- Keith Wilson And John Walker
8. Biochemistry – Donald Voet and Judith G. Voet

Session 2025-26

M.Sc. – MICROBIOLOGY

SEMESTER I

PAPER – III

MMB 103 PHYCOLOGY AND MYCOLOGY

Max. M. – 80; Min. M. - 16

Upon successful completion of the course, students will be able –

- ❖ **To Know the diversity and life cycle of Eukaryotic Microorganisms, Algae and Fungi**
- ❖ **To be able to relate the knowledge of evolutionary relationship among fungal groups**
- ❖ **To get insight into useful fungal activities and their importance**
- ❖ **To analyze the information regarding representative members of Algae and Fungi**

Unit – I

- Algae – Distribution, classification, thallus range and nutrition, Pigmentation
- Blue Green Algae: classification, properties, economic importance; Diatoms
- Algal Reproduction
- Algal Ecology
- Algal Biotechnology
- Lichens – General account, classification, structure, reproduction and economic importance.

Unit – II

- General Features of fungi: Structure and cell differentiation, Classification, Reproduction
- Salient features of Division Myxomycotina, Mastigomycotina and Zygomycotina. Life cycle and economic importance of representative members
- Salient features of Division Ascomycotina – Hemiascomycetes, Plectomycetes, Pyrenomycetes, Discomycetes, Labelbeniomycetes, Loculoascomycetes. Life cycle and economic importance of representative members

Unit – III

- Salient features of Division Basidiomycotina–Teliomycetes, Hymenomycetes. Life cycle and economic importance of representative members
- Salient features of Division Deuteromycetes –Hypomycetes, Coelomycetes, Blastomycetes. Life cycle and economic importance of representative members
- Evolutionary tendencies in lower fungi and higher fungi.

Unit – IV

- Fungi and Ecosystem –Nutritional strategies, Fungi as insect symbiont, Fungi and bioremediation, Effect of Environment on fungal growth, Prevention of fungal growth, Mycorrhiza – Ectomycorrhiza, Endomycorrhiza, Vesicular Arbuscular Mycorrhiza
- Industrial importance of Fungi
- Heterothallism in fungi
- Sex hormones in fungi

Name and Signatures:

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Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members:

Recommended Books:

1. An Introduction to Mycology – R.S. Mehrotra, and K.R. Aneja 1990, New Age International publishers.
2. Introduvtion to Mycology (3rd Ed.) –Alexopoulus, C.J. and C.W. Mims 1979. Wiley Eastern Ltd.,
3. Fundamentals of Mycology – J.H. BurnettmPublisher : Edward , Arnold Crane russak.
4. The Fungi – M.Charlile& S.C. Watkinson, Publisher:Academic Press.
5. Fundamentals of Fungi – E. Moore-Landeekeer, Publisher: Prentice Hall.
6. The Algae: Structure and Reproduction, Vol I and II – F.E. Fritsch, Vikas Publishing house Pvt. Ltd.
7. A text book of Algae – A.V.S.S. Sambamurthy, I.K. International Pub.

Session 2025-26

M.Sc. – MICROBIOLOGY

SEMESTER I

PAPER – IV

MMB 104 ADVANCED IMMUNOLOGY AND IMMUNOTECHNIQUES

M.M. – 80; Min. M. – 16

Upon successful completion of the course, students will be able –

- **To know the concept of immune system and immunity and learn the methods of immunogenic reactions**
- **To understand variety of operation related to immune response**
- **To conceptualize the origin of lymphocytic clones**
- **To know the theory of immunization and immune therapy**

Unit –I

- Immune System and Immunity: History of Immunology
- Structures, composition and functions of cells and organs involved in immune system
- Immune responses: Innate immunity and Acquired immunity
- Antigens: Structure and Properties, types, lso and allo, haptens, adjuvants, antigen specificity
- Immunoglobulin: structure, heterogeneity, types and subtypes, properties (physico-chemical and biological)

Unit –II

- Complement: structure, components, properties and functions
- In vitro Methods: agglutination, precipitation, complement fixation, immune fluorescence, ELISA, Radio Immunoassays
- In vivo Method: Skin tests & immune complex tissue demonstrations, applications of these methods in diagnosis of microbial diseases
- Immunohaematology: blood groups, blood transfusion and Rh incompatibilities

Unit – III

- Structure and functions of MHC
- Gene regulation and Ir-genes; HL-A and tissue transplantation, Tissue typing methods for organ and tissue transplantations in humans; graft versus host reaction and rejection
- Autoimmunity: Theories, mechanism and diseases with their diagnosis

Unit –IV

- Tumor immunology: Tumor specific antigens, Immune response to tumors, immune diagnosis of tumors, detection of tumor markers, alphafoetal proteins, carcino embryonic antigen
- Hypersentivity Reactions: Antibody mediated, Type I (Anaphylaxis), Type II (Antibody dependent cell cytotoxicity), Type III (Immune complex mediated reactions), Type IV (Cell mediated hypersensitivity reaction)
- Cytokines: Properties, classification, biological functions, cytokine receptors and cytokine related diseases

Name and Signatures:

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members:

Recommended Books:

1. Essentials of Immunology – I.M. Roitt,ELBS, Blackwell Scientific publishers, London.
2. Kubey Immunology II-Edition– J. Kube, W.H. Freeman and company. New York.
3. Immunology. Understanding of Immune System –Klaus D.ElgertWiley– 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 Pub. 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

Session 2025-26

M.Sc. MICROBIOLOGY

SEMESTER –I

LAB COURSE I

MMBL 01 ADVANCED BACTERIOLOGY & VIROLOGY AND PHYCOLOGY &MYCOLOGY

List of Practical Exercises

M.M. – 100

I – Bacteriology and Virology

1. Isolation of bacteria from following sources and study their cultural characteristics.
   Air, Water and Soil.
2. Identification of isolated bacteria by Gram staining, Negative staining, Acid fast staining and Flagella staining.
3. Identification of isolated bacteria on the basis of biochemical properties.
   - IMVic test
   - TSIA test
   - H_2S production test
   - Catalase production test
   - Amylase production test
4. Determination of bacterial growth by Turbidity measurement (Spectrophotometric method).
5. Isolation and examination of Actinomycetes from soil and study their cultural characteristics.
6. Phage titration and determination of Viral load in given sample.
7. Symptomatological study of Viral Diseases (plants and animals).

II – Phycology &Mycology

1. Isolation of Green Algae and Cyanobacteria from soil and water samples.
2. Study the special features of selected Green Algae, Cyanobacteria and Diatoms.
3. Study the special features of Lichens.
4. Isolation and examination of Rhizospheric fungi by Warcup's method.
5. Isolation and examination of Keratinophilic fungi from soil by Keratin Bait technique.
6. Isolation and examination of Coprophilous fungi from dung by Moist Chamber method.
7. Isolation and examination of Storage fungi from food grains by Blotter technique.
8. Isolation and examination of Zoosporic fungi from water by Seed Bait technique.
9. Isolation and examination of Aeromycoflora by Petri plate exposure.
10. Study of Endomycorrhiza colonization and calculation of percent root infection.
11. Study the special features of selected fungal isolated.
12. Micrometry and camera Lucida studies of some microbial structures.

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Departmental members:

Session 2025-26

M.Sc. MICROBIOLOGY

SEMESTER –I

LAB COURSE II

MMBL 02 STUCTURE AND FUNCTIONS OF BIOMOLECULES AND ADVANCED IMMUNOLOGY AND IMMUNOTECHNIQUES

List of Practical Exercises

M.M. – 100

I Structure and Functions of Biomolecules

1. Preparation of buffer and determination of pH.
2. Extraction and determination of total sugars in the sample by Dubois method.
3. Determination of reducing sugar in the sample by Benedict's reagent.
4. Distinguish between aldose and ketose sugar by Seliwanoff's test.
5. Determination of starch by Iodine test.
6. Detection of free amino acid in the sample by Ninhydrin test.
7. Extraction of protein and estimation by Folin-Lowry and Biuret method.
8. Detection of presence of lipid by Saponification.
9. Isolation of genomic DNA from bacterial cell and estimation by DPA method (Diphenylamine method).
10. Isolation and estimation of RNA from yeast.
11. Enzyme production test by microorganisms (Amylase/Lipase/Gelatinase/Pectinase/ Protease).

II Advanced Immunology and Immuno-techniques

1. Study of agglutination reaction with blood grouping and Blood examination for Rh factor.
2. Characterization of Lymphocytes from blood.
3. Antigen antibody reaction by Double Diffusion technique.
4. Separation of Immunogen by immuno electrophoresis technique.
5. Dot ELISA.
6. Determination of concentration of given antigen by RID technique.
7. Antigen/Antibody capture ELISA

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Departmental members:

DEPARTMENT OF MICROBIOLOGY

GOVT. V. Y. T. P.G. AUTONOMOUS COLLEGE DURG

M.Sc. MICROBIOLOGY

SYALLABUS AND MARKING SCHEME

SECOND SEMESTER

Session: 2025-2026

Paper No.	Title of the Paper	Marks Allotted in Theory		Marks Allotted in Internal Assessment		Credits
		Max	Min	Max.	Min.	
I	CELL AND MOLECULAR BIOLOGY	80	16	20	04	05
II	MICROBIAL GENETICS	80	16	20	04	05
III	MICROBIAL PHYSIOLOGY AND METABOLISM	80	16	20	04	05
IV	BIOSTATISTICS AND COMPUTER APPLICATION	80	16	20	04	05
V	LAB COURSE I Based on Paper I and II	100	33	-	-	04
IV	LAB COURSE II Based on Paper III and IV	100	33	-	-	04
	Total	520		80		28

Name and Signatures

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Subject Expert - Dr. Sonal Mishra	Departmental members
VC Nominee – Dr. Prakash Saluja	1. Mrs. Rekha Gupta 2. Mrs. Neetu Das
Member of Other Department- Dr. G.S. Thakur	3. Ms. Mrinalini Soni 4. Ms. K.K. Yashoda

Session: 2025-26

M.Sc. – MICROBIOLOGY

SEMESTER II

PAPER – I

MMB 201 CELL AND MOLECULAR BIOLOGY

Max. M. – 80; Min. M. – 16

Upon successful completion of the course, students will be able –

- **To get an in depth understanding of DNA replication and inhibitors of DNA replication**
- **To understand the significance of central dogma of gene action and understand the molecular mechanisms involved in transcription and processing of RNA**
- **To gain knowledge of genetic code and molecular mechanisms in Protein synthesis**
- **To study and compare the regulation of gene expression in both prokaryotes and eukaryotes**

Unit – I

- DNA replication: General principles in Prokaryotic and Eukaryotic organisms, various modes of replication. Rolling Circle mode of replication, Types and properties of DNA polymerases, Proof reading, Continuous and discontinuous synthesis, Exonuclease activity in eukaryotic DNA polymerases, Superhelicity in DNA. Linking number, Topological properties, Mechanism of action of topoisomerases
- Retroviruses and their unique modes of DNA synthesis

Unit – II

- Transcription: General principles in Prokaryotic and Eukaryotic organisms, basic apparatus, steps (initiation, elongation and termination), Types of RNA polymearases
- Polycistronic and monocistronic RNAs, Maturation and processing of RNA: Methylation, Cutting and trimming of rRNA, Capping, Polyadenylation and splicing of mRNA (Cutting and modification of tRNA degradation system, Catalytic RNA, group I and group II intron splicing, RNAse P)
- Basic features of genetic code
- Protein synthesis: Steps, details of initiation, elongation, termination, roles of various factors in above steps. Synthesis of exported proteins on membrane bound ribosomes

Unit – III

- Inhibitors of DNA replication: Blocking precursor synthesis, nucleotides polymerization, altering DNA structures
- Cell Cycle; Relationship between replication and cell cycle; Cell cycle regulation
- Apoptosis
- Inhibitors of RNA synthesis
- Inhibitors of proteins synthesis

Unit – IV

- Regulation of genes expression: Operon concept, catabolite repression instability of bacterial RNA
- Gene regulation: Inducers and co repressors, Negative regulation (E. coli lac operon), Positive regulation (E. coli), regulation by attenuation
- DNA binding proteins, enhancer sequences and controls of transcription by interaction between RNA polymerases and promoter regions, Use of alternate sigma factors, protein binding sites on DNA

Name and Signatures:

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members:

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. Mol Bio- Fundamentals of Molecular Biology, A. Upadhyay, Himalaya Pub.
4. Molecular Biology, A.V.S.S. Sambamurthy, Narosa Pub.
5. Essentials of Molecular Biology, Malacinski, M.George and David Freidfelder, Narosa Pub.
6. Biochemistry, C.B. Powar and Chatwal, Himalaya Pub.
7. Principles of Biochemistry, Nelson and Cox

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M.Sc. – MICROBIOLOGY

SEMESTER II

PAPER – II

MMB 202 MICROBIAL GENETICS

Max. M. – 80; Min. M. – 16

Upon successful completion of the course, students will be able –

- ❖ **To understand the mechanism of damage and repair of DNA in living system**
- ❖ **To gain the knowledge of causes and consequences of modifications in DNA structures**
- ❖ **To study the different ways of gene transfer in microorganisms**
- ❖ **To get an idea about the tools used in genetic construction and analysis**

Unit – I

- DNA damages: Biological indications of damage to DNA
- Types of DNA damage (deamination, oxidative damage, alkylation, pyrimidin dimers)
- Evidences to repair system, Repair pathways (methyl directed mismatch repair, very short patch repairs. nucleotide excision repairs, base excision repairs, recombination repairs, and SOS system)

Unit – II

- Gene as a unit of Mutation, Biochemical basis of Mutation
- Types of mutations and their origin
- Mutagenesis: Reversion and Suppression
- Gene as a unit of recombination, Molecular nature of recombination

Unit – III

- Gene transfer mechanism: Transformation, Transduction, Conjugation, Transfection
- Lysogeny and their applications
- Genetic analysis of Bacteria and Yeast
- Plasmids, types and their uses in genetic analysis, as vector for gene cloning, Replication of selected plasmids. compatibility
- Transposons and their uses in genetic analysis

Unit – IV

- Construction of bacterial strains: Isolation of Mutants, Selection of Autotrophic mutants, Strain construction methods
- Molecular methods for detection of Mutations; Genotyping of Bacteria and Viruses, DNA sequencing, AFLP. RFLP and RAPD methods
- C Value Paradox

Name and Signatures:

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members:

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 Pub.
5. Genetics – P.K. Gupta, Rastogi Pub.
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 Pub.
10. Fundamental Principles of Bacteriology – A.J. Salle, TMH Edition, New Delhi

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M.Sc. – MICROBIOLOGY

SEMESTER II

PAPER – III

MMB 203 MICROBIAL PHYSIOLOGY AND METABOLOISM

Max. M. – 80; Min. M. – 16

Upon successful completion of the course, students will be able –

- **To get an overview of bioenergetics**
- **To understand the mechanism of anabolism and catabolism in microorganisms**
- **To be acquainted with respiratory metabolic pathway, Pasture effect and fermentation of carbohydrates**
- **To distinguish nitrogen metabolism and biosynthesis of polysaccharides**

Unit – I

- Basic aspects of bioenergetics: entropy, enthalpy, electrons carrier, artificial electron donors, ATP cycle, energy rich bonds, phosphorylation.
- Global regulatory responses: Heat shocks response, stringent response and regulation by small molecules such as ppGpp and cAMP, signal hypothesis
- Brief account of photosynthetic and accessory pigments: chlorophyll, bacteriochlorophyll, rhodopsin, carotenoids, phycobiliproteins

Unit –II

- Autotrophy: Carbohydrate anabolism, Oxygenic and an-oxygenic photosynthesis
- Autotrophic generation of ATP, fixation of *CO2*, Calvin cycles, *C3-C4*pathway,
- Chemolithotrophism, Sulphur, iron, hydrogen, nitrogen oxidation
- Methanogenesis
- Bio-Luminescence

Unit – III

- Respiratory metabolism: Embden Mayer Hoff Parnas pathway, Entner-Doudroff pathway, Glyoxylate pathway, inhibitors, uncouplers
- Krebs cycle, Reverse TCA cycle, Oxidative and substrate level phosphorylation
- Gluconeogenesis, Pasteur effects
- Fermentation of carbohydrates: homo and heterolactic fermentation

Unit – IV

- Nitrogen metabolism, structure of nitrogenase enzyme, genome structure, nitrogen fixation
- Synthesis of major amino acids: polyamines
- Synthesis of polysaccharides: peptidoglycan, biopolymers as cell components.

Name and Signatures:

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members:

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

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M.Sc. MICROBIOLOGY

SEMESTER II

PAPER IV

MMB 204 BIOSTATISTICS AND COMPUTER APPLICATION

Max. M. – 80; Min. M. – 16

Upon successful completion of the course, students will be able –

- ❖ **To get the concept of biostatistics in microbiology and learn the basic measures to compile, analyze and make inference from observations**
- ❖ **To understand the correlation of obtained data and able to explain the significance of observations and discrepancy in results during scientific experiments**
- ❖ **To design an experiment and to visualize the controlling factors**
- ❖ **To understand and practice the tools of computers**

Unit – I

- Introduction: Definition, Basic concepts,
- The sample and population, Measurement scales, Statistical inference and parameters
- Classification of Data: Objective of Classification, Types of data
- Presentation of data: Tabulation, Frequency distribution, Graphical presentation of data and interpretation
- Measures of central tendencies (mean, mode, median)

Unit – II

- Measures of dispersion (range, mean deviation, standard deviation and error)
- Probability: Basic Concepts, Types, Applications
- Correlation: Types and Methods, Correlation coefficient and its significance
- Regression analysis: linear regression, regression coefficient, uses of regression analysis, difference between correlation and regression.

Unit – III

- Tests of significance: Chi-Square, characteristics, applications
- Student's t Test: Properties and Applications
- Variance – Ratio test 'F' test
- Analysis of Variance (ANOVA): Introduction, procedure, multiple comparisons
- Experimental designs: Basic concepts and principles, types, significance.
- Statistical quality control: Introduction, types, advantages.

Unit – IV

- Introduction to MS-Office Software: MS Word, MS-Excel, MS Power point, Publisher
- Basics of Internet and its applications, emailing
- Search engines: Google Scholar, Web of Science, Pub med, Scopus
- Plagiarism: types and examples, techniques to avoid plagiarism

Name and Signatures:

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members:

Recommended books:

1. Statistics in Biology – C.I.K. Bliss, Vol.1, McGraw 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 Pub.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 Pub.
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 Pub. Hyderabad.
12. Biostatistics – P. Ramakrishnan, SarasPbu. Kanyakumari.

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M.Sc. MICROBIOLOGY

SEMESTER –II

LAB COURSE: I

MMBL 03 CELL AND MOLECULAR BIOLOGY AND MICROBIAL GENETICS

List of Practical Exercises

M.M. - 100

I – Cell and Molecular Biology

1. Study the cell division stages of mitosis through onion root tips.
2. Isolation of DNA from plant (Cauliflower/Onion/ Spinach Leaf).
3. Isolation of Genomic DNA from Bacteria (Gram positive/Gram negative).
4. Estimation of total DNA from given sample by DAP method.
5. Estimation of RNA From yeast.
6. Isolation and purification of Plasmid DNA from bacteria.
7. Extraction of total protein and protein profile study.

II –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.
6. Study of bacterial Transduction.

Name and Signatures:

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members:

Session: 2025-26

M.Sc. MICROBIOLOGY

SEMESTER –II

LAB COURSE: II

MMBL 04 MICROBIAL PHYSIOLOGY AND METABOLISM AND BIOSTATISTICS AND COMPUTER APPLICATION

List of Practical Exercises

M.M. - 100.

III – Microbial Physiology and Metabolism

1. Effect of light on growth and sporulation of fungi.
2. Effect of temperature on growth of bacteria and determination TDP & TDT.
3. Effect of pH on growth of microorganism.
4. Study the fermentation of carbohydrates (glucose, sucrose & lactose).
5. Effect of salt concentration on growth of microorganism.
6. Effect of molecular oxygen on growth of microorganism.
7. Effect of heavy metal on growth of microorganism.

IV – Biostatistics and Computer Application

1. Construction of frequency tables by given sample data using MS word
2. Construction of Bar diagram, Pie chart and Histograms by given sample data using MS word and MS Excel
3. Compare the measures of central tendency from a common data table.
4. Calculate the standard deviation of the given data mean with MS Excel
5. Compare the sample mean with the population mean by t Test.
6. Determine whether the observed frequencies are similar to expected frequencies by x^2 test.
7. Estimate and test the given hypothesis about population mean by ANOVA.
8. Computation of correlation coefficient.
9. Prepare a Pawer Point Presentation by applying formatting tools

Name and Signatures:

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members:

DEPARTMENT OF MICROBIOLOGY

GOVT. V. Y. T. P.G. AUTONOMOUS COLLEGE DURG

SYALLABUS AND MARKING SCHEME

THIRD SEMESTER

Session: 2025-2026

Paper No.	Title of the Paper	Marks Allotted in Theory		Marks Allotted in Internal Assessment		Credits
		Max	Min	Max.	Min.	
I	BIOPHYSICAL TECHNIQUE, INSTRUMENTATION AND BIOINFORMATICS	80	16	20	04	05
II	MEDICAL MICROBIOLOGY	80	16	20	04	05
IIIA	FOOD AND DAIRY MICROBIOLOGY(Elective)	80	16	20	04	05
IIIB	AGRICULTURE MICROBIOLOGY(Elective)	80	16	29	04	05
V	LAB COURSE I Based on Paper I	100	33	-	-	04
IV	LAB COURSE II Based on Paper II &III	100	33	-	-	04
	Total	440	-	60	-	23

Name and Signatures

Chairperson/ HOD- Dr. Pragya Kulkarni	Industrial Representative- Shri Amitesh Mishra
Subject Expert - Dr. Anita Mahiswar	Student Nominee – Ms. Yogita Lokhande
Subject Expert - Dr. Sonal Mishra	Departmental members
VC Nominee – Dr. Prakash Saluja	1. Mrs. Rekha Gupta 2. Mrs. Neetu Das 3. Ms. Mrinalini Soni 4. Ms. K.K. Yashoda
Member of Other Department- Dr. G.S. Thakur	

Session: 2025 - 26

M.Sc. – MICROBIOLOGY

SEMESTER III

PAPER – I

MMB 301 BIOPHYSICAL TECHNIQUES, INSTRUMENTATION AND BIOINFORMATICS

M.M. – 80; Min. M. – 16

Upon successful completion of the course students will be able –

- **To gain the skill to deal with microscope, different separation techniques used for isolation and purification of bio molecules**
- **To enable the mechanism of radioactive detection, measurement and applications in biological experiments**
- **To study the origin, importance and applications of techniques like spectroscopy, NMR, ESR and PCR**
- **To understand the concept of Bioinformatics, know the forms of biological information and learn the available resources and tools**

Unit – I

- Microscopy–Phase contrast, Fluorescence microscopy
- Electron microscopy-Transmission and scanning electron microscopes (TEM & SEM)
- Centrifugation techniques: Basic principles of centrifugation, Standard sedimentation coefficient and measurement of sedimentation co-efficient, Analytical and preparative centrifugation
- Differential, rate zonal and equilibrium density gradient centrifugation

Unit – II

- Principle & application of Chromatography: General principles. Types- partition, adsorption; paper, thin layer, column chromatography, HPLC, GLC, gel filtration, ion exchange chromatography and affinity chromatography
- Principle & application of Electrophoresis: General principles, Types – paper electrophoresis, cellulose acetate, starch gel electrophoresis, polyacrylamide gel electrophoresis and Agarose gel electrophoresis, Horizontal and vertical electrophoresis, Two-dimensional electrophoresis, Immune electrophoresis
- Blotting techniques -Southern, Northern and Western blotting
- PCR – Mechanism of working & types

Unit – III

- Electromagnetic spectrum and Instrumentation: measuring the absorption and application of UV- visible spectrophotometer, Spectroscopic techniques- Principle, simple theory of absorption of light by molecules, Fluorescence spectroscopic, NMR, ESR and Mossbauer spectroscopic method
- Radio isotopic techniques: Principle, Radioactive isotopes, radioactive decay, Detection and measurement of radioactivity, Geiger-Muller counter, scintillation counter, Autoradiography, tracer techniques and applications, commonly used isotopes in biology, Labeling procedures and safety aspects.

Unit– IV

- Concept of Bioinformatics: Aim and branches, Applications, Role of internet
- Basic biomolecular concepts: Protein, Amino acids, DNA, RNA sequences, structure and functions, Forms of biological information
- Bioinformatics resources: NCBI, EBI, ExPASy, RCSB, DDBJ, available tools
- Open access bibliographic resources and literature data bases: PubMed, BioMed Central, Public Library of Science (PloS), CiteXplore

Name and Signatures:

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members:

Recommended Books:

1. Biophysical Chemistry, Principles and Techniques – Upadhyay and Upadhyay, Himalaya Pub.
2. Instrumental Analysis – Skoog and Haller
3. Analytical Chemistry – G. Chatwal and Anand, Himalaya Pub.
4. Biotechniques: Theory and Practice – S.V.S. Rana, Rastogi Pub.
5. Practical Biochemistry- Principles And Techniques- Keith Wilson And John Walker
6. Bioinformatics: Databases, Tools and Algorithms, by OrpitaBosu, Simminder Kaur Thukral, OXFORD University Press.
7. Bioinformatics: Sequence and Genome Analysis by D.W. Mount , second edition, Cold Spring Harbor Laboratory Press
8. Bioinformatics : Methods and Application by S.C. Rastogi, N. Mendira, P. Rastogi, Third edition , PHI Learning Private Limited
9. Introduction to Bioinformatics by Teresa. K. Attwood and David J. Parry- Smith, Low Price edition, Pearson Education

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M.Sc. – MICROBIOLOGY

SEMESTER III

PAPER – II

MMB 302 MEDICAL MICROBIOLOGY

Max. M.- 80; Min. M. – 16

Upon successful completion of the course students will be able –

- **To get an overview of discovery and development of medical microbiology and contributions of pioneers in the field of medical microbiology**
- **To understand the basic principles of medical microbiology and study the classification of different disease-causing agents and infectious diseases**
- **To learn the diagnostic skills for infectious diseases**
- **To recognize the measures taken for control of diseases through different systems**

Unit – I

- Early discovery of pathogenic microorganisms: Development of bacteriology as scientific discipline, Contributions made by eminent scientists
- Normal microbial flora of human body; Role of the resident flora
- Establishment, spreading, tissue damage & anti-phagocytic factors: Mechanism of bacterial adhesion
- Colonization & invasion of mucous membranes of respiratory, enteric & urogenital tracts
- Role of aggressins, Depolymerising enzymes, Organotropisms, Variation & virulence
- Four lines of defense mechanism

Unit – II

- Classification of pathogenic bacteria: Staphylococcus, Sreptococcus, Pneumococcus, Neisseria, Cornebacterium, Bacillus, Clostridium, Non-sporing Anaerobeas, Organisms belonging to Enterobacteriace, Vibrios
- Non fermenting gram negative bacilli, Yersinia, Haemophilus, Bordetella, Brucella, Mycobacteria, Spirochaetes, Actinomycetes, Rickettsiae, Chlamdiae

Unit – III

- Viruses host interactions: pox viruses, herpes virus, adeno viruses, picarno viruses, orthomyxo viruses, paramyxo viruses, arbo viruses, rhabdo viruses, hepatitis viruses, oncogenic viruses, human immuno deficiency viruses (AIDS)
- Fungal infections: Dermatophytes, dimorphic fungi, opportunistic fungal pathogens, their description, classification and laboratory diagnosis; Fungal Diseases: Mycoses systemic and subcutaneous, Pneumocystis, Blastomycoses, Dermatophytosis, Aspergilosis
- Protozoal diseases: Leishmania, Trypamosoma

Unit –IV

- Laboratory control: antimicrobial therapy, Various methods of drug susceptibility testing, Antibiotic assay in body fluids
- Brief account on available vaccines and schedules, passive prophylactic measures
- Nosocomical infection: common types of hospital infections, their diagnosis and control

Name and Signatures:

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members:

Recommended Books:

1. Text book of Microbiology – R. Ananthanarayanan and C. K. JayaramPanicker, orient Longman, 1997.
2. Medical Microbiology – Mackie and MaCartney,
1. Microbial Infection Vol. 1:.
2. Practical Medical Microbiology. Vol 2– Churchill Livingstone, 1996.
3. Microbiology in clinical Practice – D.C. Shanson, Wright PSG, 1982.
4. Bailey and Scott's Diagnostic Microbiology – Baron EJ, Peterson LR and Finegold SM Mosby, 1990.

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M.Sc. – MICROBIOLOGY

SEMESTER III

PAPER – III A (Elective)

MMB 303A FOOD AND DAIRY MICROBIOLOGY

Max. M. – 80; Min. M. – 16

Upon successful completion of the course students will be able –

- **To understand the idea microorganisms associated with food and factor for their growth**
- **To be acquainted with the principles of food preservation, food spoilage and food born infections**
- **To know the measures taken for food quality control**
- **To get an overview of various food types prepared as of microbial fermentation**

Unit – I

- Food as substrate for microorganisms: Important microorganisms 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 & intrinsic factors; Chemical preservatives and food additives,Canning, processing for Heat treatment - D, Z, and F values and working out treatment parameters.

Unit – II

- Contamination and Spoilage: Principle, Cereals, sugar products, vegetables, fruits, meat and meat products, Milk and Milk products, Fish & sea foods, poultry-spoilage of canned foods. Detection of spoilage and characterization.
- Food-borne infections and intoxications: Bacterial and nonbacterial with examples of infective and toxic types (Brucella, Bacillus, Clostridium, Escherichia, Salmonella, Shigella, Staphylococcus, Vibrio, Yesinia; Nematodes, Protozoa, algae, fungi and viruses),
- Food borne out breaks: laboratory testing procedures, Prevention Measures Food sanitation in manufacture and retail trade, Food control agencies and its regulations
- Plant sanitation: Employee's Health standards-waste treatment-disposal-quality control.

Unit –III

- Food fermentations: bread, cheese, vinegar, fermented vegetables, fermented dairy products
- Experimental and industrial production methods of fermented food products
- Spoilage and defects of fermented dairy products
- Oriental Fermented foods, their quality standards and control

Unit – IV

- Food Produced by Microbes: Fermented foods, microbial cells as food (single cell proteins)
- Bioconversions: Production of alcohol, Fermented beverages (beer and wine), Steroid conversions
- Industrial Enzymes productions; Genetically modified foods; Mushroom cultivation

Name and Signatures:

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members:

Recommended Books:

1. Food and Dairy Microbiology –M.K.Rao, Mangalam Pub.
2. Food Microbiology – M.R. Adams and M.O. Moss, New Age International Pvt. Ltd.
3. Industrial Microbiology – Jr. L.E. Casida New Age Internatinal Pvt. Ltd.
4. Food Microbiology – W. C. Frazier and D.C. Westhoff, Tata McGraw Hill Pub.
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. Biotechnology: Food Fermentation Microbiology, Biochemistry and Technology. Volume 2 - Joshi.
10. Fundamentals of Dairy Microbiology - Prajapati.
11. Essentials of Food Microbiology. Edited by John Garbult. Arnold International Students Edition.
12. Microbiology of Fermented Foods. Volume II and I. By Brian J. Wood.Elsiever Applied Science Publication.
13. Microbiology of Foods - John C. Ayres. J. OrwinMundt. William E. Sandinee. W. H. Freeman and Co.
14. Dairy Microbiology - Robinson. Volume II and I.

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M.Sc. – MICROBIOLOGY

SEMESTER III

PAPER – IIIB (Elective)

MMB 303 B AGRICULTURE MICROBIOLOGY

Max. M. – 80; Min. M. – 16

Upon successful completion of the course students will be able –

- **To understand the habitat of microorganisms with reference to Agriculture**
- **To be familiar with the plant pathogenic characters of microorganisms**
- **To know the degradation and toxic effects of microorganisms for plants**
- **To study positive effects of microorganisms in terms of Agriculture**

Unit - I

- Microorganisms of soil, rhizosphere and phyllosphere microflora, Brief account of Microbial interactions: antagonism, symbiosis, mutualism, commensalisms, synergism and parasitism
- Biogeochemical cycles: Nutrient cycle, Carbon cycle , Nitrogen cycle, Phosphorous cycle and Sulphur cycle

Unit- II

- Role of enzymes and toxins in plant pathogenesis
- Fungal diseases of plants: Rusts of wheat, linseeds; late blight of potato; red rot of sugarcane
- Bacterial diseases of plants : Citrus canker, blight of rice
- Viral diseases of plants: Leaf curl of Papaya, vein clearing of lady's finger
- Physical, chemical and Biological control of plant diseases (Bacterial control of insect pests: Bacillus thuringiensis as bacterial insecticide, Viral control of insect pests: Nuclear polyhedrosis visuses (NPV) and cytoplasmic polyhedrosis viruses (CPV), Fungal control of insect pests: Entomopathogenic fungi: Metarhiniumanisopliae, Beauveria bassiana, Verticillium lecani, Hirsutellathompsoni

Unit- III

- Storage fungi: Categories of storage fungi, conditions during storage in relation to damage of seeds, harmful effects
- Mycotoxins and their effect on human being.
- General idea about quarantine.
- Production of biogas and alcohol from agricultural wastes.

Unit- IV

- Biofertilizers: Types, production and application.
- Mycorrhizae: Types and their application in agriculture and forestry.
- Vermicomposting.
- Reclamation of waste agricultural land by microorganisms.

Name and Signatures:

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members:

Recommended Books:

1. Soil Microbiology by Prof. N.S. Subba Rao, Fourth edition, Oxford and IBH Publishing CO. PVT., LTD., New Delhi

2. Introduction to soil microbiology. Alexander M. (1977) John Wiley & Sons, Inc., New York.

3. Modern Soil Microbiology, Dirk J, Elas V, Trevors JT, Wellington, EMH (1997) Marcel Dekker INC, New York.

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M.Sc. MICROBIOLOGY

SEMESTER –III

MMBL 05 LAB COURSE I: BIOPHYSICAL TECHNIQUE, INSTRUMENTATION AND BIOINFORMATICS

List of Practical Exercises

M.M. – 100

I Biophysical Technique, Instrumentation and Bioinformatics

1. Separation of Carbohydrates by Paper Chromatography
2. Separation of Amino acids by Paper Chromatography
3. Separation of Lipids by Thin Layer Chromatography
4. Demonstration Column Chromatography
5. Demonstration HPLC and GC
6. Determination of λ max for different coloured solution
7. Verification of Lambert-Beers Law by UV-VIS Spectrophotometer
8. Separation of Proteins by Electrophoresis
9. Determination of molecular size of DNA by Agarose gel Electrophoresis
10. Confirmation of immune response by Immunoelectrophoresis
11. Demonstration of Differential, rate zonal and equilibrium density gradient centrifugation
12. Assessment of scientific data from Literature data bases (PUBMED, LITDB, Medline)
13. Assessment of nucleic acid databases for retrieval of gene sequence
14. Protein databases for retrieval of amino acid sequence of target protein
15. Pair wise sequence alignment using Dot matrix
16. Demonstration of multiple sequence alignment using BLAST

Name and Signatures:

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members:

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M.Sc. MICROBIOLOGY

SEMESTER –III

MMBL 06 LAB COURSE II: MEDICAL, FOOD AND DAIRY MICROBIOLOGY/ AGRICULTURE MICROBIOLOGY

List of Practical Exercises

M.M. – 100

I – 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. Isolation and preliminary identification of microbial flora of teeth crevices.
4. Isolation and preliminary identification of microbial flora from saliva.
5. Urine culture and its microbiological analysis.
6. Isolation and preliminary identification of enteric pathogens using TSIA medium.

II – Food and Dairy Microbiology

1. Isolation and preliminary identification of microorganisms from different food (Cereals, sugar products, meat and meat products, milk and milk products, fermented food)
2. Isolation and preliminary identification of microorganisms from different spoiled fruit and vegetables.
3. Study of different chemical preservatives and additives used for preservation of food.
4. Determination of quality of milk samples by Methylene Blue Reductase test.
5. Detection of number of bacteria in milk by SPC method
6. Microbiological examination of fresh and canned foods
7. Detection of Mycotoxins/ Aflotoxin from contaminated grains

II – Agriculture Microbiology

1. Study the bacterial, fungal and viral diseases in plants.
2. Isolation of rhizobia from root nodules of leguminous plants.
3. Inoculation of seeds with rhizobia.
4. Study of pesticidal activity of Bacillus thuringiensis.
5. Isolation of VAM spores from soil.
6. Isolation of Azotobacter species from soil.
7. Isolation of microorganisms from rhizosphere.

Name and Signatures:

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members:

DEPARTMENT OF MICROBIOLOGY

GOVT. V. Y. T. P.G. AUTONOMOUS COLLEGE DURG

SYALLABUS AND MARKING SCHEME

FOURTH SEMESTER

Session: 2025-2026

Paper No.	Title of the Paper	Marks Allotted in Theory		Marks Allotted in Internal Assessment		Credits
		Max	Min	Max.	Min.	
I	ENVIRONMENTAL MICROBIOLOGY	80	16	20	04	05
II	INDUSTRIAL MICROBIOLOGY AND FERMENTATION TECHNOLOGY	80	16	20	04	05
IIIA	MICROBIAL BIOTECHNOLOGY(Elective)	80	16	20	04	05
IIIB	MICROBIAL GENOMICS AND PROTEOMICS (Elective)	80	16	20	04	05
IV	LAB COURSE Based on Paper I	100	-	-	-	04
V	LAB COURSE Based on Paper II & III	100	-	-	-	04
VI	PROJECT WORK	200	50	-	-	08
	Total	640		60		31

Name and Signatures

Chairperson/ HOD- Dr. Pragya Kulkarni	Industrial Representative- Shri Amitesh Mishra
Subject Expert - Dr. Anita Mahiswar	Student Nominee – Ms. Yogita Lokhande
Subject Expert - Dr. Sonal Mishra	Departmental members
VC Nominee – Dr. Prakash Saluja	1. Mrs. Rekha Gupta
Member of Other Department- Dr. G.S. Thakur	2. Mrs. Neetu Das 3. Ms. Mrinalini Soni 4. Ms. K.K. Yashoda

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M.Sc. – MICROBIOLOGY
SEMESTER IV
PAPER – I
MMB 401 ENVIRONMENTAL MICROBIOLOGY

Max.M.-80; Min. M. -16

Upon successful completion of the course students will be able –

- **To understand the different branches of environmental microbiology**
- **To study the interactions of microbes in different environments**
- **To get idea about the role of microorganisms in their respective environments**
- **To make acquainted with the concept of decomposition by microbes**

Unit – I

- Aerobiology: Droplet nuclei, aerosol, Assessment of air quality, solid-liquid-impingement methods.
- Brief account of air borne transmission of microbes (viruses, bacteria & Fungi) their diseases and preventive measures.
- Positive and negative roles of microbes in environment: Bioremediation, Biodegradation of recalcitrant compounds, lignin, pesticides, bioaccumulation of metals, biodeterioration of paper, leather, wood, textiles.
- Metal corrosion: mode of deterioration, organisms involved, its disadvantages, mode of prevention.

Unit – II

- Aquatic microbiology: Water ecosystem, fresh water (pond, lakes, streams)-marine habitats (estuaries, mangroves, deep sea, hydrothermal vents, saltpans, coralreefs)
- Zonations of water ecosystems: Upwelling, Eutrophication
- Potability of water: microbial Assessment of water quality, Water purification

Unit – III

- Soil microbiology: Classification of soils, Physical and chemical characteristics
- Brief account of microbial interactions, symbiosis, mutualism, commensalisms, competition, ammensalism, synergism, parasitism, predation
- Biogeochemical cycles and the organisms: carbon, nitrogen, phosphorus and sulphur
- Biofertilisers: biological nitrogen fixation, nitrogenase enzyme, nif genes
- Symbiotic microbes: Rhizobium and Frankia, Non symbiotic microbes: azotobacter razospirillium
- Mycorrhiza: ecto, endo, ectendomycorrhizae
- Microbiology of rumen

Unit – IV

- Waste Treatment: -types of wastes (solid,liquid), characterization
- Treatments: physical, chemical, biological (aerobic, anaerobic, primary, secondary and tertiary).
- Solid waste treatment: Saccharification, Gasification, Composting,
- Utilization of solid wastes in food (SCP, mushroom, yeast), fuel (ethanol, methane) fertilizer (composting)
- Liquid waste treatment: Trickling Activated sludge, Oxidation pond, Oxidation ditch.

Name and Signatures:

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members:

Recommended Books:

1. Environmental Microbiology – Banwarila, Cybertech. Pub.
2. Introduction to Soil Microbiology – Alecxander Martin, Wiley Eastern Press.
3. Agricultural Microbiology – G. Rangaswami and D.J. Bagyaraj, Prentice Hall India Ltd.
4. Environmental Biotechnology –Indu Shekher Thakur, International Pub. House
5. Microbial Ecology fundamental &applications -R.M.Atlas &R. Bartha, Pearson pub.

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M.Sc. – MICROBIOLOGY

SEMESTER IV

PAPER – II

MMB 402 INDUSTRIAL MICROBIOLOGYAND FERMENTATION TECHNOLOGY

M.M. – 80; Min. M. -16

Upon successful completion of the course students will be able –

- **To understand the history and scope of industrially important microorganisms**
- **To be acquainted with the mechanism of strain improvement strategies**
- **To gain skill to deal with new ideas through modern techniques**
- **To get overview of different products of microbial origin for commercial production**

Unit – I

- Introduction to industrial microbiology. Definition, scope, history, Screening for microbes of industrial importance
- Primary screening and Secondary screening, Fermentation equipment and its use
- Mode of fermentation: Batch, fed batch and continuous fermenters
- Design and Types of fermenters: Agitation, aeration, antifoam; pH and temperature control during fermentation
- Methods of fermentation: Direct, dual or multiple fermentations, Scale-up of fermentations

Unit – II

- Strain development strategies: Environmental factors and genetic factors for improvement
- Raw materials: Saccharides, starchy and cellulosic materials
- Fermentation media and sterilization
- Types of fermentations processes – Solid state, surface and submerged fermentations.
- Role of computer in fermenter operation
- Downstream Processing

Unit – III

- Production and application of microbial enzymes: Amylases and proteases, uses, microorganisms, inoculum preparation, production medium, fermentation and recovery
- Fermentative production of vitamin B2 and vitamin B12
- Industrial production of organic acid-citric acid, glutamic acid and lactic acid

Unit– IV

- Industrial production of alcohol and alcoholic beverage (beer and wine)
- Commercial production of antibiotics –Penicillin, Tetracycline, Streptomycin
- Fermentative production of amino acids and uses

Name and Signatures:

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members:

Recommended Books:

1. Fermentation technology – M.L. Srivastava,Nrosa Pub.
2. Principles of Fermentation technology – P.R. Stanbury
3. Solid State Fermentation in Biotechnology –A.Pandey, S. Rodriguez and Nigam, Asia Tech Pub.
4. Advances in Fermentation Technology – A.Pandey, S. Rodriguez and Nigam, Asia Tech Pub.
5. Biotechnological innovations in chemical synthesis – BOITOLpub., Butterworth,
6. Industrial Microbiology – G.Reed (Editor), CBS publishers, New Delhi.
7. Biology of Industrial Microorganisms – A. L. Demain.
8. Pharmaceutical Biotechnology – S.P. Vyas and V.K. Dixit, Cbs pub. New Delhi.
9. Industrial Biotechnology – S.N. Jogdand, Himalaya Pub. House ,Delhi
10. Industrial Microbiology – A.H. Patel, Macmillan India Ltd.

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M.Sc. – MICROBIOLOGY

SEMESTER IV

PAPER – III A (Elective)

MMB 403A MICROBIAL BIOTECHNOLOGY

M.M.- 80; Min. M. -16

Upon successful completion of the course students will be able –

- **To learn about core techniques, different strategies and cloning vectors of rDNA Technology**
- **To learn the sequential steps for creation of important products**
- **To know about genetically modified organisms and their impact on environment**
- **To understand PCR technique and its applications and gain the knowledge of rights, ethical issues and safety aspects about microbial biotechnology**

Unit – I

- Genetic Engineering: Scope, Core techniques & essential enzymes used in rDNA technology
- Restriction digestion, ligation & transformation
- Cloning vectors: Plasmids, types & structures, Phages, cosmids vectors, Expression vectors, Promoter probe vectors
- Artificial chromomsomes: YAC, and BAC

Unit – II

- Specialized Cloning strategies: cDNA synthesis and cloning, mRNA enrichment, DNA Primers, Linkers, Adopters and their synthesis
- Genomic librabries, Nucleic acid microArrays
- Site directed mutagenesis and Agrobacterium-mediated transformation
- Particle bombardment, Calcium chloride transformation of bacteria

Unit – III

- Steroid transformations – Substrates, typical structures, microorganisms, inoculums preparation, 11-hydroxylation, process and recovery
- Therapies for genetic diseases (gene therapy)
- Monoclonal antibodies and hybridoma technology, Vaccine development, Immobilized enzyme
- Genetically modified microorganism and their impact.

Unit – IV

- PCR: Methods and Applications
- Introduction to Intellectual Property Rights, Patentable subject matter and patent types, Patent requirements: technical specifications, novelty, and non-obviousness
- Rights of patent holder, Patent protection for biological materials
- Regulations for clinical trials, Rules for import and export of biological materials
- Bio-safety and Bioethics

Name and Signatures:

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members:

Recommended Books:

1. Principles of gene manipulation – Old and Primrose, Blackwell Publications
2. Molecular Cloning – Sambrose and Russell, CHS press
3. Biotechnology – B. D. Singh, Kalyani Pub.
4. A text book of Biotechnology – R.C. Dubey, S. Chand & Company Ltd.
5. Biotechnology – S.N. Jogdand, Himalaya Pub.
6. Gene Cloning – Sambrook, MacGraw hill Pub.
7. Genomics and Cloning Technology and Application – H.D. Kumar, East-West Press Pvt.Ltd.

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M.Sc. – MICROBIOLOGY

SEMESTER IV

PAPER – III B (Elective)

MMB 403B MICROBIAL GENOMICS AND PROTEOMICS

Max. M.- 80 Min. M.-16

Upon successful completion of the course students will be able –

- ❖ **To understand the broader biology of microorganisms for their genetic composition**
- ❖ **To contributes substantial characteristics required for genomic studies**
- ❖ **To be familiar with techniques of identification of genetic material**
- ❖ **To generate a basic knowledge about current applied techniques for proteomic studies**

Unit - 1

- Whole genome analysis: preparation of ordered cosmid libraries
- Bacterial artificial chromosome libraries, shotgun libraries
- Conventional sequencing (Sanger, Maxam and gilbert methods), automated sequencing

Unit- 2

- Sequence analysis: computational methods, homology algorithms (BLAST) for proteins and nucleic acids
- Open reading frames, annotations of genes, conserved protein motifs related structure/function (PROSITE, PFAM, Profile Scan)
- DNA analysis for repeats (direct and inverted), palindromes, folding programs

Unit - 3

- DNA microarray: printing or oligonucleotides and PCR products on glass slides, nitrocellulose paper
- Whole genome analysis for global patterns of gene expression using fluorescent labelled cDNA or end labelled RNA probes
- Analysis of single nucleotide polymorphisms using DNA chips

Unit - 4

- Proteome analysis: Two-dimensional separation of total cellular proteins, isolation and sequence analysis of individual protein spots by mass spectroscopy.
- Protein microarray
- Advantages and disadvantages of DNA and protein microarrays
- Use of internal, public domain databases for nucleic acid and protein sequences (EMBL,GenBank), database for protein structures (PDB)

Name and Signatures:

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members:

Recommended Books:

1. Introduction to Bioinformatics. Lesk M.A. (2008) Oxford Publication, 3rd International Student Edition
2. Bioinformatics: methods and applications, genomics, proteomics and drug discovery,Rastogi S.C., Mendiratta N. and Rastogi P. (2007) 2nd ed. Prentice Hall India Publication
3. Principles of Protein structure- Schultz, G. E., and Schirmer, R. H. Dr. ShaktiSahi Proteomics, Daniel C. Leibler
4. Microbial Proteomic- MarjoPoutanen
5. Proteins: Structures and Molecular Principles (2d ed.), TE Creighton Organic spectroscopy, William Kemp
6. Proteome Research: Two-Dimensional Gel Electrophoresis and DetectionMethods (Principles andPractice), T. Rabilloud (Editor), 2000, Springer Verlag
7. Introduction to Protein Architecture: The Structural Biology of Proteins, M.Lesk, 2001, Oxford University Pres

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M.Sc. MICROBIOLOGY

SEMESTER –IV

MMBL 07 LAB COURSE I: ENVIRONMENTAL MICROBIOLOGY

List of Practical Exercises

M.M. - 100

I -Environmental Microbiology

1. Isolation of pesticide & herbicide degrading microorganisms
2. Study of mycorrhizal root colonization and spore load in soil of different plants
3. Isolation of symbiotic & non-symbiotic biofertilizers from soil
4. Identification of symbiotic bacteroid of Rhizobia
5. Isolation of phosphate solubilizing microorganism from soil
6. Isolation of antibiotic producer from soil and determine the antimicrobial spectrum of isolates.
7. Isolation of nitrate producing microorganism from soil
8. Water analysis for total bacterial population by standard plate count (SPC) method
9. Detection of coliform bacteria in water sample
10. Determination of Biological Oxygen Demand (BOD) of water.
11. Detection of Cyanotoxin in water samples

Name and Signatures:

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members:

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M.Sc. MICROBIOLOGY
SEMESTER –IV
MMBL 08 LAB COURSE II: INDUSTRIAL MICROBIOLOGY, FERMENTATION TECHNOLOGY AND MICROBIAL BIOTECHNOLOGY/ MICROBIAL GENOMICS AND PROTEOMICS

List of Practical Exercises

M.M. - 100

I–INDUSTRIAL MICROBIOLOGY AND FERMENTATION TECHNOLOGY

1. Lipase production and confirmation.
2. Cellulase production and confirmation.
3. Amylase production and confirmation.
4. Xylanase production and confirmation.
5. Production of antibiotics from Actinomycetes and confirmation of anti microbial activity.
6. Liposome production for immobilization of protein.
7. Demonstration of Alcohol production
8. Enzyme assay and study of enzyme kinetics

II A- MICROBIAL BIOTECHNOLOGY

1. Isolation of DNA from bacteria and determination of molecular size Isolation and purification of Plasmid DNA from bacteria.
2. Gene Expression study in microorganism.
3. Restriction Mapping of DNA and interpretation.
4. Bio templet based nanomaterial synthesis and study of antimicrobial activity
5. Awareness of Patenting

II B - MICROBIAL GENOMICS AND PROTEOMICS

1. Sequence analysis of DNA
2. Protein isolation from E coli, Bacillus and Yeast.
3. Sequence analysis of proteins (by BLAST, ClustalW and Phylip).
4. Protein structure prediction by Homology modeling.
5. Overexpression of heterologous protein in *E. coli.*
6. Purification of cloned protein in *E. coli.*
7. Protein identification by immunoblotting

Name and Signatures:

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Industrial Representative **Member of Other Department** **Student Nominee**

Departmental members: