

KRISHNA UNIVERSITY, MACHILIPATNAM
Andhra Pradesh. India



Department Of Microbiology
4-Year UG Honours in B.Sc. (Microbiology) with
Curriculum framework w.e.f. AY 2025-26

B.Sc., Honours in Microbiology
Approved by Board of Studies
Dated: July 2026

KRISHNA UNIVERSITY

Dr. P. VeeraBramhachari

REGISTRAR (FAC)

Rudravaram

Machilipatnam-521004.

Mobile : 9542487999

E-mail : registrarku@gmail.com



No.KRU/AAC/Board of Studies/Microbiology/2023

Dated: 20-12-2023

Sub: KU – Academic Audit – The constitution of the UG Board of Studies (BoS) members in Microbiology for the approval of the Under Graduation (UG) CBCS syllabus w.e.f 2023-24 (APSCHE-AC-Revision of syllabus under CBCS with effect from 2023-24 syllabus) – Reg.

Read: Note order's of the Vice-Chancellor, dt: 20-12-2023.

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ORDER:

In accordance with the provisions contained by the Krishna University act No:29 of 2008 of A.P. Govt., Hon'ble Vice-Chancellor is pleased to appoint the Board of Studies in Faculty of Microbiology with the following members.

UG BOARD OF STUDIES FOR MICROBIOLOGY		
S.No.	Name of the Faculty	Designation
1	Dr Kopuri Aruna Department of Microbiology Government Degree College (A), Vijayawada Mobile: 9490040657, E-Mail: kopuriarunadl@gmail.com	Chairperson
2	Dr. D Jyothi Lecturer in Microbiology Government Degree College (A), Vijayawada Mobile:9440959088, E-Mail:jyothisurendra.d@gmail.com	Member
3	Dr. K Sucharitha Lecturer in Microbiology Government Women's College (Autonomous), Guntur Mobile: 9963180561, E-Mail: sucharitak@gmail.com	Member
4	Sri. M Ravi Kumar Assistant Manager, DMPK - Toxicology Laila Nutraceuticals, Vijayawada, E- Mail: ravimadireddi@gmail.com	Industrialist
5	Dr. P Veera Bramhachari Dept. of Biosciences & Biotechnology Krishna University, Machilipatnam	University Nominee
6	Ms. Koti Siri SRR & CVR Government Degree College, Vijayawada Mobile: 9704060477, E-Mail: sirikote77@gmail.com	Student Member-1
7	Ms. B Swarnarekha SRR & CVR Government Degree College, Vijayawada Mobile: 9390907966, E-Mail: barrelaswarn053@gmail.com	Student Member-2

The term of office of all the members including the chairman of Board of studies until further orders with effect from the date of the order or until the new boards of studies are constituted.

These orders shall come in to force with immediate effect.

(BY ORDER)



REGISTRAR

REGISTRAR

KRISHNA UNIVERSITY
RUDRAVARAM (V)
MACHILIPATNAM - 521 004
ANDHRA PRADESH, INDIA

Copy to:

The Chairperson & all members of UG Board of Studies of the above
All Directors and Principals of the University and Constituent Colleges/Units
PA's to Vice-Chancellor/Registrar KRU
Accounts Section/Establishment Section
File.

KRISHNA UNIVERSITY, MACHILIPATNAM, ANDHRA PRADESH, INDIA

Department Of Microbiology

Board of studies meeting: 20225-26

Agenda

To discuss, consider and approve academic matters i.e.

To approve the Course Structure of **4-Year UG Honours in B.Sc. (Microbiology) as Major in consonance with Curriculum framework w.e.f. AY 2025-26**

1. To review III and IV Semesters Microbiology Major syllabus as per APSCHE Guidelines under single major in subject Microbiology 2025-26
2. To review, update and approve the content of courses for the following Semesters.

Semester – 3: Major Course 5	Theory and Practical syllabus
Major Course 6	Theory and Practical syllabus
Major Course 7	Theory and Practical Syllabus
Semester – 4 Major Course 8	Theory and Practical syllabus
Major Course 9	T heory and Practical Syllabus
Major Course 10	Theory and Practical Syllabus
3. To review and revise Microbiology Minor courses in Semester III and IV syllabus as per APSCHE Guidelines under single major in subject Microbiology 2025-26.

Semester – 3: Minor Course 1	Theory and Practical syllabus
Semester – 4 Minor Course 2	Theory and Practical syllabus
4. Regarding approval of model question papers and blue print
5. About internal and external assessments
6. Other Pedagogy techniques for internal assessment (written test, Seminars, Power point presentation, assignment, attendance / Swatchbharat / Red Cross Activities etc.,)
7. To invite suggestions / recommendations by the statutory body pertaining to research, teaching, extension and other academic activities in the Department / College.
8. Any other inputs invited by the statutory body that needs to be incorporated for strengthening the curricular, co-curricular and extracurricular activities.



Dr Kopuri Aruna, Krishna University BOS
UG Microbiology Chairperson

KRISHNA UNIVERSITY, MACHILIPATNAM

ANDHRA PRADESH, INDIA

Board of Studies Meeting: 2025-26: Dated 22nd December 2025

Minutes of the Board of Studies in Microbiology for Semester I, II, III & IV

1. Agenda: To adopt the new curriculum frame work under single Major /Minor in UG Microbiology suggested by APSHE.

Proposal: The Chairperson BOS UG BSc Honours in Microbiology, Dr Kopuri. Aruna, proposed Course structure is placed before the BOS committee to approve.

Discussion: University Nominee Dr. P Veera Bramhachari and the Members of BOS go through the Course titles, Credits of Courses and framework of the Courses in Semesters I and IV of B.Sc Honour in Microbiology Major and Minor.

Resolution: It is resolved to approve the Courses and Credits.

2. Agenda: To review and update Microbiology Major Semester III and IV syllabi as per APSHE guidelines.

Proposal: The proposed syllabi for the courses in Microbiology Major Semester III and IV are placed before the participants for approval.

Discussion: The University Nominee Dr. P. Veera Bramhachari and subject experts proposed some changes in some topics after long and fruitful discussion.

Resolution: It is resolved to introduce syllabus for semester – III and IV along with practicals and Co-curricular activities in all courses with incorporation of following topic.

Semester – 3: Major Course 5	Theory and Practical syllabus
Major Course 6	Theory and Practical syllabus
Major Course 7	Theory and Practical Syllabus
Semester – 4 Major Course 8	Theory and Practical syllabus
Major Course 9	T heory and Practical Syllabus

Agenda 3: To review and update Microbiology Minor Semester III and IV syllabi as per APSHE

Proposal: The proposed syllabi for the courses in Microbiology Minor Semester III and IV are placed before the participants for approval.

Discussion: The University Nominee Dr. P. Veera Bramhachari and subject experts proposed some changes in some topics after long and fruitful discussion.

Resolution: It is resolved to introduce Microbiology Minor syllabus for semester – III and IV along with practicals and Co-curricular activities in all courses with incorporation of following topic.

Semester – 3: Major Course 1	Theory and Practical syllabus
Semester – 4 Major Course 2	Theory and Practical syllabus

Agenda 4: To consider and approve Model question papers and Blue print

Proposal: The proposed Model question papers and Blue print is placed before the BOS committee to approve.

Resolution: Resolved to adopt the model question paper in Section-A having answer 5 short questions carries 4 marks out of 8 and 5 essay questions with internal choice from each unit and each question carries 10 marks and prepared blue print.

Agenda 5: About internal and external assessments

Resolution: It is resolved that 30 marks for internal and 70 marks for external assessment.

Agenda 6: To introduce MOOC courses as per APSHE.

Resolution: It is resolved introduce MOOC courses for I & II BSc students and complete at least two MOOC Courses.

Agenda 7: To introduce pedagogy techniques for internal assessment (written test, Seminars, Power point presentation, assignment, and attendance.

Resolution: It is resolved introduce pedagogy techniques for internal assessment (written test, Seminars, Power point presentation, assignment, and attendance,

Agenda 8: To introduce co-curricular activities Swatchbharat / Red Cross Activities etc.,) Government flagship programmes.

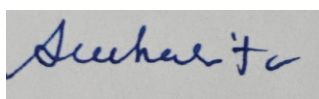
Resolution: It is resolved introduce co-curricular activities Swatchbharat / Red Cross Activities etc.,) Government flagship programmes.



1. Dr. Kopuri Aruna , KU BOS UG Microbiology, Chairperson.



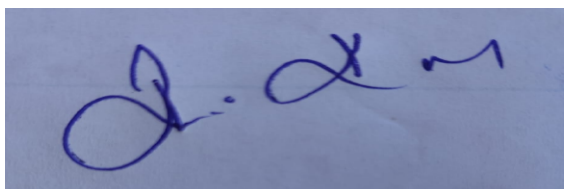
2. R P Veera Bramhachari, Professor, University Nominee BOS UG Microbiology.



3. Dr K Sucharita, Subject Expert, GDC Women (A), Guntur.



4. **Dr D Jyothi, Subject Expert , SRR and CVR Govt Degree College (A), Vijayawada.**



5. **Mr M Ravi Kumar, Industrialist, Assistant Manager, Laila Nutraceuticals, Vijayawada.**

KRISHNA UNIVERSITY, MACHILIPATNAM

Syllabus for 4-Year UG Honours in B.Sc. (Microbiology) as Major in consonance with Curriculum framework w.e.f. AY 2025-26

COURSE STRUCTURE (for Semester I to VI)

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits	
I	I	1	Introduction to Microbiology and Microbial Diversity	3	3	
			Introduction to Microbiology and Microbial Diversity-Practical	2	1	
		2	Principles of Bacteriology and Microbial Techniques	3	3	
			Principles of Bacteriology and Microbial Techniques-Practical	2	1	
	II	3	Fundamentals of Biochemistry and Analytical techniques	3	3	
			Fundamentals of Biochemistry and Analytical techniques-Practical	2	1	
		4	Microbial Physiology	3	3	
			Microbial Physiology-Practical	2	1	
II	III	5	Cell biology and Genetics	3	3	
			Cell biology and Genetics-Practical	2	1	
		6	Molecular biology and bacterial Genetics	3	3	
			Molecular biology and bacterial Genetics-Practical	2	1	
		7	r DNA Technology, Bioinformatics and Biostatistics	3	3	
			r DNA Technology, Bioinformatics and Biostatistics-Practical	2	1	
	IV	8	Basics of Immunology	3	3	
			Basics of Immunology-Practical	2	1	
		9	Medical Microbiology	3	3	
			Medical Microbiology-Practical	2	1	
		10	Agricultural Microbiology	3	3	
			Agricultural Microbiology-Practical	2	1	
III	V	11	Food Microbiology	3	3	
			Food Microbiology-Practical	2	1	
Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits	
		12 A	Industrial Microbiology	3	3	
			Industrial Microbiology-Practical	2	1	
		OR				
		12 B	Fermentation Technology	3	3	
			Fermentation Technology-Practical	2	1	

		13 A	Environmental microbiology	3	3
			Environmental microbiology-Practical	2	1
		OR			
		13 B	Mushroom Cultivation	3	3
			Mushroom Cultivation-Practical	2	1
	VI	14 A	Clinical microbiology	3	3
			Clinical microbiology-Practical	2	1
		OR			
		14 B	Veterinary microbiology	3	3
			Veterinary microbiology-Practical	2	1
		15 A	QA & QC in Food and Pharmaceutical Industry	3	3
			QA & QC in Food and Pharmaceutical Industry-Practical	2	1
		OR			
		15 B	Microbial Biotechnology	3	3
			Microbial Biotechnology-Practical	2	1
IV	VII	16	Microbial Biochemistry and Analytical Techniques	3	3
			Microbial Biochemistry and Analytical Techniques-Practical	2	1
		17	Virology	3	3
			Virology-Practical	2	1
		18	Biology of Eukaryotic Microorganisms	3	3
			Biology of Eukaryotic Microorganisms-Practical	2	1
		19 A	Marine Microbiology	3	3
			Marine Microbiology-Practical	2	1
		OR			
		19 B	Organic Farming	3	3
			Organic Farming-Practical	2	1
	VIII	20	Microbial Metabolism	3	3
			Microbial Metabolism-Practical	2	1
		21	Molecular genetics of microorganisms	3	3
			Molecular genetics of microorganisms-Practical	2	1
Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
		22	Immunology	3	3
			Immunology-Practical	2	1
		23 A	Biofertilization Technology	3	3
			Biofertilization Technology-Practical	2	1
		OR			
		23 B	Cellular microbiology	3	3
			Cellular microbiology-Practical	2	1

Note: In the III Year (during the V and VI Semesters), students are required to select a pair of electives from one of the Two specified domains. For example: if set ‘A’ is chosen, courses 12 to 15 to be chosen as 12 A, 13 A, 14 A and 15 A. To ensure in-depth understanding and skill development in the chosen domain, students must continue with the same domain electives in both the V and VI Semesters.

KRISHNA UNIVERSITY, MACHILIPATNAM

Syllabus for 4-Year UG Honours in B.Sc. (Microbiology) as Minor in consonance with Curriculum framework w.e.f. AY 2025-26

Programme Framework (Courses and Credits): B.Sc. Microbiology (Minor)

Semester	Course No	Course	No of Hrs (T+P)	Cr (T+P)
III	1	Basic Microbiology	5 (3+2)	4 (3+1)
IV	2	Techniques in Microbiology	5 (3+2)	4 (3+1)
V	3	Basics of Microbial Genetics	5 (3+2)	4 (3+1)
	4	Agricultural & Environmental Microbiology	5 (3+2)	4 (3+1)
VI	5	Microbial Pathogenicity	5 (3+2)	4 (3+1)
	6	Food and Industrial Microbiology	5 (3+2)	4 (3+1)

SEMESTER-III
COURSE 5: CELL BIOLOGY AND GENETICS
Theory Credits: 3 3 hrs/week

I. Learning Objectives:

1. Explain cell theory, organelles, the cell cycle, and cytoskeleton functions.
2. Describe cell membrane, nuclear envelope, nucleolus, and basics of cancer development.
3. Illustrate protein sorting, signal transduction, apoptosis, and specialized chromosomes.
4. Apply Mendelian genetics, including crosses, inheritance patterns, and allele frequencies.
5. Understand linkage, crossing over, Hardy-Weinberg law, natural selection, genetic drift, and sex determination.

II. Course Outcomes: On completion of this course students will be able to:

1. Distinguish prokaryotic and eukaryotic cell structures, describe major cell organelles and cytoskeletal elements, and explain the regulation of the cell cycle and mitosis.
2. Understand membrane structure and transport, nuclear organization, and basic concepts of cancer.
3. Learn about cell signaling mechanisms, protein transport pathways, and the regulation of apoptosis.
4. Gain knowledge of Mendelian inheritance and its extensions, including specialized chromosomes, pedigree analysis, multiple alleles, and epistasis.
5. Describe linkage and crossing over, apply population genetics principles, and differentiate modes of sex-linked and extranuclear inheritance.

III. Syllabus of Theory:

Unit 1 Cell Structure and Organization

Hrs: 09

- 1.1 Cell theory: Principles and significance; Structure and functions of cell organelles: Mitochondria, Chloroplasts, Lysosomes, Glyoxysomes, Peroxisomes, Golgi apparatus and ER.
- 1.2 Structure of prokaryotic cell and eukaryotic cell (plant and Animal cell)
- 1.3 Cell Cycle and Cell Division: Phases of cell cycle (G₁, S, G₂, M) and check points. Mitosis.
- 1.4 Cytoskeleton: Structure and organization. Components and functions: Microfilaments (actin), Intermediate filaments, Microtubules; Role of myosin.

Unit 2 Cell Membrane Structure and Transport Mechanisms

Hrs: 09

- 2.1 Structure and functions Cell membrane, proton pumps (Na⁺-K⁺ pump, Ca²⁺-calmodulin) and their distribution.
- 2.2 Endocytosis: Phagocytosis, Pinocytosis, Exocytosis.
- 2.3 Nuclear envelope: Structure of nuclear pore complex, nuclear lamina, Nucleolus; Transport across nuclear membrane.
- 2.4 Elementary knowledge of cancer development and causes; Oncogenes and suppressor genes,

Unit 3 Basics of Cell Signalling

Hrs: 09

- 3.1 Basic structure of cell signalling systems; first messengers (hormones, ligands) and intracellular Secondary messengers (cAMP, Ca²⁺).
- 3.2 Cell-to-cell signalling: In Eukaryotes: endocrine hormone signalling, cytokine signalling; In Prokaryotes: quorum sensing, bacterial pheromones.
- 3.3 Protein sorting and Signal Transduction: Protein sorting and intracellular transport, Signal transduction pathways: GPCR, ERK/MAPK Pathway)
- 3.4 Cell Fate and Development: Apoptosis: (programmed cell death): mechanism and significance;

Stem cells: types and basic concepts.

UNIT 4 Principles of Genetics and Inheritance

Hrs: 09

4.1 Mendal's Laws: Law of dominance, Law of segregation and Law of Independent assortment.

4.2 Deviations from mendal's laws: Incomplete dominance, Co-dominance, Epistasis.

4.3 Chromosomal Basis of Inheritance: Chromosomal theory of inheritance, Multiple alleles, lethal alleles

Unit 5 Genetic Linkage, Sex Determination and Evolution

Hrs: 09

5.1 Linkage and Crossing over: Theories of linkage; Significance of Linkage:

Crossing over: Types of crossing over and mechanism of crossing over. Difference between linkage and crossing over.

5.2 Sex Determination and Sex-Linked Inheritance: Mechanism of Sex determination (XX–XY, ZZ–ZW, etc.); Sex linked inheritance.

5.3 Theories of Evolution: Natural selection; Genetic drift.

IV. Co-curricular activities:

1. Create 3D models of cell organelles and demonstrate their functions.
2. Observe mitosis, cell structures, and apoptosis using prepared slides.
3. Solve monohybrid, dihybrid, problems.
4. Use interactive software or games to explore linkage, crossing over, and sex-linked inheritance.

V. Reference Books:

1. A.J.F Griffiths, S. R Wessler, S. B Carroll & J. Doebley, An Introduction to Genetic Analysis,. 10th Ed., W.H. Freeman & Company (New York) 2010
2. Geoffrey M. Cooper and Robert E. Hausman - The cell a molecular approach.
3. Bruce Alberts , Rebecca Heald, et al. Molecular Biology Of The Cell
4. Arnold Berk (Author), Chris A. Kaiser (Author), Harvey Lodish (Author), Angelika Amon (Author), Molecular Cell Biology.
5. Benjamin Lewin Genes
6. Eldon John Gardner, Michael J. Simmons, D. Peter Snustad Principles of Genetics
7. Karp G, John Wiley Cell Biology
8. Jane B. Reece (Author), Martha R. Taylor (Author), Eric J. Simon (Author), Jean L. Dickey , Campbell Biology: Concepts and Connections
9. Veer Bala Rastogi, Genetics B D Singh, Genetics

SEMESTER-I
COURSE 5: **CELL BIOLOGY AND GENETICS**
Practical Credits: 1 2 hrs/week

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Observe and analyze cell structure, organelles, and cell viability.
2. Examine mitosis, meiosis, and identify cancer cells using microscopy.
3. Apply genetic principles to study linkage, recombination, and gene mapping.

II. Laboratory/Field exercises:

1. Yeast cell counting and Viability
2. Study a representative plant (Chlorella) and animal cell (Amoeba) by microscopy.
3. Study of ultrastructure of cell (Plasma membrane, Nucleus, Nuclear Pore Complex, Chloroplast, Mitochondrion, Golgi bodies, Lysosomes, SER and RER)
4. Demonstration of the presence of mitochondria in striated muscle cells/ cheek epithelial cell using vital stain Janus Green B
5. Mitosis from onion root tips.
6. Meiosis of flower buds.
7. Identification and study of cancer cells by photomicrographs
8. Study of Linkage, recombination using marker-based data from Drosophila.

SEMESTER-III
COURSE 6: MOLECULAR BIOLOGY AND BACTERIAL GENETICS

Theory Credits: 3 3 hrs/week

I. Learning Objectives:

1. Explore experiments demonstrating DNA/RNA as genetic material, prokaryotic replication, and plasmids/transposons.
2. Examine gene concepts, structure, and transcription in prokaryotes and eukaryotes.
3. Illustrate translation, genetic code, and bacterial gene regulation.
4. Analyze mutations, their molecular basis, and DNA repair mechanisms.
5. Investigate bacterial recombination through conjugation, transformation, and transduction.

II. Course Outcomes: On completion of this course students will be able to:

1. Explain the experiments demonstrating DNA/RNA as genetic material, DNA replication, and plasmids/transposons.
2. Describe gene concepts, structure, and transcription.
3. Illustrate translation and bacterial gene regulation.
4. Classify mutations and summarize DNA repair.
5. Explain bacterial recombination and its applications.

III. Syllabus of Theory:

Unit - 1: DNA/RNA as genetic material, Replication of DNA **No. of Hrs: 9**

- 1.1 DNA and RNA as genetic material (Griffith, Avery-MacLeod-McCarty Experiment, Hershey & Chase) Genome organization in prokaryotes.
- 1.2 Replication of DNA in prokaryotes. Bidirectional and unidirectional replication, Semiconservative Replication: Proof Mechanism.
- 1.3 Extra chromosomal genetic elements: General characters, types and applications of Plasmids and transposons.

Unit - 2: Concept of gene, Transcription **No. of Hrs: 9**

- 2.1 Classical Concept of gene: Mutton, Recon and Cistron; One gene-one enzyme, one gene-One polypeptide.
- 2.2 Modern concept of gene: Definition of gene; Open reading frame; Types of genes (structural, constitutive and regulatory genes; Gene Slicing - concept of introns and exons
- 2.3 Transcription- Definition, mechanism of transcription.

Unit - 3: Translation and regulation of gene expression **No. of Hrs: 9**

- 3.1 Genetic code: Salient features, Wobble hypothesis.
- 3.2 Translation- Mechanisms of initiation, elongation and termination of polypeptides. Inhibitors of protein synthesis.
- 3.3 Regulation of gene expression in bacteria – lac operon.

Unit - 4: Mutations and DNA repair**Hrs: 9**

- 4.1 Mutations: Definition and types of Mutations (Spontaneous and induced, Somatic and germline); Physical and chemical mutagens;
- 4.2 Molecular basis of mutations (base pair changes, frame shifts, deletions, inversions, tandem duplications, insertions); Functional mutants (loss and gain of function mutants); Uses of mutations.
- 4.3 Outlines of DNA repair mechanisms: Direct, Excision, Mismatch, Recombination Repair, SOS Repair.

Unit - 5: Genetic recombination in bacteria**Hrs: 9**

- 5.1 Conjugation - Definition, F-factor, F+ & Hfr, mechanism of conjugation, applications of conjugation;
- 5.2 Transformation- Discovery, mechanism of transformation, factors affecting transformation and application of transformation.
- 5.3 Transduction- discovery, mechanism and types of transduction.

IV. Co-curricular activities:

- 1. Prepare and present a poster or model illustrating DNA replication, plasmids, and transposons.
- 2. Perform a simulation or virtual lab on transcription, translation, and bacterial gene regulation.
- 3. Conduct a case study or discussion on mutations, DNA repair, and bacterial recombination, highlighting real-world applications.

V. Reference Books:

- 1. James D. Watson Tania A. Baker, Stephen P. Bell Alexander Gann, Michael Levine, Richard Losick, 2013, Molecular Biology of the Gene, 5th Edition, Pearson Edu Publishers.
- 2. Roger Y. Stanier, Edward A. Adelberg, John L. Ingraham, 1977, General Microbiology 5th edition, London Macmillan.
- 3. David Freifelder 1986 Molecular Biology 3rd edition, Jones & Bartlett Publishers
- 4. T.A. Brown, Gene cloning and DNA analysis- An Introduction, 4th edition
- 5. Bernard R. Glick and Jack. J. Pasternak, Molecular Biotechnology. 3rd edition
- 6. David Freifelder. Essentials of molecular biology. Jones and Bartlett Publishers, 1998

SEMESTER-III
COURSE 6: MOLECULAR BIOLOGY AND BACTERIAL GENETICS
Practical Credits: 1 2 hrs/week

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Isolate and visualize DNA/RNA and plasmids using electrophoresis micrographs and schematic representations.
2. Solve DNA/RNA, transcription, translation problems and study bacterial mutations.
3. Demonstrate molecular biology equipment like transformation, PCR, and ultracentrifugation.

II. Laboratory/Field exercises:

1. Isolation of genomic DNA from E. coli
2. Study of different types of DNA and RNA using micrographs and model / schematic representations
3. Study of semi-conservative replication of DNA through micrographs / schematic Representations
4. Resolution and visualization of DNA by Agarose Gel Electrophoresis.
5. Study of different conformations of plasmid DNA through agarose gel electrophoresis.
6. Problems related to DNA and RNA characteristics, Transcription and Translation.
7. Induction of mutations in bacteria by UV light.
8. Demonstration of bacterial transformation
9. Instrumentation in molecular biology – Ultra centrifuge, Transilluminator, PCR

SEMESTER-III
COURSE 7: r-DNA TECHNOLOGY, BIOINFORMATICS AND BIOSTATISTICS
Theory Credits: 3 3 hrs/week

I. Learning Objectives:

1. To learn principles, tools, and vectors used in gene cloning.
2. To understand blotting, DNA sequencing, PCR, and RFLP techniques.
3. To impart knowledge about gene libraries, recombinant DNA applications, and intellectual property rights.
4. To explore bioinformatic databases, tools, sequence alignment, and ChIP.
5. To understand measures of central tendency, dispersion, and data presentation.

II. Course Outcomes: On completion of this course students will be able to:

1. Explain the fundamental principles and tools of genetic engineering, including gene cloning steps, vectors, and DNA transformation methods.
2. Outline genomic techniques and explain major applications of recombinant DNA technology in various fields.
3. Describe key genetic engineering techniques and recognize the importance of intellectual property rights in biotechnology.
4. Utilize major bioinformatics databases and tools for sequence retrieval, alignment, and analysis.
5. Apply basic biostatistical methods for data analysis and effectively use statistical software for biological data interpretation.

III. Syllabus of Theory:

UNIT- 1: Gene cloning- Tools and techniques

Hrs: 9

- 1.1 Steps in gene cloning: Steps involved in gene cloning (isolation, cutting, ligation, transformation, Selection of recombinant clones, Host systems)
- 1.2 Cloning tools: Restriction endonucleases (Type II), DNA polymerases, DNA ligases, Exonucleases and DNase, polynucleotide kinase, Alkaline phosphatase; Use of linkers and adaptors.
- 1.3 Cloning Vectors: Characteristics of an ideal vector, Plasmids (PBR 322), Bacteriophages (Phage λ), Cosmids, BAC, YAC; Expression vectors: *E.coli* lac promoter- based vector.
- 1.4 Methods of DNA transfer into host cells: Chemical method and Electroporation.

UNIT- 2: Techniques in genetic engineering

Hrs: 9

- 2.1 Blotting Techniques: Principle and steps of blotting; Types of blotting: Southern, Northern and Western blotting techniques
- 2.2 DNA Sequencing: Principles of DNA sequencing; Sanger's (dideoxy chain termination) method.
- 2.3 Polymerase chain Reaction: Basic principles and steps of PCR, Applications of PCR; Restriction Fragment Length Polymorphism (RFLP): principle and applications.

UNIT- 3: Gene libraries, Applications of r-DNA technology and IPR

Hrs: 9

- 3.1 Gene Libraries: Concept and types of gene libraries; Genomic Library: preparation and uses; cDNA library: preparation and uses
- 3.2 Application of genetic engineering: Applications in industry (enzyme production, biofuels), Agriculture (genetically modified crops) and medicine (insulin, vaccines, gene therapy).
- 3.3 Introduction to Intellectual property Rights; Types of IPR: Patents, Trademark, Copyright; Importance of IPR in biotechnology

UNIT- 4: Bioinformatics

Hrs: 9

- 4.1. Bioinformatic resources: NCBI, EMBL, DDBJ, PUBMED, BIOMED.
- 4.2 Sequence Databases – GENBANK, BLAST, FASTA, ExPasy, PDB, NDB, UNIPROT – SWISS PROT.
- 4.3 Sequence alignment – Sequence homology, pairwise sequence alignment, automated DNA sequencing, ChIP.

UNIT- 5: Biostatistics

Hrs: 9

- 5.1 Measurement of central tendency: Mean, Median, Mode.
- 5.2 Measurement of dispersion: Standard Deviation, Standard error, t-test and Chi square test
- 5.3 Sample and population: Types of Data, methods of Data presentation.
- 5.4 Use of Biostatistics software: IBM- SPSS or Minitab

IV. Co-curricular activities:

- 1. Create a model or poster showing cloning steps and vectors.
- 2. Demonstrate PCR or virtual blotting techniques in a workshop.
- 3. Prepare a chart/poster on r-DNA applications and IPR concepts.
- 4. Hands-on session using BLAST or GenBank for sequence analysis.

V. Reference Books:

- 1. Brown, T. A. (2010). *Gene Cloning and DNA Analysis* (6th ed.). Blackwell Publishing, Oxford, UK.
- 2. Campbell, A. M., & Heyer, L. J. (2006). *Discovering Genomics, Proteomics and Bioinformatics* (2nd ed.). Benjamin Cummings.
- 3. Clark, D. P., & Pazdernik, N. J. (2009). *Biotechnology: Applying the Genetic Revolution*. Elsevier Academic Press, USA.
- 4. Ghosh, Z., & Bibekanand, M. (2008). *Bioinformatics: Principles and Applications*. Oxford University Press.
- 5. Glick, B. R., Pasternak, J. J., & Patten, C. L. (2010). *Molecular Biotechnology* (4th ed.). ASM Press.
- 6. Gupta, P. K. (2009). *Elements of Biotechnology* (2nd ed.). Rastogi Publications.
- 7. Pevsner, J. (2009). *Bioinformatics and Functional Genomics* (2nd ed.). Wiley-Blackwell.
- 8. Primrose, S. B., & Twyman, R. M. (2008). *Genomics: Applications in Human Biology*. Blackwell Publishing, Oxford, UK.

9. Ratledge, C., & Kristiansen, B. (2001). *Basic Biotechnology* (2nd ed.). Cambridge University Press.
10. Sambrook, J., & Russell, D. (2001). *Molecular Cloning: A Laboratory Manual* (3rd ed.). Cold Spring Harbor Laboratory Press.
11. Swartz, J. R. (2001). Advances in Escherichia coli production of therapeutic proteins. *Current Opinion in Biotechnology*, 12, 195–201.

SEMESTER-I

COURSE 7: r-DNA TECHNOLOGY, BIOINFORMATICS AND BIOSTATISTICS

Practical

Credits: 1

2 hrs/week

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Isolate, digest, ligate, and amplify DNA using standard molecular biology techniques.
2. Analyse DNA fragments, interpret sequencing data, and perform RFLP analysis.
3. Retrieve and align sequences using bioinformatics tools like BLAST and Clustal W.

II. Laboratory/Field exercises:

1. Isolation of plasmid DNA by Agarose gel Electrophoresis.
2. Digestion of DNA using restriction enzymes and analysis by agarose gel electrophoresis.
3. Ligation of DNA fragments by using T4 DNA Ligase.
4. Amplification of DNA by PCR
5. Demonstrate RFLP
6. Interpretation of sequencing gel electropherograms.
7. Introduction to bioinformatics databases: NCBI, EMBL
8. Sequence retrieval using BLAST.
9. Sequence alignment using clustal W.

SEMESTER-IV
COURSE 8: BASICS OF IMMUNOLOGY
Theory Credits: 3 3 hrs/week

I. Learning Objectives:

1. Outline the basics of immunity, immune cells, and organs.
2. Describe properties, types, and interactions of antigens and antibodies.
3. Illustrate primary and secondary immune responses through cell-mediated and humoral pathways.
4. Classify hypersensitivity, autoimmune, and immunodeficiency disorders.
5. Evaluate vaccination principles, immunological diagnostic techniques, and monoclonal antibody production.

II. Course Outcomes: On completion of this course students will be able to:

1. Differentiate innate and adaptive immunity, major immune cells, and lymphoid organs.
2. Describe antigens, antibody classes and structures, and antigen-antibody interactions.
3. Illustrate MHC function, T and B cell activation, and effector mechanisms of CTLs, NK cells, antibodies, and complement.
4. Categorize hypersensitivity reactions and summarize autoimmune and immunodeficiency diseases.
5. Distinguish types of vaccines, implement immunological techniques, and assess applications of monoclonal antibodies.

III. Syllabus of Theory:

Unit 1: Introduction to Immunology:

9 Hrs

- 1.1. Definition, Contributions of the scientists – Edward Jenner, Karl Landsteiner, Elie Metchnikoff, MacFarlane Burnet, Neils K Jerne and Susumu Tonegawa. Types of Immunity: Innate and acquired Immunity.
- 1.2 Cells of the Immune System: Structure and functions of Macrophages, Neutrophils, Basophils and Eosinophils, Lymphocytes (B cells, T cells, NK cells), Dendritic Cells.
- 1.3 Organs of the Immune System: Primary (Bone marrow, Thymus, bursa fabricius) and Secondary (Lymph nodes, Spleen and lymphoid tissues) lymphoid organs.

Unit 2: Antigens and Antibodies

9Hrs

- 2.1 Antigens: Definition, Types (Exogenous, Endogenous, Autoantigens), Characteristics (Foreignness, Molecular size, Heterogeneity and solubility); Haptens, Epitopes (T & B cell epitopes); T-dependent and T-independent antigens; Adjuvants
- 2.2 Antibodies (Immunoglobulins): Basic structure (Heavy and Light Chains, Fab and Fc regions); Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic); Classes of Immunoglobulins (IgG, IgM, IgA, IgE, IgD)
- 2.3 Antigen-Antibody Interaction: Specificity, Avidity, Affinity; Functions of Antibodies: Immune complex formation and elimination -Agglutination, Precipitation, Neutralisation;

Complement fixation, Phagocytosis

Unit 3: Generation of Immune Response

9 Hrs

- 3.1 Primary and Secondary Immune Response; concept on Major Histocompatibility Complex.
- 3.2 Cell Mediated Immune Response (Self MHC restriction, T cell activation, Co-stimulatory signals); Killing Mechanisms by CTL and NK cells, Introduction to tolerance
- 3.2 Humoral Immunity: Generation of Humoral Immune Response (Plasma and Memory cells)
Complement System in brief: Components and functions of complement (lysis, opsonization, and inflammation)

Unit 4: Hypersensitivity and Immunological Disorders

9 Hrs

- 4.1 Hypersensitivity Reactions (Gell and Coombs Classification):
- 4.2 Autoimmune Disorders: Rheumatoid Arthritis, Systemic Lupus Erythematosus
- 4.3 Immunodeficiency Disorders: Primary (e.g., SCID) and Secondary (e.g., AIDS) immunodeficiencies

Unit 5: Vaccines and Immunotechnology

9 Hrs

- 5.1 Principles of Vaccination: Active vs Passive Immunization; Types of Vaccines (Live attenuated, Inactivated, Subunit, mRNA-based); Adjuvants in Vaccines
- 5.2 Diagnostic Immunological Techniques: Principles of Precipitation, Agglutination, Immunodiffusion, ELISA, Immunofluorescence.
- 5.3 Monoclonal Antibodies: Production (Hybridoma technology); Applications in diagnostics and Therapy.

IV. Co-curricular activities:

- 1. Participate in quizzes or debates on vaccines, autoimmune diseases, or emerging immunology topics.
- 2. Create 3D models or posters of immune cells, antigen-antibody interactions, or hypersensitivity mechanisms.
- 3. Visit a diagnostic lab or vaccine research center, or attend a guest lecture by an immunologist.

V. Reference Books:

- 1. Abbas, A. K., Lichtman, A. H., & Pillai, S. (2007). *Cellular and Molecular Immunology* (6th ed.). Saunders Publication, Philadelphia.
- 2. Delves, P., Martin, S., Burton, D., & Roitt, I. M. (2006). *Roitt's Essential Immunology* (11th ed.). Wiley-Blackwell Scientific Publication, Oxford.
- 3. Goldsby, R. A., Kindt, T. J., & Osborne, B. A. (2007). *Kuby's Immunology* (6th ed.). W.H. Freeman and Company, New York.
- 4. Murphy, K., Travers, P., & Walport, M. (2008). *Janeway's Immunobiology* (7th ed.). Garland Science Publishers, New York.
- 5. Peakman, M., & Vergani, D. (2009). *Basic and Clinical Immunology* (2nd ed.). Churchill Livingstone Publishers, Edinburgh.
- 6. Richard, C., & Geoffrey, S. (2009). *Immunology* (6th ed.). Wiley-Blackwell Publication.

SEMESTER-IV
COURSE 8: **BASICS OF IMMUNOLOGY**
Practical Credits: 1 2 hrs/week

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Identify human blood groups and perform serum separation.
2. Conduct total and differential leukocyte counts.
3. Apply immunological techniques such as immunodiffusion and DOT-ELISA.

II. Laboratory/Field exercises:

1. Identification of human blood groups.
2. Perform Total Leukocyte Count of the given blood sample.
3. Perform Differential Leukocyte Count of the given blood sample.
4. Separate serum from the blood sample (demonstration).
5. Perform immunodiffusion by RID/ Ouchterlony method.
6. Perform Dot ELISA.

I. Learning Objectives:

- II. Course Outcomes: On completion of this course students will be able to:**

- ### III. Syllabus of Theory:

Unit 1 Normal microflora of the human body and host pathogen interaction 9 Hrs

- 1.1 Normal microflora of the human body: Importance of normal microflora, normal microflora of skin, throat, gastrointestinal tract, urogenital tract
- 1.2 Host pathogen interaction: Definitions - Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Carriers and their types, Transmission of infection
- 1.3 Opportunistic infections, Nosocomial infections.

Unit - 2: Bacterial and Viral diseases **9 Hrs**

Detailed study of the following diseases covering Symptoms, mode of transmission, pathogenesis, diagnosis, prophylaxis and control

- 2.1 Respiratory Diseases: Tuberculosis (*Mycobacterium tuberculosis*) and COVID-19 (*SARS-CoV-2*)
- 2.2 Gastrointestinal Diseases: Typhoid (*Salmonella typhi*) and Hepatitis (Hepatitis A)
- 2.3 Sexually transmitted diseases: Gonorrhea (*Neisseria gonorrhoeae*) and AIDS (*Human Immunodeficiency Virus – HIV*)

Unit - 3: Fungal diseases & Protozoal**9 Hrs**

Detailed study of the following diseases covering Symptoms, mode of transmission, pathogenesis, diagnosis, prophylaxis and control

- 3.1 Candidiasis
- 3.2 Aspergillosis
- 3.3 Amoebiasis (*Entamoeba histolytica*)
- 3.4 Malaria (*Plasmodium* spp.)

Unit 4 Sample collection, transport and diagnosis**9 Hrs**

- 4.1 Collection and transport of clinical samples,
- 4.2 Culturing, isolation, and identification of pathogens based on cultural characteristics, microscopy and biochemical/physiological properties
- 4.3 principles of diagnostic tests ELISA, Immunofluorescence, Agglutination, Complement fixation, molecular assays (PCR, DNA probes).

Unit - 5: Antimicrobial agents**9 Hrs**

- 5.1 Antimicrobial agents- General modes of action of antibacterial agents (Penicillin, Streptomycin), antifungal agents (Amphotericin and Griseofulvin), Antiviral agents (Amantadine, Acyclovir) agents, Interferons.
- 5.2. Antibiotic resistance: Definition, causes, brief mechanisms (Enzymatic degradation, Target site alteration, Efflux pumps, Reduced permeability), examples (MRSA, Multidrug-resistant TB), consequences, and prevention strategies.
- 5.3 MIC Tests for antimicrobial susceptibility (Disc diffusion).

IV. Suggested extracurricular activities:

- 1. Visit a hospital or diagnostic lab to observe infection identification and discuss case studies.
- 2. Practice mock collection, labeling, and transport of clinical samples and discuss contamination prevention.
- 3. Create posters or digital presentations on diseases, highlighting symptoms, transmission, and prevention.
- 4. Design posters or digital content on proper antibiotic use, resistance, and prevention strategies.

V. Reference Books:

- 1. **Ananthanarayan R. & Paniker C.K.J.** (2009). *Textbook of Microbiology* (8th ed.). University Press.
- 2. **Brooks G.F., Carroll K.C., Butel J.S., Morse S.A., & Mietzner, T.A.** (2013). *Jawetz, Melnick, and Adelberg's Medical Microbiology* (26th ed.). McGraw Hill.
- 3. **Goering R., Dockrell H., Zuckerman M., & Wakelin D.** (2007). *Mims' Medical Microbiology* (4th ed.). Elsevier.

4. **Willey J.M., Sherwood L.M., & Woolverton C.J.** (2013). *Prescott, Harley and Klein's Microbiology* (9th ed.). McGraw Hill.
5. **Madigan M.T., Martinko J.M., Dunlap P.V., & Clark D.P.** (2014). *Brock Biology of Microorganisms* (14th ed.). Pearson.
6. **Patrick R. Murray** (2023). *Murray's Basic Medical Microbiology: Foundations and Clinical Cases* (2nd ed.). Elsevier. ISBN: 978-0323878104.
7. **Patrick R. Murray** (2023). *Medical Microbiology* (10th ed.). Elsevier. ISBN: 978-0443261336.

SEMESTER-IV
COURSE 9: MEDICAL MICROBIOLOGY
Practical Credits: 1 2 hrs/week

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

II. Laboratory/Field exercises:

1. Study of composition and use of important differential media for identification of bacteria: EMB Agar, McConkey agar, Mannitol salt agar, Deoxycholate citrate agar, TCBS
2. Isolation of Normal flora of human body (Hands, Feet, Nostrils, Teeth Surface) by swab method.
3. Identify bacteria (any three of *E. coli*, *Salmonella*, *Pseudomonas*, *Staphylococcus*, *Bacillus*)
4. Using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC,
5. TSI, nitrate reduction, urease production and catalase tests
6. Study symptoms of the diseases with the help of photographs: Polio, anthrax, herpes, chicken, Pox, HPV warts, AIDS (candidiasis), dermatomycoses (ring worms)
7. Study of various stages of malarial parasite in RBCs using permanent mounts
8. Antibacterial sensitivity by Kirby-Bauer method
9. Determination of minimal inhibitory concentration of an antibiotic (Streptomycin).

SEMESTER-IV
COURSE 10: AGRICULTURAL MICROBIOLOGY
Theory Credits: 3 3 hrs/week

I. Learning Objectives:

1. Explore soil as a microbial habitat and summarize microbial diversity and interactions.
2. Classify microbial and viral virulence factors and illustrate plant defense mechanisms.
3. Compare strategies for controlling plant diseases, including chemical, biological, and genetic methods.
4. Identify plant diseases caused by fungi, bacteria, viruses, and viroids, and outline their symptoms and spread.
5. Evaluate the role of beneficial microbes in promoting plant growth and managing pests.

II. Course Outcomes: On completion of this course students will be able to:

1. Summarize soil properties, explore microbial diversity, and outline microbe interactions.
2. Categorize virulence factors and depict plant defense mechanisms.
3. Compare disease management strategies and demonstrate GM crop applications.
4. Recognize major plant diseases and examine their symptoms and spread.
5. Differentiate biofertilizers and bioinsecticides and appraise their use in agriculture.

III. Syllabus of Theory:

Unit 1: Soil Microbiology **9 Hrs**

1. Soil as Microbial Habitat, Soil profile and properties, Soil formation, Diversity and distribution of microorganisms in soil.
2. Mineralization of cellulose, hemicelluloses, lignocelluloses, lignin and humus.
3. Microbial interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism, predation. Microbe-Plant interaction: Symbiotic and non-symbiotic interactions.

Unit 2: Host Pathogen Interaction **9 Hrs**

- 2.1. Microbial Pathogenicity: Bacterial virulence factors- enzymes, toxins (host-specific and non-specific), growth regulators; Viral virulence factors: replicase, coat protein, silencing suppressors
- 2.2. Effects on Host Physiology: Impact on photosynthesis, respiration, cell membrane permeability, nutrient and water translocation, growth, and reproduction.
- 2.3. Defence Mechanisms in Plants: Concepts of constitutive defences; Inducible structural defenses: cork layer, abscission layer, tyloses, gums; Inducible biochemical defenses: hypersensitive response (HR), systemic acquired resistance (SAR), phytoalexins; pathogenesis related (PR) proteins.

Unit 3: Plant Diseases control**9 Hrs**

- 3.1. Principles and Practices of Disease Management: Regulatory methods- quarantine, avoidance of pathogens, use of pathogen-free propagative material; Cultural methods: host eradication, crop rotation, sanitation.
Chemical methods: systemic fungicides, antibiotics; development of pathogen resistance.
- 3.2. Biological Control: Antagonistic microbes (bacteria and fungi).
- 3.3. Genetic Engineering of Disease-Resistant Plants: Use of plant-derived and pathogen-derived genes; Development of genetically modified (GM) crops (BT)

Unit: 4: Study of Plant diseases**9 Hrs**

Study of selected plant diseases with emphasis on etiological agent, symptoms, epidemiology, and control:

- 4.1 Diseases Caused by Fungi:
 - a) Black stem rust of wheat – *Puccinia graminis tritici*
 - b) Wilt of tomato – *Fusarium oxysporum* f. sp. *Lycopersici*
 - c) Early blight of potato – *Alternaria solani*
- 4.2 Diseases Caused by Phytopathogenic Bacteria: bacterial blight of rice, crown galls, bacterial cankers of citrus
- 4.3. Diseases caused by viruses and viroids: Papaya ring spot, tomato yellow leaf curl.
diseases caused by viroids: Potato spindle tuber, coconut cadang cadang

Unit 5: Biofertilization, Phytostimulation, Bioinsecticides**No of Hrs: 9**

- 5.1. Plant growth promoting bacteria and biofertilizers – symbiotic (Bradyrhizobium, Rhizobium), Non Symbiotic (Azospirillum, Phosphate solubilizers)
- 5.2. Mycorrhizal Inoculum: Types of mycorrhizae, associated plants, Mass production of VAM (Vesicular-Arbuscular Mycorrhiza), field applications of Ectomycorrhizae and VAM.
- 5.3. Bioinsecticides: Advantages over synthetic pesticides, *Bacillus thuringiensis*-production and field applications; Viruses- Baculoviruses cultivation and field applications.

III. Co-curricular activities:

1. Collect soil samples, observe microbial diversity, and present findings.
2. Create posters or models of disease control strategies and present them.
3. Prepare charts of plant diseases or visit a farm to observe and discuss them.

V. Reference Books:

1. Agarwal, S. K. (2005). *Advanced Environmental Biotechnology*. APH Publishing.
2. Agrios, G. N. (2006). *Plant Pathology* (5th ed.). Academic Press, San Diego.
3. Bagyaraj, D. J., & Rangaswami, G. (2005). *Agricultural Microbiology*. Prentice Hall of India Pvt. Ltd.
4. James, A. (2021). *Soil and Agricultural Microbiology*. Ed-Tech Press.

5. Lacomme, C. (Ed.). (2025). *Plant Pathology: Techniques and Protocols* (2nd ed.). Springer.
6. Lucas, J. A. (1998). *Plant Pathology and Plant Pathogens* (3rd ed.). Blackwell Science, Oxford.
7. Mahindra, K. Rai. (2005). *Handbook of Microbial Biofertilizers*. The Haworth Press, New York.
8. Mehrotra, R. S. (1994). *Plant Pathology*. Tata McGraw-Hill Limited.
9. Reddy, S. M., et al. (2002). *Bioinoculants for Sustainable Agriculture and Forestry*. Scientific Publishers.
10. Rangaswami, G. (2005). *Diseases of Crop Plants in India* (4th ed.). Prentice Hall India Pvt. Ltd., New Delhi.
11. Salem, F., & Shakoori, A. R. (2012). *Development of Bioinsecticide*. Lap Lambert Academic Publishing GmbH KG.
12. Singh, K. P., Jahagirdar, S., & Sarma, B. K. (Eds.). (2020). *Emerging Trends in Plant Pathology*. Springer.
13. Singh, R. S. (1998). *Plant Diseases Management* (7th ed.). Oxford & IBH, New Delhi.
14. Subba Rao, N. S. (1995). *Soil Microorganisms and Plant Growth*. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
15. Subba Rao, N. S. (2009). *Soil Microbiology*. Oxford and IBH Publishing Company.
16. Kannaiyan, S. (2003). *Biotechnology of Biofertilizers*. CHIPS, Texas.
17. Academic Press. (2025). *Textbook of Agricultural Microbiology & Phytoremediation*. Academic Press.

SEMESTER-IV

COURSE 10: AGRICULTURAL MICROBIOLOGY

Practical

Credits: 1

2 hrs/week

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Observe and analyse soil properties and microbial diversity.
2. Apply techniques for isolating and characterizing beneficial soil microbes.
3. Identify plant pathogens and examine disease symptoms through microscopic observations and Koch's postulates.

II. Laboratory/Field exercises:

1. Study of soil profile, water activity, pH.
2. Study microflora of different types of soils.
3. Rhizobium as soil inoculant, characteristics and field application.
4. Azotobacter as soil inoculant, characteristics and field application.
5. Isolation of cellulose degrading organisms
6. Demonstration of Koch's postulates in fungal, bacterial and viral plant pathogens.
7. Study of important diseases of crop plants by cutting sections of infected plant material (microscopic observations)- Albugo, Puccinia, Ustilago, Fusarium, Colletotrichum.

SEMESTER-III
COURSE 1: BASIC MICROBIOLOGY

Theory

Credits: 3

3 hrs/week

I. Learning Objectives:

1. To introduce the history, scope, and importance of microbiology.
2. To provide knowledge of microbial diversity, including bacteria, archaea, fungi, algae, protozoa, helminths, and viruses.
3. To explain microbial cell structures and their functional significance.
4. To describe microbial growth, nutrition, and environmental influences.
5. To establish a foundation for advanced microbiology courses.
- 6.

II. Course Outcomes: On completion of this course students will be able to:

1. Recall the history and contributions of pioneers in microbiology.
2. Differentiate between prokaryotic and eukaryotic microorganisms.
3. Explain structural and physiological features of microbial groups.
4. Classify microorganisms based on Bergey's Manual, morphology, and host specificity.
5. Interpret microbial growth patterns under varying nutritional and environmental conditions.

III. Syllabus of Theory:

Unit 1: Fundamentals of Microbiology

No. of hrs: 9

- 1.1 History and major contributions – Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Joseph Lister, Ignaz Semmelweis, Alexander Fleming, Ivanowsky, Beijerinck, Winogradsky.
- 1.2 Scope, branches, applications and importance of microbiology in health, agriculture, food, industry and environment.
- 1.3 Classification of microorganisms – Whittaker's Five Kingdoms, Carl Woese's Three Domains.
- 1.4 Origin of microbial life on Earth – Timeline of microbial evolution, Endosymbiosis theory (role of cyanobacteria), differences between prokaryotic and eukaryotic cells.

Unit 2: Microbial Diversity – Prokaryotes

No. of hrs: 9

- 2.1 General features of Bacteria and Archaea.
- 2.2 Bacterial cell structure: cell wall, glycocalyx/capsule, flagella, pili, fimbriae, nucleoid, plasmids, ribosomes, cytoplasmic membrane, mesosomes, inclusion bodies, endospore.
- 2.3 Gram-positive and Gram-negative bacteria – structural differences and significance.
- 2.4 Bergey's Manual of Systematic Bacteriology – basic outline of bacterial classification.

SEMESTER-III

Economic importance of bacteria.

Unit 3: Microbial Diversity – Eukaryotes

No. of hrs: 9

- 3.1 General features of fungi – morphology, reproduction, significance.
- 3.2 General features of Microalgae – classification, ecological roles, Photosynthetic pigments
- 3.3 General features of protozoa – Morphology, modes of nutrition, reproduction, parasitic protozoa overview.
- 3.4 Economic importance of Algae and Fungi.

Unit 4: Viruses and Other Acellular Agents

No. of hrs: 9

- 4.1 General characteristics of viruses, bacteriophages, viroids, and prions.
- 4.2 Structure of typical viruses – bacterial, plant, animal viruses.
- 4.3 Host specificity and classification of viruses – plant viruses, animal viruses, bacteriophages.
- 4.4 Role of viruses as disease-causing agents and as useful tools in biotechnology (gene therapy vectors, vaccine development)

Unit 5: Bacterial Growth and Nutrition

No. of hrs: 9

- 5.1 Nutritional requirements of bacteria: macronutrients, micronutrients, growth factors; nutritional types (autotrophs, heterotrophs, phototrophs, chemotrophs).
- 5.2 Culture media: defined, complex, selective, differential, enrichment, transport.
- 5.3 Bacterial growth curve: phases (lag, log, stationary, death) and significance.
- 5.4 Factors affecting bacterial growth: temperature, pH, osmotic pressure, oxygen requirement (aerobes, anaerobes, facultatives, microaerophiles).

IV. Co-curricular activities:

- 1. Seminars: Contributions of microbiologists, microbial diversity presentations.
- 2. Assignments: Charts on microbial cell structure, microbial growth curve.
- 3. Poster/Model Making: Prokaryotic vs. eukaryotic cells, virus structure.
- 4. Field Visit: Local water body/soil site for microbial awareness.
- 5. Quiz/Debate: “Are viruses living or non-living?”

IV. Reference Books:

- 1. Pelczar, Reid & Chan – Microbiology.
- 2. Prescott, Harley & Klein – Microbiology.
- 3. Madigan & Martinko – Brock Biology of Microorganisms.
- 4. Tortora, Funke & Case – Microbiology: An Introduction.
- 5. Cappuccino & Sherman – Microbiology: A Laboratory Manual.

SEMESTER-III
COURSE 1: BASIC MICROBIOLOGY

Practical Credits: 1 2 hrs/week

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Demonstrate Good Laboratory Practices, biosafety procedures, and proper handling of the compound light microscope and its parts.
2. Perform microscopic observation and identification of microorganisms including bacteria, algae, fungi, protozoa, and interpret electron micrographs of viruses.
3. Operate essential microbiology laboratory equipment like autoclave, hot air oven, and laminar airflow chamber by following correct working principles and aseptic techniques.

II. Laboratory/Field exercises:

1. Microbiology Laboratory: Basic Rules and Requirements
2. Laboratory equipment: Working principles of Autoclave, Hot air oven, Laminar airflow chamber.
3. Demonstration of the presence of microflora in the environment by exposing nutrient agar plates to air.
4. Study of fungal morphology using Lactophenol cotton blue.
5. Study of algal morphology using wet mount.
6. Enumeration of Bacteriophages by Plaque Assay
7. Effect of Environmental temperature on Bacterial Growth.

SEMESTER-IV
COURSE 2: TECHNIQUES IN MICROBIOLOGY

Theory

Credits: 3

3 hrs/week

I. Learning Objectives:

1. Learn principles and use of microscopes and basic staining methods.
2. Understand preparation of media and isolation of pure cultures.
3. Learn methods to estimate microbial numbers and assess growth.
4. Understand physical and chemical sterilization methods and their applications.
5. Learn biosafety levels, PPE usage, and safe handling of biohazardous materials.

II. Course Outcomes: On completion of this course students will be able to:

1. Identify microbial morphology, arrangements, and structures using different stains and microscopes.
2. Demonstrate isolation of microbes and maintain pure cultures effectively.
3. Quantify microbial populations and monitor growth patterns.
4. Sterilize media, glassware, instruments, and workspaces effectively.
5. Apply good laboratory practices to prevent contamination and ensure safety.

III. Syllabus of Theory:

No. of hrs: 9

Unit 1: Microscopy and Staining Techniques

- 1.1 Principles and applications of light microscopy, phase-contrast, and fluorescence microscopy
- 1.2 Electron microscopy: SEM and TEM, sample preparation, and applications
- 1.3 Staining methods: Simple, differential, and special staining (Gram, Acid-fast, Capsule, Endospore)

Unit 2: Culture and Isolation Techniques

No. of hrs: 9

- 2.1 Media preparation: Types of media: selective, differential, and enrichment media
- 2.2 Isolation techniques: Streak plate, spread plate, pour plate
- 2.3 Pure culture maintenance: Sub-culturing and preservation methods.

Unit 3: Quantitative and Qualitative Microbial Analysis

No. of hrs: 9

- 3.1 Microbial enumeration: Serial dilution, standard plate count, most probable number (MPN)
- 3.2 Microscopic counts: Direct counts using counting chambers with vital staining
- 3.3 Assessment of microbial growth: Turbidity measurement, spectrophotometry, and dry Weight

Unit 4: Sterilization Techniques

No. of hrs: 9

- 4.1 Physical methods: Autoclaving, dry heat, filtration, and radiation techniques
- 4.2 Chemical methods: Alcohols, phenolics, aldehydes, quaternary ammonium compounds
- 4.3 Sterilization: Sterilization of Media, glassware, instruments, and workspace

Unit 5: Biosafety and Handling Biohazardous Materials

No. of hrs: 9

- 5.1 Laboratory biosafety levels (BSL-1 to BSL-3) and PPE
- 5.2 Handling, transport, and disposal of biohazardous materials
- 5.3 Good microbiological and laboratory practices

IV. Co-curricular activities:

1. Hands-on session for students to explore different microscopes (light, phase-contrast, fluorescence) and practice staining techniques.
2. Organize a mini-competition on serial dilution, colony counting, and turbidity measurement to reinforce quantitative techniques.
3. Simulation activity where students demonstrate proper use of personal protective equipment, handling of biohazardous materials, and sterilization practices.

IV. Reference Books:

1. Appl, M. (1999). *Microbiology of Extreme Soils*. Springer.
2. Atlas, R. M. (2010). *Handbook of Microbiological Media* (4th ed.). CRC Press.
3. Cappuccino, J. G., & Sherman, N. (2014). *Microbiology: A Laboratory Manual* (10th ed.). Pearson Education.
4. Frazier, W. C., & Westhoff, D. C. (2014). *Food Microbiology* (5th ed.). McGraw-Hill Education.
5. Pelczar, M. J., Chan, E. C. S., & Krieg, N. R. (2009). *Microbiology: Concepts and Applications* (6th ed.). McGraw-Hill Education.
6. Prescott, L. M., Harley, J. P., & Klein, D. A. (2005). *Microbiology* (6th ed.). McGraw-Hill Education.
7. Tortora, G. J., Funke, B. R., & Case, C. L. (2020). *Microbiology: An Introduction* (13th ed.). Pearson Education.
8. Willey, J. M., Sherwood, L. M., & Woolverton, C. J. (2017). *Prescott's Microbiology* (10th ed.). McGraw-Hill Education.

SEMESTER-IV
COURSE 4: TECHNIQUES IN MICROBIOLOGY

Practical

Credits: 1

2 hrs/week

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Perform basic staining and microscopic techniques to study microorganisms.
2. Handle culture media and isolate pure microbial cultures using aseptic methods.
3. Estimate bacterial population using quantitative methods and follow laboratory biosafety practices.

II. Laboratory/Field exercises:

1. Compound Light microscope: Parts, handling and observation of the cultures.
2. Simple Staining Technique.
3. Gram Staining Technique.
4. Observation of electron microphotographs of viruses (Lambda, T4, TMV, HIV, SARS CoV-2, Polio).
5. Demonstration of biosafety cabinet usage.
6. Sterilization of Glassware using Hot Air Oven.
7. Preparation and Sterilization of Media using Autoclave.
8. Aseptic transfer of microbial cultures using loop and pipette.
9. Isolation of pure culture of bacteria by streak plate, pour plate and spread plate method.
10. Determination of bacterial count using standard plate count method.
11. Determination of bacterial count using turbidity (spectrophotometric) method.

KRISHNA UNIVERSITY, MACHILIPATNAM
Andhra Pradesh. India



Department Of Microbiology

**Blue Print & Model Question Papers both Theory and
Practical: (Semester III & IV)**

Single Major Program in Microbiology

KRISHNA UNIVERSITY
B.Sc., Biotechnology Honours: MAJOR/MINOR
I B.Sc., Semester III- & IV
Model Question Paper

BLUE PRINT

Sl. No.	UNIT	PART-A Short Answer Questions	PART-B Long Answer Questions
1.	UNIT - I	1 OR 2	a (OR) b
2.	UNIT - II	1 OR 2	a (OR) b
3.	UNIT - III	1 OR 2	a (OR) b
4.	UNIT - IV	1 OR 2	a (OR) b
5.	UNIT - V	1 OR 2	a (OR) b
	Total Marks	5×4M=20M	5×10M=50M

KRISHNA UNIVERSITY
B.Sc. Honours MICROBIOLOGY Major
(WITH EFFECT FROM 2025-26Admitted Batch)
Second Year/Semester-III
COURSE 5: CELL BIOLGY AND GENETICS

Time: 3 Hours

Max Marks: 70

Section – A

Answer any **FIVE** questions:

5 × 4 = 20 M

1. Golgicomplex
2. Prokaryotic cell structure
3. exocytosis
4. Oncogenes
5. Cell-to-cell signalling
6. Lethal alleles
7. Genetic drift
8. Apoptosis

Section – B

Answer **ALL** questions:

5 X 10 = 50 M

Draw labeled diagrams wherever necessary

1.a. Discuss mitosis.

Or

b. Explain structure of eukaryotic cell.

2.a. Discuss structure and functions of cell membrane.

Or

b. Write a note on endocytosis.

3.a. Write cell signaling systems.

Or

b. Explain signal transduction pathway.

4.a. Discuss on Mendal's laws.

Or

b. Explain chromosomal theory of inheritance.

5.a. Discuss theories of linkage and its significance.

Or

b. Write mechanism of sex determination.

II B.Sc., Semester III
Model Question Paper
COURSE 5: CELL BIOLOGY AND GENETICS

Practicals: 2 hrs/week

Credits: 1

1. Cultivation of phototrophic bacteria by enrichment method.
2. Effect of Temperature on *E. Coli* growth
3. Effect of pH on bacterial *E. Coli* growth
4. Effect of salt on growth of *E. coli* growth
5. Study and plot the growth curve of *E. coli* by turbidometric and standard plate count methods
6. Observation and identification of permanent slides of cyanobacteria

Practicals Model Question Paper (For both Internal & External exam)

Time: 3hrs

Max.Marks:25

1. Major experiment: 8M
2. Minor experiment: 6M
3. Identification of given spotters: 3x2=6M
4. Record & Viva voce: 5M

Total: 25M

Note: Practical Internal exam also conducted for 25M with the same pattern as given above

KRISHNA UNIVERSITY
B.Sc. Honours MICROBIOLOGY Major
(WITH EFFECT FROM 2025-26Admitted Batch)

Second Year/Semester-III

COURSE 6: Molecular Biology and Microbial Genetics

Time: 3 Hours

Max Marks: 70

Section – A

Answer any **FIVE** questions:

5 × 4 = 20 M

1. Plasmids
2. Gene splicing
3. Introns and Exons
4. Wobble hypothesis
5. Inhibitors of protein synthesis
6. Conjugation
7. SOS repair
8. Spontaneous mutations

Section – B

Answer **ALL** questions:

5 X 10 = 50 M

Draw labeled diagrams wherever necessary

1.a. Discuss semi conservative mode of DNA replication in prokaryote.

Or

b. Explain experimental evidences to DNA as genetic material in bacteria.

2.a. Define transcription and explain mechanism of transcription in prokaryotes.

Or

b. Write one gene one enzyme hypothesis.

3.a. Explain Mechanisms of translation in prokaryotes.

Or

b. Write lac operon in bacteria.

4.a. Define mutations and explain types of mutations.

Or

b. Explain outlines of DNA repair mechanism.

5.a. Discuss mechanism of conjugation in bacteria.

Or

b. Write mechanism of transformation and factors affecting the transformation.

KRISHNA UNIVERSITY
B.Sc., Microbiology Honours: MAJOR

II B.Sc., Semester III

Model Question Paper

COURSE 6: MOLECULAR BIOLOGY AND BACTERIAL GENETICS

Practicals: 2 hrs/week

Credits: 1

1. Isolation of genomic DNA from E. coli
2. Study of different types of DNA and RNA using micrographs and model / schematic representations
3. Study of semi-conservative replication of DNA through micrographs / schematic Representations
4. Resolution and visualization of DNA by Agarose Gel Electrophoresis.
5. Study of different conformations of plasmid DNA through agarose gel electrophoresis.
6. Problems related to DNA and RNA characteristics, Transcription and Translation.
7. Induction of mutations in bacteria by UV light.
8. Demonstration of bacterial transformation
9. Instrumentation in molecular biology – Ultra centrifuge, Transilluminator, PCR.

Practicals Model Question Paper (For both Internal & External exam)

Time: 3hrs

Max.Marks:25

1. Major experiment: 8M
2. Minor experiment: 6M
3. Identification of given spotters: 3x2=6M
4. Record & Viva voce: 5M

Total: 25M

Note: Practical Internal exam also conducted for 25M with the same pattern as given above

KRISHNA UNIVERSITY
B.Sc. Honours MICROBIOLOGY Major
(WITH EFFECT FROM 2025-26Admitted Batch)

Second Year/Semester-III

COURSE 7: r-DNA TECHNOLOGY, BIOINFORMATICS AND BIOSTATISTICS

Time: 3 Hours

Max Marks: 70

Section – A

Answer any **FIVE** questions:

5 × 4 = 20 M

1. PBR 322
2. Restriction endonucleases
3. FRLP
4. cDNA library
5. Copy rights
6. PUBMED
7. T test
8. DNA ligase

Section – B

Answer **ALL** questions:

5 X 10 = 50 M

Draw labeled diagrams wherever necessary

1.a. Discuss methods involved in DNA transfer in to the host cell.

Or

b. Explain steps involved in gene cloning.

2.a. Explain DNA sequencing by sangers' method.

Or

b. Write principle, steps and applications of PCR.

3.a. Write applications of genetic engineering.

Or

b. Define IPR. Write types IPR and dicuss applications of IPR in biotechnology.

4.a. Define mutations and explain types of mutations.

Or

b. Explain outlines of DNA repair mechanism.

5.a. Discuss methods to measure central tendency.

Or

b. Write uses of biostatistics software.

KRISHNA UNIVERSITY
B.Sc., Microbiology Honours: MAJOR
II B.Sc., Semester III
Model Question Paper
COURSE 7: r-DNA TECHNOLOGY, BIOINFORMATICS AND
BIOSTATISTICS

Practicals: 2 hrs/week

Credits: 1

1. Isolation of plasmid DNA by Agarose gel Electrophoresis.
2. Digestion of DNA using restriction enzymes and analysis by agarose gel electrophoresis.
3. Ligation of DNA fragments by using T4 DNA Ligase.
4. Amplification of DNA by PCR
5. Demonstrate RFLP
6. Interpretation of sequencing gel electropherograms.
7. Introduction to bioinformatics databases: NCBI, EMBL
8. Sequence retrieval using BLAST.
9. Sequence alignment using clustal W.

Practicals Model Question Paper (For both Internal & External exam)

Time: 3hrs

Max.Marks:25

1. Major experiment: 8M
2. Minor experiment: 6M
3. Identification of given spotters: 3x2=6M
4. Record & Viva voce: 5M

Total: 25M

Note: Practical Internal exam also conducted for 25M with the same pattern as given above

KRISHNA UNIVERSITY
B.Sc. Honours MICROBIOLOGY Major
(WITH EFFECT FROM 2025-26Admitted Batch)

Second Year/Semester-IV

COURSE 8: BASICS OF IMMUNOLOGY

Time: 3 Hours

Max Marks: 70

Section – A

Answer any **FIVE** questions:

5 × 4 = 20 M

1. Edward Jenner
2. Macrophage
3. Antigen
4. Agglutination and precipitation
5. Killing mechanism of NK cells
6. Opsonization
7. AIDS
8. ELISA

Section – B

Answer **ALL** questions:

5 X 10 = 50 M

Draw labeled diagrams wherever necessary

1.a. Discuss organs of immune system.

Or

b. Explain cell structure and functions of immune system.

2.a. Explain structure and functions of antibodies.

Or

b. Write antigen and antibody interactions.

3.a. Discuss humoral immunity.

Or

b. Explain cell mediated immunity.

4.a. Discuss hypersensitivity reactions.

Or

b. Explain autoimmune disorders.

5.a. Write note on vaccines.

Or

b. Discuss hybridoma technology and its applications.

KRISHNA UNIVERSITY
B.Sc., Microbiology Honours: MAJOR
II B.Sc., Semester IV
Model Question Paper
COURSE 8: BASICS OF IMMUNOLOGY

Practicals: 2 hrs/week

Credits: 1

1. Identification of human blood groups.
2. Perform Total Leukocyte Count of the given blood sample.
3. Perform Differential Leukocyte Count of the given blood sample.
4. Separate serum from the blood sample (demonstration).
5. Perform immunodiffusion by RID/ Ouchterlony method.
6. Perform Dot ELISA.

Practicals Model Question Paper (For both Internal & External exam)

Time: 3hrs

Max.Marks:25

1. Major experiment: 8M
2. Minor experiment: 6M
3. Identification of given spotters: 3x2=6M
4. Record & Viva voce: 5M

Total: 25M

Note: Practical Internal exam also conducted for 25M with the same pattern as given above

KRISHNA UNIVERSITY
B.Sc. Honours MICROBIOLOGY Major
(WITH EFFECT FROM 2025-26Admitted Batch)

Second Year/Semester-IV

COURSE 9: MEDICAL MICROBIOLOGY

Time: 3 Hours

Max Marks: 70

Section – A

Answer any **FIVE** questions:

5 × 4 = 20 M

1. Pathogen and virulence
2. Hepatitis A
3. Gonorrhea
4. Candidiosis
5. Aspergillosis
6. Transport media
7. Interferons
8. MIC test

Section – B

Answer **ALL** questions:

5 X 10 = 50 M

Draw labeled diagrams wherever necessary

1.a. Explain normal flora of human body.

Or

b. Write a note on nosocomial infections

2.a. Explain causal organism, pathogenesis, epidemiology, prevention and control of tuberculosis.

Or

b. Explain causal organism, pathogenesis, epidemiology, prevention and control of typhoid.

3.a. Explain causal organism, pathogenesis, prevention and control of malaria.

Or

b. Explain causal organism, pathogenesis, prevention and control of amebiasis

4.a. Write a note on collection and transportation of clinical samples.

Or

b. Explain biochemical methods for identification of clinical pathogens.

5.a. Explain mode of action of antibacterial drugs.

Or

b. Discuss mechanism of action of antibiotic resistance

KRISHNA UNIVERSITY
B.Sc., Microbiology Honours: MAJOR
II B.Sc., Semester IV
Model Question Paper
COURSE 9: MEDICAL MICROBIOLOGY

Practicals: 2 hrs/week

Credits: 1

-
1. Study of composition and use of important differential media for identification of bacteria: EMB Agar, McConkey agar, Mannitol salt agar, Deoxycholate citrate agar, TCBS
 2. Isolation of Normal flora of human body (Hands, Feet, Nostrils, Teeth Surface) by swab method.
 3. Identify bacteria (any three of *E. coli*, *Salmonella*, *Pseudomonas*, *Staphylococcus*, *Bacillus*)
 4. Using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC,
 5. TSI, nitrate reduction, urease production and catalase tests
 6. Study symptoms of the diseases with the help of photographs: Polio, anthrax, herpes, chicken, Pox, HPV warts, AIDS (candidiasis), dermatomycoses (ring worms)
 7. Study of various stages of malarial parasite in RBCs using permanent mounts
 8. Antibacterial sensitivity by Kirby-Bauer method
 9. Determination of minimal inhibitory concentration of an antibiotic (Streptomycin).

Practicals Model Question Paper (For both Internal & External exam)

Time: 3hrs

Max.Marks:25

-
1. Major experiment: 8M
 2. Minor experiment: 6M
 3. Identification of given spotters: 3x2=6M
 4. Record & Viva voce: 5M

Total: 25M

Note: Practical Internal exam also conducted for 25M with the same pattern as given above

KRISHNA UNIVERSITY
B.Sc. Honours MICROBIOLOGY Major
(WITH EFFECT FROM 2025-26Admitted Batch)

Second Year/Semester-IV

COURSE 10: AGRICULTURAL MICROBIOLOGY

Time: 3 Hours

Max Marks: 70

Section – A

Answer any **FIVE** questions:

5 × 4 = 20 M

- 1, Soil profile
2. Commensalism
3. Phytoalexins
4. Coconut cadang cadang
5. Citrus canker
6. Phosphate solubilizers
7. Biological control
8. Systemic fungicides

Section – B

Answer **ALL** questions:

5 X 10 = 50 M

Draw labeled diagrams wherever necessary

1.a. Explain about Microbe-Plant interaction.

Or

- b. Write a note on microbial interactions.
- 2.a. Enumerate the bacterial virulence factors.

Or

b. Explain defense mechanisms in plants towards pathogens.

3.a. Explain about different practices of disease management.

Or

b. Explain about development of genetically modified crop (BT).

4.a. Enumerate the symptoms, epidemiology and control of Black Stem Rust of Wheat.

Or

- b. Illustrate any two diseases caused by Viruses.
- 5.a. Mention the method of cultivation and field application of Baculoviruses.

Or

b. Describe the mass production and field application of VAM

KRISHNA UNIVERSITY
B.Sc., Microbiology Honours: MAJOR
II B.Sc., Semester IV
Model Question Paper
COURSE 10: AGRICULTURAL MICROBIOLOGY

Practicals: 2 hrs/week

Credits: 1

1. Study of soil profile, water activity, pH.
2. Study microflora of different types of soils.
3. Rhizobium as soil inoculant, characteristics and field application.
4. Azotobacter as soil inoculant, characteristics and field application.
5. Isolation of cellulose degrading organisms
6. Demonstration of Koch's postulates in fungal, bacterial and viral plant pathogens.
7. Study of important diseases of crop plants by cutting sections of infected plant material (microscopic observations)- Albugo, Puccinia, Ustilago, Fusarium, Colletotrichum.

Practicals Model Question Paper (For both Internal & External exam)

Time: 3hrs

Max.Marks:25

1. Major experiment: 8M
2. Minor experiment: 6M
3. Identification of given spotters: 3x2=6M
4. Record & Viva voce: 5M

Total: 25M

Note: Practical Internal exam also conducted for 25M with the same pattern as given above

KRISHNA UNIVERSITY, MACHILIPATNAM
Andhra Pradesh. India



Department Of Microbiology

**Blue Print & Model Question Papers both Theory and
Practical: (Semester III & IV)**

Minor Program in Microbiology

KRISHNA UNIVERSITY
B.Sc., Biotechnology Honours: MAJOR/MINOR
I B.Sc., Semester III- & IV
Model Question Paper

BLUE PRINT

Sl. No.	UNIT	PART-A Short Answer Questions	PART-B Long Answer Questions
1.	UNIT - I	1 OR 2	a (OR) b
2.	UNIT - II	1 OR 2	a (OR) b
3.	UNIT - III	1 OR 2	a (OR) b
4.	UNIT - IV	1 OR 2	a (OR) b
5.	UNIT - V	1 OR 2	a (OR) b
	Total Marks	5×4M=20M	5×10M=50M

KRISHNA UNIVERSITY
B.Sc. Honours MICROBIOLOGY Minor
(WITH EFFECT FROM 2025-26Admitted Batch)
Second Year/Semester-III
COURSE 1: BASIC MICROBIOLOGY

Time: 3 Hours

Max Marks: 70

Section – A

Answer any **FIVE** questions:

5 × 4 = 20 M

1. Edward Jenner
2. Alexander Fleming
3. Archaea.
4. Mode of nutrition in protozoa
5. Bacteriophage
6. Viroids
7. Selective media
8. Autotrophs

Section – B

Answer **ALL** questions:

5 X 10 = 50 M

Draw labeled diagrams wherever necessary

- 1.a. Write contributions of Louis Pasteur and Robert Koch.

Or

- b. Explain Whittaker's Five Kingdoms classification of microorganisms.

- 2.a. Discuss ultra structure of bacteria.

Or

- b. Write structural differences of cell wall of gram-positive and gram- negative bacteria.

- 3.a. Write economic importance of algae.

Or

- b. Explain general features of fungi.

- 4.a. Discuss general characteristics of viruses.

Or

- b. Explain role of viruses as useful tools in biotechnology.

- 5.a. Discuss bacterial growth curve and significance.

Or

- b. Discuss factors effecting the bacterial growth curve.

KRISHNA UNIVERSITY
B.Sc., Microbiology Honours: Minor
II B.Sc., Semester III
Model Question Paper
COURSE 1: BASIC MICROBIOLOGY

Practicals: 2 hrs/week

Credits: 1

1. Microbiology Laboratory: Basic Rules and Requirements,
2. Laboratory equipment: Working principles of Autoclave, Hot air oven, Laminar airflow chamber.
3. Demonstration of the presence of microflora in the environment by exposing nutrient agar plates to air.
4. Study of fungal morphology using Lactophenol cotton blue.
5. Study of algal morphology using wet mount.
6. Enumeration of Bacteriophages by Plaque Assay
7. Effect of Environmental temperature and pH on Bacterial Growth.

Practicals Model Question Paper (For both Internal & External exam)

Time: 3hrs

Max.Marks:25

1. Major experiment: 8M
2. Minor experiment: 6M
3. Identification of given spotters: 3x2=6M
4. Record & Viva voce: 5M

Total: 25M

Note: Practical Internal exam also conducted for 25M with the same pattern as given above

KRISHNA UNIVERSITY
B.Sc. Honours MICROBIOLOGY Minor
(WITH EFFECT FROM 2025-26Admitted Batch)

Second Year/Semester-IV

COURSE 2: TECHNIQUES IN MICROBIOLOGY

Time: 3 Hours

Max Marks: 70

Section – A

Answer any **FIVE** questions:

5 × 4 = 20 M

1. Acid fast staining
2. Principles of light microscopy
3. Enrichment media.
4. Selective media
5. Serial dilution
6. BSL-1
7. Filter sterilization
8. TEM

Section – B

Answer **ALL** questions:

5 X 10 = 50 M

Draw labeled diagrams wherever necessary

- 1.a. Write principle, sample preparation and applications of SEM.

Or

- b. Explain differential grams staining technique.

- 2.a. Discuss methods to maintain pure cultures.

Or

- b. Write methods for isolation of microorganism.

- 3.a. Write qualitative methods for assessment of microbial growth.

Or

- b. Explain microbial enumeration methods.

- 4.a. Write physical methods of sterilization.

Or

- b. Explain chemical methods of sterilization.

- 5.a. Discuss laboratory biosafety levels.

Or

- b. Explain methods to handle, transport, and disposal of biohazardous materials.

KRISHNA UNIVERSITY
B.Sc., Microbiology Honours: Minor
II B.Sc., Semester IV
Model Question Paper
COURSE 2: TECHNIQUES IN MICROBIOLOGY

Practicals: 2 hrs/week

Credits: 1

1. Compound Light microscope: Parts, handling and observation of the cultures.
2. Simple Staining Technique.
3. Gram Staining Technique.
4. Observation of electron microphotographs of viruses (Lambda, T4, TMV, HIV, SARS CoV-2, Polio).
5. Demonstration of biosafety cabinet usage.
6. Sterilization of Glassware using Hot Air Oven.
7. Preparation and Sterilization of Media using Autoclave.
8. Aseptic transfer of microbial cultures using loop and pipette.
9. Isolation of pure culture of bacteria by streak plate, pour plate and spread plate method.
10. Determination of bacterial count using standard plate count method.
11. Determination of bacterial count using turbidity (spectrophotometric) method.

Practicals Model Question Paper (For both Internal & External exam)

Time: 3hrs

Max.Marks:25

1. Major experiment: 8M
2. Minor experiment: 6M
3. Identification of given spotters: 3x2=6M
4. Record & Viva voce: 5M

Total: 25M

Note: Practical Internal exam also conducted for 25M with the same pattern as given above