

S. S. Jain Subodh P.G. College, Jaipur (Autonomous)
M. Sc. Microbiology Semester I
Assignment Oct. 2026

Paper-I
GENERAL MICROBIOLOGY

Students are required to attempt 4 questions (one question from each unit). Write answers in at least 500 words with good presentation.

UNIT-I

- Q.1. Explain the spontaneous generation controversy in detail. Discuss the experiments of Redi, Needham, Spallanzani and Louis Pasteur.
- Q.2. Write short notes on the following:
- (a) Contribution of Alexander Flemming.
 - (b) Scope of Microbiology

UNIT- II

- Q.3. What is binomial nomenclature? Explain its rules with suitable examples.
- Q.4. Compare Whittaker's five-kingdom classification with the three-domain system.

UNIT- III

- Q.5. What are acellular infectious agents? Discuss the general characteristics of viruses, viroids, virusoids and prions.
- Q.6. Write short notes on the following:
- (a) Bacterial cell morphology.
 - (b) Common shapes and size of bacteria.

UNIT-IV

- Q.7. Discuss the beneficial and harmful roles of fungi in human life, agriculture, food and industry.
- Q.8. Describe the structure and morphology of *Rhizopus* with a neat labelled diagram.

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Paper-II

BIOINSTRUMENTATION AND MICROBIAL TECHNIQUES

Students are required to attempt 4 questions (one question from each unit). Write answers in at least 500 words with good presentation.

UNIT-I

Q1. Explain in brief control of microorganism by physical, chemical and radiation method in detail.

Q2. Write short note on the following:

- (a) Types of culture media and its applications
- (b) Methods of isolation of pure culture

UNIT-II

Q3. What do you mean by staining? Write detail note on gram staining procedure with labelled diagram.

Q4. Write short note on the following:

- (a) Cultivation of bacteria and disposal methods
- (b) ELISA and PCR

UNIT-III

Q5. What do you mean by microscopy? Write detail note on SEM & TEM (Electron microscope) with diagram.

Q6. Write short note on the following:

- (a) Centrifugation
- (b) Spectrophotometer and its applications

UNIT-IV

Q7. What do you mean by chromatography technique? Write principle and applications of various types of chromatography.

Q8. Write short note on the following:

- (a) HPLC and its applications
- (b) Electrophoresis and its applications

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Paper-III

MICROBIAL BIOCHEMISTRY AND PHYSIOLOGY

Students are required to attempt 4 questions (one question from each unit). Write answers in at least 500 words with good presentation.

UNIT-I

- Q1. Describe the various mechanisms of nutrient transport across microbial cell membranes. Highlight the key biochemical and energetic differences between active transport and group translocation.
- Q2. Write Short Notes on the following:
- (a) Nutritional categories of microbes based on their carbon and energy sources.
 - (b) Classification, chemistry, and functions of polysaccharides.

UNIT-II

- Q3. Discuss the different types of enzyme inhibition (competitive, noncompetitive, uncompetitive, and allosteric) in detail. Include a brief explanation of how the "lock and key" and "induced fit" models describe biocatalysis.
- Q4. Write short, explanatory notes on the following:
- (a) The primary, secondary, tertiary, and quaternary structural levels of proteins.
 - (b) Reactions of AMINO ACIDS: carboxyl and amino groups.

UNIT-III

- Q5. Provide a detailed account of bacterial respiration, focusing on the electron transport system and oxidative phosphorylation?
- Q6. Write short notes on the following:
- (a) Major groups of photosynthetic bacteria and their characteristic photosynthetic pigments.
 - (b) Mechanisms of lactic acid fermentation.

UNIT-IV

- Q7. Describe the detailed architecture of a bacterial endospore. Explain the sequential stages of sporulation and discuss the various factors that influence this process.
- Q8. Write short notes on the following:
- (a) The roles of nitrification, denitrification, and ammonifying bacteria in the nitrogen cycle.
 - (b) Differences between symbiotic and free-living nitrogen-fixing systems.

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Paper-IV
FOOD AND DAIRY MICROBIOLOGY

Students are required to attempt 4 questions (one question from each unit). Write answers in at least 500 words with good presentation.

UNIT-I

- Q1. Explain food as a substrate for microbial growth. Describe the chemical changes caused by microorganisms during food spoilage.
- Q2. Write short note on:
- (a) Mycotoxins
 - (b) Aflatoxins

UNIT-II

- Q3. Discuss the physical methods of food preservation in detail.
- Q4. What are food additives? Discuss their types, functions and importance.

UNIT-III

- Q5. What are starter cultures? Explain their characteristics, types and applications in the dairy industry.
- Q6. Write short notes on:
- (a) Probiotics
 - (b) Synbiotics

UNIT-IV

- Q7. Compare standard plate count, direct microscopic count and reductase test.
- Q8. Write short note on the following:
- (a) Staphylococcal food poisoning
 - (b) Botulism

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Paper-I

VIROLOGY

Students are required to attempt 4 questions (one question from each unit). Write answers in at least 500 words with good presentation.

UNIT-I

- Q1. Give a detailed account of the general characteristics, morphology and ultrastructure of viruses. Discuss the structure and arrangements of capsids, different types of viral genomes with suitable examples.
- Q2. Explain the methods used for cultivation of viruses, with special reference to growth in embryonated eggs, primary cell cultures and secondary cell lines. Add a note on cyanophages and mycoviruses.

UNIT-II

- Q3. Describe the structural organization and multiplication cycle of bacteriophages. Explain the eclipse phase, phage production and burst size, and discuss the lytic and lysogenic cycles with special reference to T4 bacteriophage.
- Q4. Explain the principle and methodology of bacteriophage typing and discuss the applications and uses of bacteriophages in bacterial genetics.

UNIT-III

- Q5. Describe the classification and nomenclature of plant viruses. Discuss the major disease symptoms produced by plant viruses. (Baltimore system of classification)
- Q6. Describe the major families of human DNA and RNA viruses, their life cycles, pathogenicity, diagnosis and treatment, giving suitable examples.

UNIT-IV

- Q7. Explain the principles and procedures of serological methods used in viral diagnosis.
- Q8. Describe the various physical and chemical methods used for the assay of viruses

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Paper-II

ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY

Students are required to attempt 4 questions (one question from each unit). Write answers in at least 500 words with good presentation.

UNIT-I

- Q1. What do you mean by microbial degradation? Give a detailed account of the Microbial degradation of pesticides and heavy metals
- Q2. Write short note on:
- (a) Biodeterioration
 - (b) GMO and their impact and microbial plastics

UNIT-II

- Q3. Explain in detail various methods used in waste water treatment process.
- Q4. Write short note on:
- a) Bioremediation techniques
 - b) Monitoring of environmental with biosensors & biological indicators.

UNIT-III

- Q5. Write a detailed note on the microbial fertilizers and its applications
- Q6. Write detailed note on microbial herbicides and biopesticides and their applications.

UNIT-IV

- Q7. Explain in detail principles of plant disease control of bajra (Ergot) and Sugarcane (Red rot).
- Q8. Explain in brief microbial diseases of animals (Anthrax), their prevention and control.

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Paper III -A

GENETIC ENGINEERING

Students are required to attempt 4 questions (one question from each unit). Write answers in at least 500 words with good presentation.

UNIT-I

- Q 1.** Describe the modifications of restriction fragment ends and explain different methods used for joining DNA fragments.
- Q 2.** Describe the different enzymes used in recombinant DNA technology and explain their functions.

UNIT-II

- Q 3.** What are shuttle vectors? Explain their construction properties and applications.
- Q 4.** Write short notes on the following:
(a) Genomic library
(b) Plasmids

UNIT-III

- Q 5.** Describe the methods used for introduction of recombinant vectors into bacterial and non-bacterial cells.
- Q 6.** Write short note on the following:
(a) Human genome project
(b) Immunochemical screening.

UNIT-IV

- Q 7.** Describe Southern, Northern and Western blotting techniques and differentiate between them.
- Q 8.** Write short note on the following:
(a) Differentiate between Sanger and Maxam-Gilbert sequencing.
(b) What is PCR for mutagenesis?

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Paper-III B

PHARMACEUTICAL MICROBIOLOGY

Students are required to attempt 4 questions (one question from each unit). Write answers in at least 500 words with good presentation.

UNIT-I

- Q1. Discuss the scope and importance of pharmaceutical microbiology in the modern drug industry. Describe the specific roles and responsibilities of a pharmaceutical microbiologist.
- Q2. Write short, explanatory notes on the following:
- (a) Differences and applications of chemical disinfectants, antiseptics, and preservatives.
 - (b) Antifungal and antitumor antimicrobial substances.

UNIT-II

- Q3. Explain the primary mechanisms of action of antibiotics, focusing specifically on the inhibitors of cell wall, nucleic acid, and protein synthesis. How do bacteria ultimately develop resistance to these targeted mechanisms?
- Q4. Write short, explanatory notes on the following:
- (a) Drug delivery systems utilized in gene therapy.
 - (b) Molecular principles of drug targeting.

UNIT-III

- Q5. Describe the microbial contamination and spoilage of pharmaceutical products, comparing the risks and sterilization approaches for sterile injectables, ophthalmic preparations, and implants.
- Q6. Write short, explanatory notes on the following:
- (a) Advancements in new vaccine technology (DNA vaccines and synthetic peptide vaccines).
 - (b) Pharmaceuticals produced by microbial fermentations (Streptokinase and Streptodornase).

UNIT-IV

- Q7. Discuss in detail about the principles of sterilization control and sterility testing?
- Q8. Write short, explanatory notes on any TWO of the following:
- (a) An elementary overview of the Indian Pharmacopoeia (IP), British Pharmacopoeia (BP), and United States Pharmacopeia (USP).
 - (b) Quality assurance and quality management certifications (ISO, WHO, and US certification).
 - (c) Chemical and biological indicators used in sterilization

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Paper-IVA

MICROBES IN SUSTAINABLE DEVELOPMENT

Students are required to attempt 4 questions (one question from each unit). Write answers in at least 500 words with good presentation.

UNIT-I

Q1. Describe soil as a microbial habitat. Discuss the diversity, distribution and factors affecting the distribution of microorganisms in soil.

Q2. Write short notes on:

- (a) Mechanisms of microbial biocontrol.
- (b) Microbial agents used for control of plant pathogens and insects

UNIT-II

Q3. Discuss the microbial transformations of phosphate, nitrate, silica and potassium in soil. Explain their significance in nutrient cycling.

Q4. Write short notes on:

- (a) Microbial production and control of methane (CH₄)
- (b) Microbial degradation of lignin and humus

UNIT-III

Q5. Describe genetically modified (GM) crops. Discuss their advantages and associated social and environmental aspects, with special reference to Bt crops and Golden Rice.

Q6. Write short notes on:

- (a) Rhizobium, Bradyrhizobium and Frankia as symbiotic biofertilizers.
- (b) Azotobacter and Azospirillum as non-symbiotic biofertilizers.

UNIT-IV

Q7. Explain the microbial production of bioethanol and biodiesel. Discuss their commercial production from lignocellulosic wastes and algal biomass.

Q8. Write short notes on:

- (a) Microbial degradation of xenobiotics.
- (b) Microbial removal of heavy metals and mineral recovery in bioremediation

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Paper-IV B

FUNGAL BIOTECHNOLOGY AND BIOPROSPECTING

Students are required to attempt 4 questions (one question from each unit). Write answers in at least 500 words with good presentation.

UNIT-I

- Q1. Discuss the screening methods for industrially useful fungal metabolites, detailing the principles of enrichment culture and auxanography. Differentiate between primary and secondary products of fungal metabolism.
- Q2. Write short, explanatory notes on the following:
- (a) Different habitats and ecological groups of fungi.
 - (b) Classification of fungal secondary metabolites.

UNIT-II

- Q3. Explain the principles of fermenter design and operation specifically tailored for fungal biotechnological processes. How does the formulation of the fermentation medium impact the fungal system?
- Q4. Write short, explanatory notes on the following:
- (a) Types of fermenters used in fungal systems.
 - (b) Fungal strain improvement.

UNIT-III

- Q5. Detail the advancements in mushroom cultivation technology. Include a comprehensive overview of commercial mushroom species cultivation, spawn production, and the nutritional aspects of mushrooms.
- Q6. Write short notes on the following:
- (a) Production and significance of Mycoproteins.
 - (b) Fungal biofertilizers and biopesticides.

UNIT-IV

- Q7. Describe the biotechnological production process of industrially important products from fungi, focusing specifically on the commercial production of citric acid and amylase.
- Q8. Write short, explanatory notes on the following:
- (a) Fungal biomedical products and therapeutic peptides.
 - (b) Production of antibiotics from fungi.