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# M.Sc. (Microbiology) (Semester - I) (New) (NEP CBCS) Examination: March/April - 2026
## Microbial Diversity and Taxonomy (2316101)

Day & Date: Friday, 17-04-2026 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

**Instructions:** 1) All questions are compulsory.
2) Draw neat labeled diagrams wherever necessary.
3) Figures to the right indicate full marks.

**Q.1 A) Rewrite the sentence by selecting correct alternative given below. 08**

1) _____ are found in extreme environments.
   a) Eubacteria b) Micrococci
   c) Archaebacteria d) Mycobacterium

2) Linnaeus evolved a system of nomenclature called _____.
   a) Vernacular b) Monomial
   c) Binomial d) Polymial

3) Sexual reproduction is absent in _____.
   a) Volvox b) Nostoc
   c) Aspergillus d) Ulothrix

4) _____ proposed the phylogenetic tree for living entities.
   a) Carlo Urbani b) Louis Pasteur
   c) Robert Koch d) Carl Wose

5) Supporting Endosymbiotic theory, mitochondria and chloroplasts have _____ member.
   a) double b) thin
   c) thick d) single

6) Type strain is used for referring to _____.
   a) species b) Genus
   c) family d) order

7) According to Bergey's manual of systematic bacteriology, prokaryotes belong to _____ group.
   a) Gracilicutes b) Fermicutes
   c) Tenericutes d) Mendocicutes

8) %similarly (%) of each strain to every other strain is calculated by _____.
   a) Numerical taxonomy b) Genetic relatedness
   c) Intuitive method d) DNA homology

**B) True or False:** **04**

1) Carl Wose proposed two domain classification.
2) Lichens are indicators of pollution.
3) Methanogens grow anaerobically on cellulosic material to produce methane, $CO_2$ and hydrogen.
4) Kingdom-Division-Class-Order-Family-Genus-Species, is correct order of taxonomic groups.

**Q.2 Answer the following. (Any Six)** **12**

**a)** Nomenclature
**b)** Methanogenesis
**c)** Alkalophiles
**d)** Importance of microbial evolution
**e)** Ecosystem
**f)** Hydrosphere
**g)** Mycorrhiza
**h)** Termoenzymes

**Q.3 Answer the following. (Any Three)** **12**

**a)** Dead sea and desert
**b)** Osmoadaptation
**c)** Hierarchical organization
**d)** Microbial phylogeny

**Q.4 Answer the following. (Any Two)** **12**

**a)** Theoretical aspects of evolutionary analysis
**b)** Classification and habitat of Methanogens
**c)** Carl Woese classification

**Q.5 Answer the following. (Any Two)** **12**

**a)** Role of DNA and RNA hybridization in taxonomy
**b)** Metabolic characters used in taxonomy
**c)** Whittaker's five kingdom classification

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# M.Sc. (Microbiology) (Semester - I) (New) (NEP CBCS) Examination: March/April - 2026
## Recent Trends in Virology (2316102)

Day & Date: Monday, 20-04-2026 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

**Instructions:** 1) All questions are compulsory.
2) Figures to the right indicate full marks.

**Q.1 A) Choose correct alternative. (MCQ)** **08**

1) Viruses are considered obligate parasites because: _____.
   a) They can grow on an artificial medium
   b) They depend on host cell machinery for replication
   c) They are prokaryotes
   d) They can synthesize ATP independently

2) The lytic cycle of bacteriophage results in _____.
   a) Integration of phage DNA into the host genome
   b) Immediate replication and lysis of the host cell
   c) Latent infection without replication
   d) Chronic infection

3) Which of the following statements are true about a virion?
   a) Lytic phage
   b) Lysogenic phage
   c) The viral capsid
   d) An infectious and fully formed viral particle

4) Which of the following is an immunological method of virus detection?
   a) ELISA b) Gradient centrifugation
   c) Ultrafiltration d) Plaque assay

5) Infectious RNA particles without the protein coat are called _____.
   a) Prion b) Virion
   c) Viroid d) Virusoid

6) Baltimore classification divides viruses into _____.
   a) 7 groups b) 5 groups
   c) 4 groups d) 10 groups

7) The genetic material of the Tobacco Mosaic Virus (TMV) is _____.
   a) Single-stranded DNA b) Double-stranded DNA
   c) Single-stranded RNA d) Double-stranded RNA

8) Which of the following can be used as host cells for culturing animal viruses?
   a) Chicken eggs  b) Seeds
   c) Wood  d) Leaves

**B) Write True or False.** **04**

1) Prions are infectious nucleic acids without proteins.
2) Temperate bacteriophages can undergo lysogeny and the Lytic cycle.
3) Purification of viruses can be done by the ELISA method.
4) The genetic material of T4 Bacteriophages is double-stranded RNA.

**Q.2 Answer the following. (Any Six)** **12**

**a)** Define Prions.
**b)** Give the names of methods used for the cultivation of viruses.
**c)** Define prophage.
**d)** Give any two names of antiviral drugs.
**e)** Define interferon.
**f)** Give any two names of vaccines that can control viral infections.
**g)** Write the only symptoms of Coronavirus.
**h)** Give the names of any two DNA viruses.

**Q.3 Answer the following. (Any Three)** **12**

**a)** Write a note on the morphology and ultra-structure of viruses.
**b)** Write a note on the purification of viruses by ELISA.
**c)** Explain oncogenesis by DNA viruses.
**d)** Write a note on Viroids.

**Q.4 Answer the following. (Any Two)** **12**

**a)** Describe the control of viral infections by Antiviral drugs and Antibodies.
**b)** Explain in detail the cultivation of viruses by using embryonated eggs.
**c)** What is an assay of viruses and write a note on the assay of viruses by Infectivity Assay.

**Q.5 Answer the following. (Any Two)** **12**

**a)** Explain in detail emerging viral infections by EBOLA.
**b)** Describe in detail the lambda lysogeny interactions and cascade.
**c)** Explain in detail the Pathogenesis of Plant Virus e.g., TMV.

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# M.Sc. (Microbiology) (Semester - I) (New) (NEP CBCS) Examination: March/April – 2026
## Diagnostic Microbiology (2316107)

Day & Date: Wednesday, 22-04-2026 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

**Instructions:** 1) All questions are compulsory.
2) Figures to the right indicate full marks.

**Q.1 A) Choose correct alternative. (MCQ)** **08**

1) Standard Operating Procedures (SOPs) are _____.
   a) Optional guidelines
   b) Written instructions for routine procedures
   c) Verbal rules
   d) Experimental errors

2) HEPA filters in biosafety cabinets removes _____.
   a) Microorganisms and particles
   b) Large particles only
   c) Only gases
   d) Only dust

3) BSL-3 laboratories are designed for _____.
   a) Food testing b) Airborne infectious agents
   c) Soil microbes only d) Water purification

4) The etiological agent of peptic ulcer is _____.
   a) Escherichia coli b) Vibrio cholerae
   c) Salmonella typhi d) Helicobacter pylori

5) Transmission of leptospirosis occurs through _____.
   a) Mosquito bite
   b) Contaminated water/animal urine
   c) Air
   d) Food only

6) Before collecting throat sample, patient should _____.
   a) Eat food b) Drink water
   c) Avoid eating/drinking d) Sleep

7) The term microbiome refers to _____.
   a) Only bacteria in soil
   b) All microorganisms and their genes in a habitat
   c) Only viruses in humans
   d) Only fungi in environment

8) Probiotics help in _____.
   a) Causing infection  b) Restoring gut microbiota
   c) Destroying immunity  d) Increasing toxins

**B) Write True/False.** **04**

1) The gut contains the largest population of microorganisms in the human body.
2) Herpes causes vesicular lesions on skin or mucosa.
3) UV light should remain on during work in biosafety cabinets.
4) FMT is mainly used to treat recurrent Clostridioides difficile infection

**Q.2 Answer the following. (Any Six)** **12**

**a)** Write on mode of transmission and symptoms of Ascaris lubricoides.
**b)** Explain the method of collection of CSF.
**c)** Enlist methods of discarding biohazardous waste.
**d)** What are the methods of transport of clinical samples to laboratory?
**e)** Give significance human microbiome.
**f)** What are the precautions required during collection of blood sample?
**g)** What are the symptoms of Rubella?
**h)** Write in brief Good laboratory practices.

**Q.3 Answer the following. (Any Three)** **12**

**a)** Discuss probiotic therapy in detail.
**b)** Describe laboratory diagnosis of Rubiola.
**c)** Write in detail on storage of clinical samples.
**d)** What are Good microbiological practices?

**Q.4 Answer the following. (Any Two)** **12**

**a)** Give Details of using protective clothing, and specification for BSL-1, BSL-2, and BSL-3.
**b)** Write on modes of transmission, symptoms, laboratory diagnosis, prophylaxis and treatment of disease caused by Helicobacter pyelori.
**c)** Write on modes of transmission, symptoms, laboratory diagnosis, prophylaxis and treatment of disease caused by Balantidium coli.

**Q.5 Answer the following. (Any Two)** **12**

**a)** Write on Human microbiome and disease association. Focus on fecal transplant therapy.
**b)** Discuss various types of samples collected for diagnosis. Write on methods of collection of urine and fecal samples.
**c)** Describe symptoms, laboratory diagnosis, prophylaxis and treatment of Herpes.

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# M.Sc. (Microbiology) (Semester - I) (New) (NEP CBCS) Examination: March/April – 2026
## Techniques in Microbiology I (2316108)

Day & Date: Wednesday, 22-04-2026 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

**Instructions:** 1) All questions are compulsory.
2) Figures to the right indicate full marks.

**Q.1 A) Choose correct alternatives:** **08**

1) Spectrophotometers are widely used in _____.
   a) Determining the purity of DNA and RNA samples
   b) Measuring blood pressure
   c) Determining soil texture
   d) Analyzing sound waves

2) Laminar air flow chambers are used in _____.
   a) Magnetic resonance imaging (MRI)
   b) Sterile tissue culture work
   c) Blood sample centrifugation
   d) Noise reduction

3) The key principle of an electron microscope is _____.
   a) Use of electron beams instead of light
   b) Use of visible light to magnify images
   c) Measurement of sound waves
   d) Separation of isotopes

4) Dark field microscopy is useful for _____.
   a) Measuring light intensity
   b) Observing DNA samples
   c) Viewing live, unstained specimens
   d) Measuring pH values

5) The key advantage of using radioisotopic tracers in biochemical studies is _____
   a) They are highly stable
   b) They are detectable in very small amounts
   c) They have no radiation effects
   d) They react chemically with substances in the body

6) In agarose gel electrophoresis, DNA moves towards the _____.
   a) Anode b) cathode
   c) the center of the gel d) remains stationary

7) Fluorescence Lifetime Imaging Microscopy can be used to study _____.
   a) Protein-protein interactions
   b) Protein conformation and binding
   c) Sample morphology
   d) Light scattering in materials

8) _____ is a key advantage of nanomaterials in diagnostics and imaging.
   a) Poor biocompatibility
   b) Low surface area
   c) High surface-to-volume ratio
   d) Limited interaction with biological systems

**B) Fill in the blanks.** **04**

1) _____ is the size range typically associated with nanoparticles.
2) _____ radioisotope is commonly used for labelling in DNA research.
3) _____ are semiconductor particles a few nanometres in size with optical and electronic properties.
4) The working principle of a colorimeter is based on _____ law.

**Q.2 Answer the following. (Any Six)** **12**

**a)** What is the principle of Phase contrast microscope? State its applications.
**b)** Give significance of SDS.
**c)** State two applications of autoradiography.
**d)** Applications of ORD.
**e)** What is the principle of FILM? Give its application.
**f)** Applications of carbon nanoparticles.
**g)** What is the principle of Centrifuge machine? Give its application.
**h)** Differentiate paper and thin later chromatography.

**Q.3 Answer the following. (Any Three)** **12**

**a)** Describe in brief principle, working and applications of electron microscope.
**b)** Give details of agarose gel electrophoresis.
**c)** Brief on principle and applications of confocal fluorescence microscopy.
**d)** Write on different types of nanoparticles.

**Q.4 Answer the following. (Any Two)** **12**

**a)** Describe in detail Nano fertilizers and Nano pesticides.
**b)** Give principle and applications of scanning tunnelling electron microscopy.
**c)** Write on principle, instrumentation and applications UV-visible spectrophotometry.

**Q.5 Answer the following. (Any Two)** **12**

**a)** Explain in detail nanoparticles synthesis and characterization.
**b)** Describe in brief Atomic absorption spectroscopy.
**c)** Radio-isotopic techniques for detection and analysis of biomolecules.

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# M.Sc. (Microbiology) (Semester - I) (New) (NEP CBCS) Examination: March/April – 2026
# Research Methodology (2316103)

Day & Date: Friday, 24-04-2026 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

**Instructions:** 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Draw neat labeled diagrams wherever necessary.

**Q.1 A) Choose correct alternative.** **08**

1) Research is primarily conducted to _____.
   a) Earn money b) Generate new knowledge
   c) Pass exams d) None

2) _____ type of research focuses on solving immediate problems.
   a) Basic research b) Applied research
   c) Descriptive research d) Analytical research

3) A good research design should be _____.
   a) Flexible b) Rigid
   c) Expensive d) Lengthy

4) independent variable is _____.
   a) Dependent on outcome b) Manipulated variable
   c) Constant d) None

5) _____ is a reliable literature database.
   a) Facebook b) PUBMED
   c) WhatsApp d) Instagram

6) Primary data is collected through _____.
   a) Books b) Journals
   c) Surveys d) Reports

7) IMRAD format stands for _____.
   a) Introduction, Methods, Results, Discussion
   b) Index, Method, Report, Data
   c) Intro, Model, Review, Data
   d) None

8) Plagiarism means _____.
   a) Original writing b) Copying without credit
   c) Referencing d) Editing

**B) True or False.** **04**

1) Research always involves hypothesis testing.
2) Exploratory research helps in defining problems.
3) Secondary data is always more reliable than primary data.
4) Peer review improves research quality.

**Q.2 Answer the following. (Any Six)** **12**

**a)** What is PUBMED? Give it's importance.
**b)** State any two objectives of research.
**c)** What is research design?
**d)** Define hypothesis
**e)** What is literature survey?
**f)** Name two search engines used for research.
**g)** What is primary data?
**h)** What is abstract in research paper?

**Q.3 Answer the following. (Any Three)** **12**

**a)** Discuss types of hypotheses.
**b)** Explain importance of literature survey.
**c)** Describe methods of data collection
**d)** Write an account on Google, NCBI and PUBMED

**Q.4 Answer the following. (Any Two)** **12**

**a)** Explain methods of research in detail.
**b)** Discuss exploratory and descriptive research design.
**c)** Explain tools and techniques of data collection with examples.

**Q.5 Answer the following. (Any Two)** **12**

**a)** Describe the process of publication and peer review.
**b)** Explain on Questionnaire as tool of data collection.
**c)** Describe in detail ‘Types of reports’.

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# M.Sc. (Microbiology) (Semester - II) (New) (NEP CBCS) Examination: March/April – 2026
# Pharmaceutical Microbiology (2316201)

Day & Date: Thursday, 16-04-2026 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

**Instructions:** 1) All questions are compulsory.
2) Draw neat labeled diagrams wherever necessary.
3) Figures to the right indicate full marks.
4) Use of log table and calculators is allowed.

**Q.1 A) Rewrite the following sentences the correct alternative. 08**

1) _____ is a potential disadvantage of DNA vaccines.
   a) They are limited to a small number of specific antigens
   b) They do not pose a risk of altering the host's genetic material
   c) They often induce a weaker immune response in larger animals and humans compared to traditional vaccines
   d) They cannot be designed and produced quickly to respond to new viral variants

2) In a pharmaceutical microbiology lab, if a spill of a live microbial culture occurs _____ is the correct first-response procedure.
   a) Immediately wipe the spill with a dry cloth
   b) Cover the spill with an absorbent material and then disinfect it
   c) Pour water over the spill to dilute it
   d) Inform the waste disposal department immediately without handling it

3) _____ is a common vector used to deliver genes in gene therapy.
   a) Antibodies b) Hormones
   c) Viruses and plasmids d) Carbohydrates

4) _____ is the most effective way for a patient to help prevent the development of antibiotic resistance.
   a) Stop taking the antibiotic as soon as symptoms disappear
   b) Share leftover antibiotics with family members for future use
   c) Complete the full course of antibiotics as prescribed, even if they feel better
   d) Ask the doctor for a stronger antibiotic for the next time

5) _____ is the primary risk associated with microbial contamination in pharmaceutical products.
   a) Reduced shelf life
   b) Altered product color
   c) Compromised safety, quality, and efficacy
   d) Inefficient packaging

6) _____ is the process of using the three-dimensional structure of a microbial target protein to design a new drug molecule.
   a) Ligand-based drug design (LBDD)
   b) Quantitative Structure-Activity Relationship (QSAR)
   c) Structure-based drug design (SBDD)
   d) High-throughput screening (HTS)

7) _____ methods is used for sterility testing of parenterals and ophthalmics.
   a) Direct Inoculation  b) Membrane Filtration
   c) Autoclaving  d) Chemical Sterilization

8) _____ is the primary goal of GMP in pharmaceutical microbiology.
   a) To increase production speed
   b) To ensure consistent product quality and safety from microbial contamination
   c) To lower manufacturing costs
   d) To reduce the amount of final product testing

**B) Write True or False:** **04**

1) Synthetic peptide train the immune system to recognize and attack tumor-specific antigens that are not present on healthy cells.
2) Magic bullet would specifically seek out and destroy disease-causing microorganisms without harming healthy cells.
3) Regulatory affairs ends once a drug receives marketing authorization.
4) A preservative is not a terminal sterilant.

**Q.2 Answer the following. (Any Six)** **12**

**a)** What are synthetic peptide vaccines.
**b)** Enlist the preservatives used in pharmaceutical products.
**c)** What is gene therapy?
**d)** What is drug diffusion?
**e)** How are ophthalmic preparations spoiled?
**f)** What are the good manufacturing practices?
**g)** How is the waste disposal managed in pharmaceuticals.
**h)** Enlist the microbial enzymes applied in the pharmaceuticals.

**Q.3 Attempt the following. (Any Three)** **12**

**a)** Write an account on the biological indicators used in pharmaceuticals.
**b)** Explain the safety measures required in the microbiology laboratory.
**c)** Write an account on the regulatory practices in pharmaceuticals.
**d)** Explain the factors contributing to bacterial resistance of antibiotics.

**Q.4 Attempt the following. (Any Two)** **12**

**a)** What is drug targetting? Explain the molecular principles of drug targetting.
**b)** Write an account on drug immobilization procedure and it's application in pharmaceuticals.
**c)** Explain the sterility testing for validation of pharmaceutical products.

**Q.5 Attempt the following. (Any Two)** **12**

**a)** Write an essay on biosensors in pharmaceuticals.
**b)** Explain the action of chemical disinfectants and antiseptics.
**c)** Describe the characteristics of an ideal antimicrobial agent.

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# M.Sc. (Microbiology) (Semester - II) (New) (NEP CBCS) Examination: March/April – 2026
## Microbial Biochemistry (2316202)

Day & Date: Saturday, 18-04-2026 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

**Instructions:** 1) All questions are compulsory.
2) Figures to the right indicate full marks.

**Q.1 A) Choose correct alternative. (MCQ)** **08**

1) _____ is the general formula of Carbohydrates.
   a) $(C_4H_2O)_n$ b) $(C_6H_2O)_n$
   c) $(CH_2O)_n$ d) $(C_2H_2O)_n$ COOH

2) Pyruvate dehydrogenase complex is an example of _____.
   a) Allosteric enzyme b) Multienzyme complex
   c) Isoenzyme d) Zymogen

3) Allosteric effectors bind to the ____.
   a) Active site b) Inhibitory site
   c) Regulatory site d) Product site

4) _____ vitamin functions as both, hormone and visual pigment.
   a) Thiamine b) Retinal
   c) Riboflavin d) Folic acid

5) _____ of the following is a fat-soluble vitamin.
   a) Vitamin B12 b) Vitamin C
   c) Vitamin D d) Vitamin B6

6) _____ type of inhibition can be reversed by increasing substrate concentration.
   a) Non-competitive b) Competitive
   c) Irreversible d) Uncompetitive

7) _____model explains cooperativity in allosteric enzymes.
   a) Induced fit model b) MWC model
   c) Lock and key model d) Michaelis-Menten model

8) Catalase protects the cell from _____.
   a) Alcohol toxicity b) Oxygen toxicity
   c) Heat shock d) Nitrogen toxicity

**B) Write Short Answer.** **04**

1) Name one microbial hormone
2) What is osmosis?
3) Name two fat-soluble vitamins.
4) Which vitamin deficiency causes scurvy?

**Q.2 Answer the following. (any Six)** **12**

**a)** Define polysaccharide.
**b)** Explain hormones.
**c)** Define alpha oxidation.
**d)** Explain Prostaglandins.
**e)** Define and explain fat soluble vitamins.
**f)** What is irreversible inhibition? Example.
**g)** Explain role of Chymotrypsin and lysozyme.
**h)** Define osmosis and reverse osmosis.

**Q.3 Answer the following. (Any Three)** **12**

**a)** Give an account of types of fatty acids with examples.
**b)** Explain Multienzymes with examples.
**c)** Explain reversible inhibition of enzymes.
**d)** Write a note on oxygen toxicity.

**Q.4 Answer the following. (Any Two)** **12**

**a)** Explain various mechanisms of Drug metabolism.
**b)** What is kinetics, write on Briggs and Haldane modification.
**c)** Describe classification of carbohydrates with structures.

**Q.5 Answer the following. (Any Two)** **12**

**a)** Write on degradation of aliphatic hydrocarbons by $\beta$ oxidation with one example.
**b)** Explain chemical nature of proteins and explain structural features of protein.
**c)** Give an account of type of fatty acids with examples.

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# M.Sc. (Microbiology) (Semester - II) (New) (NEP CBCS) Examination: March/April - 2026
## Bioinformatics and Biostatistics (2316207)

Day & Date: Tuesday, 21-04-2026 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

**Instructions:** 1) All questions are compulsory.
2) Figures to the right indicate full marks.

**Q.1 A) Choose correct alternative. (MCQ) 08**

1) Which tool is used for finding sequence similarity in biological data?
   a) BLAST b) RASMOL
   c) PubMed d) Ligand Explorer

2) Which of the following is NOT a nucleic acid sequence database?
   a) GenBank b) EMBL
   c) DDBJ d) SWISS-PROT

3) Which software is commonly used for molecular visualization?
   a) RASMOL b) BLAST
   c) FASTA d) PubMed

4) DNA microarrays are primarily used to study _____.
   a) Protein 3D structure b) Gene expression patterns
   c) Genome editing d) Metabolomics

5) FASTA format is commonly used for the _____.
   a) Protein 3D structures b) Sequence alignment
   c) Literature databases d) Pathway mapping

6) Mean, Median, and Mode are examples of _____.
   a) Measures of dispersion b) Measures of central tendency
   c) Probability distributions d) Regression statistics

7) The graphical representation of data using bars is called _____.
   a) Pie chart b) Histogram
   c) Line graph d) Scatter plot

8) In ANOVA, which assumption is NOT required?
   a) Random sampling
   b) Normal distribution of errors
   c) Homogeneity of variances
   d) Perfect correlation between variables

**B) Write true/false.** **04**

1) EMBL is a European nucleotide sequence database.
2) Phylogenetic trees show evolutionary relationships among species.
3) P-value helps in hypothesis testing.
4) The probability value can be greater than 1.

**Q.2 Answer the following. (Any Six)** **12**

**a)** Name any two protein sequence databases.
**b)** Define functional genomics.
**c)** What is the full form of DDBJ?
**d)** What is proteomics?
**e)** What is a histogram?
**f)** What is the shape of a normal distribution curve?
**g)** What is the purpose of the Chi-square test?
**h)** Define Variance.

**Q.3 Answer the following. (Any Three)** **12**

**a)** Write a note on Genomics.
**b)** Write a note on BLAST.
**c)** Explain TrEMBL as a protein sequence database.
**d)** Write a note on Measures of Central Tendency.

**Q.4 Answer the following. (Any Two)** **12**

**a)** Discuss PubMed as an open-access bibliographic resource.
**b)** Describe the major sequence databases: GenBank, EMBL, and DDBJ.
**c)** What is the meaning of a P-value? Explain its role in hypothesis testing.

**Q.5 Answer the following. (Any Two)** **12**

**a)** What are motifs? Explain the importance of motif searches in bioinformatics.
**b)** Explain the various methods used for phylogenetic tree construction.
**c)** Describe various diagrammatic and graphical data representation types with neat diagrams and examples.

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# M.Sc. (Microbiology) (Semester - II) (New) (NEP CBCS) Examination: March/April – 2026
# Physiology and Metabolism (2316208)

Day & Date: Tuesday, 21-04-2026 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

**Instructions:** 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Draw neat labelled diagrams wherever necessary.

**Q.1 A) Choose correct alternative. (MCQ) 08**

1) The movement of water across a bacterial cell membrane from high concentration to low concentration without the help of a carrier is an example of _____.
   a) Active transport b) Group translocation
   c) Simple diffusion d) Amino acid permeation

2) Transport that requires metabolic energy (ATP or a proton gradient) to move substances against a concentration gradient is known as _.
   a) Passive transport b) Group translocation
   c) Simple diffusion d) Active transport

3) The ability of the TCA cycle to function in both catabolic (breakdown) and anabolic (synthesis) processes is why it is described as _____ in nature.
   a) Amphibolic b) Anaplerotic
   c) Cataplerotic d) Oxidative

4) The biosynthetic pathway for saturated fatty acids involves the sequential addition of two-carbon units derived from _____.
   a) Pyruvate b) Acetyl-CoA
   c) Glycerol d) Succinate

5) The $\omega$-oxidation pathway specifically involves the oxidation of the _____ carbon atom of the hydrocarbon chain.
   a) Alpha ($\alpha$) b) Beta ($\beta$)
   c) First d) Terminal methyl ($\omega$)

6) When a microbial cell is placed in a hypertonic solution, water leaves the cell, causing the plasma membrane to separate from the cell wall, a process called _____.
   a) Reverse osmosis b) Turgor
   c) Plasmolysis d) Swelling

7) The enzyme that catalyzes the breakdown of hydrogen peroxide ($H_2O_2$) into water and oxygen, protecting the cell from oxidative damage, is _____.
   a) Catalase b) Superoxide dismutase
   c) Peroxidase d) Hydroxylase

8) The transport mechanism that chemically modifies the nutrient as it is brought into the bacterial cell is called ____.
   a) Simple diffusion b) Group translocation
   c) Active transport d) Facilitated diffusion

**B) Write True or False:** **04**

1) Permeases in E. coli are specific proteins that facilitate the transport of solutes like amino acids and inorganic ions across the membrane.
2) Saturated fatty acid synthesis proceeds by the sequential removal of two-carbon units in a cycle.
3) Superoxide dismutase detoxifies the superoxide radical ($O2^-$) by converting it directly into water and oxygen.
4) De novo synthesis of purines builds the complete ring structure directly onto a ribose sugar backbone.

**Q.2 Answer the following. (Any Six)** **12**

**a)** What is osmosis?
**b)** Which is the final electron acceptor in the electron transport chain?
**c)** Which is the first fully formed purine nucleotide in the de novo pathway?
**d)** Which is the main organ responsible for drug metabolism in the human body?
**e)** Which harmless products are produced by the action of catalase on hydrogen peroxide?
**f)** What is the role of Autoinducer-3 (AI-3)?
**g)** What is osmotic stresses?
**h)** Why Anaplerotic Reactions of Citric Acid Cycle (TCA cycle) are Necessary?

**Q.3 Write short notes. (Any Three)** **12**

**a)** Bacterial permeation.
**b)** Structure of mitochondria.
**c)** Amino acid synthesis pathway.
**d)** Drug metabolism.

**Q.4 Answer the following. (Any Two)** **12**

**a)** Describe in detail ETC.
**b)** Explain in detail oxidation of aromatic hydrocarbons.
**c)** Write in detail on microbial hormones and their significance.

**Q.5 Answer the following. (Any Two)** **12**

**a)** Explain in detail on oxygen toxicity.

**b)** Describe in detail various transport mechanisms across the cell membrane.

**c)** Write in detail on oxidation of alkanes and alkenes.

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Set **P**

# M.Sc. (Microbiology) (Semester - III) (New) (NEP CBCS)
## Examination: March/April – 2026
## Principles of Bioinstrumentation and Techniques (2316301)

Day & Date: Friday, 17-04-2026 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

**Instructions:** 1) All questions are compulsory.
2) Figures to the right indicate full marks.

**Q.1 A) Choose correct alternative. (MCQ)** **08**

1) The buffers resist changes in pH because they _____.
   a) Completely dissociate in water
   b) Contain a weak acid and its conjugate base
   c) Do not ionize at all
   d) Contain only strong acids

2) _____ is the main principle of electrophoresis.
   a) Solubility differences
   b) Migration of charged particles in an electric field
   c) Density differences
   d) Enzyme activity

3) Which of the following applies to Affinity chromatography?
   a) Porous beads
   b) Specific ligand-receptor interaction
   c) Electric field
   d) Mass difference

4) X-ray diffraction is primarily used to _____ study.
   a) Protein secondary structure
   b) Crystal structures of macromolecules
   c) DNA melting curves
   d) Enzyme kinetics

5) Which of the following phenomena is the basis of UV-visible spectroscopy?
   a) Vibrational transitions b) Electronic transitions
   c) Spin transitions d) Nuclear resonance

6) MALDI-TOF is widely used for _____.
   a) Protein sequencing and mass analysis
   b) X-ray diffraction
   c) Electrophoresis
   d) Chromatography

7) Transmission Electron Microscopy is mainly used for _____ study.
   a) Surface structures
   b) Internal ultrastructure
   c) Whole organism morphology
   d) Protein folding

8) The numerical aperture of a lens is directly related to _____.
   a) Resolution
   b) Magnification
   c) Refraction only
   d) Focal length

**B) Write True / False.** **04**

1) In potentiometric titration, changes in conductivity are measured.
2) SDS-PAGE separates proteins based on their net charge.
3) ESR spectroscopy detects vibrational modes of molecules.
4) In isoelectric focusing, proteins migrate to the point where pH = pI.

**Q.2 Answer the following. (Any Six)** **12**

**a)** Define buffer and give one example.
**b)** Write any two applications of Circular Dichroism (CD) spectroscopy.
**c)** Define Beer-Lambert law.
**d)** Define resolving power in microscopy.
**e)** Define pH and pOH.
**f)** Enlist the various types of chromatography.
**g)** What is the principle of capillary electrophoresis?
**h)** Write any two applications of Mass Spectroscopy.

**Q.3 Answer the following. (Any Three)** **12**

**a)** Write a short note on the Titration curve that reveals the pKa of a weak Acid.
**b)** Write a short note on the concept of Potentiometric.
**c)** Explain in short Gel filtration chromatography.
**d)** Write a short note on the Density gradient centrifugation.

**Q.4 Answer the following. (Any Two)** **12**

**a)** Explain the derivation of the Henderson-Hasselbach equation.
**b)** Describe in detail the principle, working, and applications of UV-visible spectroscopy
**c)** Describe in detail the differentiation characteristics of TEM and SEM.

**Q.5 Answer the following. (Any Two)** **12**

**a)** Explain the principle and application of ion-exchange chromatography.
**b)** Discuss in detail the principle, working, and application of agarose gel electrophoresis.
**c)** Explain the principle, working, and applications of IR Spectroscopy.

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**Set P**

# M.Sc. (Microbiology) (Semester - III) (New) (NEP CBCS) Examination: March/April - 2026
# Bioprocess Technology (2316302)

Day & Date: Monday, 20-04-2026 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

**Instructions:** 1) All questions are compulsory.
2) Figures to the right indicate full marks.

**Q.1 A) Choose correct alternative.** **08**

1) For bioassay of penicillin _____ is used as test organism.
   a) E. coli b) S. typhi
   c) S. aureus d) V. cholerae

2) Mushroom is very rich in _____.
   a) Carbohydrate b) Proteins
   c) Lipids d) Sugars

3) Distillation process is used for recovery of _____.
   a) Ethanol b) Penicillin
   c) Vitamin $B_{12}$ d) SCP

4) Patents are granted to _____ in return for a public disclosure of their inventions.
   a) Laboratories b) Institutes
   c) Industries d) Inventors

5) Streptomyces griseus is used for production of _____.
   a) Penicillin b) Amylase
   c) Streptomycin d) Lysine

6) Brandy is produced by distillation of _____.
   a) Beer b) Vinegar
   c) Ethanol d) Wine

7) Bruce Ames test is used for _____ testing.
   a) Assay b) Carcinogenicity
   c) Allergy d) Toxicity

8) In industry actually for fermentation of product _____ media are used.
   a) Crude b) Synthetic
   c) Pure d) Semisynthetic

**B) Write True / False.** **04**

1) Baffles in fermenter reduces vortex formation during fermentation process.
2) Hot air oven is used for stock culture maintenance.
3) Molasses is a waste from dairy industry.
4) Mice are used in Toxicity testing.

**Q.2 Answer the following. (Any Six)** **12**

**a)** What is concept of GM foods?
**b)** What is Quality Assurance?
**c)** What is continuous fermentation?
**d)** What is meaning of pyrogenicity testing?
**e)** What are the uses of Vitamin $B_{12}$?
**f)** What is Biosafety?
**g)** How the Biomass is separated during recovery of product?
**h)** What is meaning of copyrights?

**Q.3 Answer the following. (Any Three)** **12**

**a)** Describe the strain improvement process.
**b)** Describe in short Amylase production.
**c)** Describe in brief Assay testing.
**d)** Give the recovery of product by solvent extraction.

**Q.4 Answer the following. (Any Two)** **12**

**a)** Describe in detail streptomycin production.
**b)** Describe in detail computer applications in Fermentation industry.
**c)** Describe the guidelines for safety in Microbiological processes.

**Q.5 Answer the following. (Any Two)** **12**

**a)** Describe in detail Fermenter with design and function.
**b)** Describe in detail Fermentation Media.
**c)** Describe in detail industrial production of Whisky and Brandy.

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**Set P**

# M.Sc. (Microbiology) (Semester - III) (New) (NEP CBCS) Examination: March/April – 2026
# Immunology (2316306)

Day & Date: Wednesday, 22-04-2026 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

**Instructions:** 1) All questions are compulsory.
2) Figures to the right indicate full marks.

**Q.1 A) Choose correct alternative. (MCQ) 08**

1) A graft between members of the same species is called as _____.
   a) Xenograft b) Autograft
   c) Isograft d) Allograft

2) Immunological unresponsiveness to self-antigen is called as _____.
   a) Acquired immunity b) ADCC
   c) Tolerance d) Tolerogen

3) _____ complex plays important role in antigen presentation in the humoral immune response.
   a) Class III MHC b) class I MHC
   c) class IV MHC d) class II MHC

4) _____ are called as the soluble proteins or glycoproteins released by one cell population that acts as an intercellular mediator or signaling molecule in immunity.
   a) Antibiotics b) Bacteriocins
   c) Cytokines d) Tumor Necrosis Factors

5) Vaccines are prepared from killed microbes called as _____ vaccine.
   a) Recombinant b) Inactivated
   c) DNA d) Live

6) _____ fluorescent dyes commonly used for the labelling of antibody.
   a) Et- Br b) Sulphur
   c) Fluorescein isothiocyanate d) Iodine

7) _____ antibody is found in colostrum's, saliva, tears.
   a) lgD b) lgE
   c) lgG d) IgA

8) _____ is the non organ specific (systemic) autoimmune disease.
   a) Hashimoto's thyroiditis
   b) Systemic lupus erythematous (SLE)
   c) Myasthenia gravis
   d) Pernicious anemia

**B) Fill in the blanks.** **04**

1) _____ antibody is present in breast milk.
2) In ELISA test, substrate used is _____ which is acted by an enzyme alkaline phosphatase.
3) _____ occurs when the recipients immune system attacks the donated graft and begins destroying the transplanted tissue or organ.
4) In humans MHC loci or HLA complex is present on chromosome number _____.

**Q.2 Answer the following. (Any Six)** **12**

**a)** What is autoimmunity.
**b)** Define agglutination.
**c)** Draw the structure of IgM.
**d)** What is the function of bone marrow?
**e)** Define Cytokines.
**f)** Give the applications of Flow cytometry.
**g)** What is MALT?
**h)** Define attenuated vaccine and give one example.

**Q.3 Answer the following. (Any Three)** **12**

**a)** Explain the non-organ specific autoimmunity.
**b)** Write an account on primary immunodeficiency disorders and types.
**c)** Write an account on HLA typing.
**d)** What are DNA and synthetic peptide vaccines.

**Q.4 Answer the following. (Any Three)** **12**

**a)** What are immunoglobulins? Write the properties and function of IgA and draw its structure.
**b)** Write an account on mechanism of graft rejection.
**c)** Write an account on MHC class II molecule.
**d)** Describe the structure and function of lymphnode.

**Q.5 Answer the following. (Any Two)** **12**

**a)** Explain ELISA test in detail with its application.
**b)** Describe details of mechanism of Immunological Tolerance.
**c)** Explain Myasthenia Gravis and Rheumatoid arthritis.

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**Set P**

# M.Sc. (Microbiology) (Semester - III) (New) (NEP CBCS) Examination: March/April – 2026
# R-DNA technology (2316307)

Day & Date: Wednesday, 22-04-2026 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

**Instructions:** 1) All Questions are compulsory.
2) Figure to right indicate full marks.

**Q.1 A) Choose correct alternative. (MCQ) 08**

1) Type II restriction enzymes are widely used as they _____.
   a) Cleave DNA randomly
   b) Cut far from recognition sites
   c) Recognize palindromes and cut at/near them
   d) Require ATP and SAM

2) Role of alkaline phosphatase in cloning is to _____.
   a) Add phosphates for ligation
   b) Remove Phosphates to prevent self-ligation
   c) Generate sticky ends
   d) Repair DNA nicks

3) In pBR322, insertion into tetracycline site is done because _____.
   a) Bacteria is resistant to tetracycline only
   b) Inactivation makes bacteria sensitive to tetracycline
   c) Both resistance genes inactivated
   d) Cannot screen using resistance

4) Unique feature of cosmids are that they _____.
   a) Cannot replicate in E. coli
   b) Carry up to ~45 kb via cos sites
   c) Have markers but no origin
   d) Only replicate in yeast

5) Key step in colony hybridization is to _____.
   a) Radiolabel plasmid DNA
   b) Denature DNA for probe binding
   c) Use selectable markers
   d) PCR amplify inserts

6) Best method for introducing DNA into plant protoplasts is _____.
   a) $CaC1_2$ heat shock
   b) Electroporation
   c) Liposome transfection
   d) Agrobacterium conjugation

7) Limitation of chromosome walking is _____.
   a) Not for eukaryotes
   b) Slow hybridization-based screening prone to gaps
   c) Restriction mapping cannot generate large fragments
   d) Only plasmid vectors with low capacity

8) Recombinant insulin production in E. coli is done by _____.
   a) Direct expression with natural promoter
   b) Fusion of A- and B-chains to $\beta$-galactosidase, then chemically reconstituted
   c) Pre-proinsulin in mammalian cells
   d) Full gene with introns expressed in bacteria

**B) Write True/False** **04**

1) Type II restriction endonucleases require ATP for cleavage, whereas Type I restriction enzymes cleave DNA precisely at their recognition sites.
2) The pBR322 vector carries both ampicillin and tetracycline resistance genes, which can be used to identify recombinant clones by insertional inactivation.
3) In blue-white screening using pUC vectors, recombinant colonies appear blue because insertional inactivation of the lacZ gene prevents - galactosidase production.
4) Chromosome walking allows identification of non-contiguous genomic regions, making it more efficient than chromosome jumping in covering long stretches of DNA.

**Q.2 Answer the following. (Any Six)** **12**

**a)** Differentiate between T4 DNA ligase and E. coli DNA ligase in terms of cofactors and blunt-end ligation.
**b)** What unique feature of pUC vectors makes them suitable for blue-white screening compared to pBR322?
**c)** Explain how insertional inactivation of the lacZ gene distinguishes recombinant from non-recombinant colonies.
**d)** State one major limitation of chemical gene synthesis compared to enzymatic isolation of genes.
**e)** Distinguish between chromosome walking and chromosome jumping.
**f)** Briefly explain how Bt cotton demonstrates an application of rDNA technology in agriculture.
**g)** Write in short role & reverse transcriptase in gene manipulation.
**h)** Define mini chromosome report with its example.

**Q.3 Answer the following. (Any Three)** **12**

**a)** Explain the classification of restriction endonucleases with respect to recognition sequences, cleavage patterns, and cofactor requirements.

**b)** Compare and contrast plasmid vectors (pBR322, pUC series) and phage vectors ($\lambda$, Ml3) in terms of insert size capacity, copy number, and applications in gene cloning.

**c)** Describe the direct and indirect screening methods used to identify recombinant clones, giving one example for each, and explain the principle behind their selection or detection.

**d)** Discuss the strategies of genome mapping including restriction mapping, chromosome walking, and chromosome jumping, and provide one example of how rDNA technology is applied in medicine or agriculture.

**Q.4 Answer the following. (Any Two)** **12**

**a)** Explain the roles, mechanisms, and applications of restriction endonucleases, DNA ligases, and reverse transcriptase, with one example each.

**b)** Compare cloning vectors in *E. coli,* yeast, and plants in terms of structure, replication, insert capacity, and protein expression.

**c)** Describe gene isolation, cut-end modification, and transformation methods. How do genome mapping techniques aid applications like insulin or Bt cotton?

**Q.5 Answer the following. (Any Two)** **12**

**a)** Explain the roles and mechanisms of key enzymes used in rDNA technology, with one application for each.

**b)** Compare plasmid, phage, and artificial chromosome vectors in terms of structure, insert capacity, and applications.

**c)** Describe restriction mapping, chromosome walking and chromosome jumping along with one example of their application.

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**Set P**

# M.Sc. (Microbiology) (Semester - IV) (New) (NEP CBCS) Examination: March/April – 2026
## Food and Dairy Microbiology (2316401)

Day & Date: Thursday, 16-04-2026 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

**Instructions:** 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Draw neat-labelled diagrams wherever necessary.

**Q.1 A) Choose correct alternative. (MCQ) 08**

1) The presence of coliform bacteria in a food or milk sample is a primary indicator of _____.
   a) High fat content b) High vitamin content
   c) Fecal contamination d) Optimal fermentation

2) Aflatoxin, a potent carcinogen, is produced by _____.
   a) *Penicillium camemberti*
   b) *Saccharomyces cerevisiae*
   c) *Aspergillus flavus*
   d) *Clostridium perfringens*

3) _____ is a fermented foods relies on a double fermentation process.
   a) Dosa b) Lime pickle
   c) Mango pickle d) Jalebi

4) The characteristic tart or sour flavor of yogurt is primarily due to the production of _____.
   a) Ethanol b) Acetic acid
   c) Carbon dioxide d) Lactic acid

5) A type of spoilage in milk where a thick, slimy material is produced is called as _____.
   a) Ropiness b) Bitterness
   c) Proteolysis d) Stormy fermentation

6) In packaged foods like cheese and lunch meats, slime formation is often caused by _____.
   a) Yeast
   b) Lactic acid bacteria
   c) Spore former thermophiles
   d) Actinomycetes

7) Irradiation, as a food preservation method, uses _____ to destroy bacteria, insects, and delay ripening.
   a) Ultraviolet light b) Gamma rays
   c) Infrared radiation d) Microwave radiation

8) In the United States _____ is the federal agency primarily responsible for ensuring the safety and wholesomeness of all food products, including dairy.

a) FDA b) USDA
c) EPA d) CDC

**B) Write True / False.** **04**

1) The phosphatase test is a crucial test for milk pasteurization which detects the activity of an enzyme destroyed by proper pasteurization.
2) The spongy, porous texture of Idli is primarily due to the production of methane gas during fermentation.
3) Soft rot in vegetables like potatoes and carrots, characterized by a watery, soft decay, is commonly caused by *Erwinia carotovora.*
4) Quaternary Ammonium Compounds are a type of chlorine-based sanitizer commonly used in dairy plants.

**Q.2 Answer the following. (Any Six)** **12**

**a)** What is a HACCP?
**b)** Define probiotics.
**c)** What is a food infection?
**d)** Enlists the approved food preservatives and additives.
**e)** What are the different pasteurization methods?
**f)** Enlist two common lactic acid bacteria involved in yoghurt production.
**g)** What are the sources of contamination of milk?
**h)** What are the components of food?

**Q.3 Answer the following. (Any Three)** **12**

**a)** Discuss in detail safety and quality assurance in food and dairy industry.
**b)** What are the methods of food preservation? Give a brief account on food preservation by canning and chemicals.
**c)** Enlist the types of cheese. Describe in short cheese production.
**d)** Explain Dye reduction tests.

**Q.4 Answer the following. (Any Two)** **12**

**a)** Describe in detail fermentation of idli.
**b)** Discuss in brief methods of microbiological examination of food.
**c)** Discuss in brief spoilage of meat and fish.

**Q.5 Answer the following. (Any Two)** **12**

**a)** Describe in detail spoilage of milk products.
**b)** Describe in detail food borne diseases.
**c)** Give an account on food adulteration and contamination.

**SLR-PP-15**

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**Set P**

# M.Sc. (Microbiology) (Semester - IV) (New) (NEP CBCS) Examination: March/April – 2026
## Molecular Biology and Genetic Engineering (2316402)

Day & Date: Saturday, 18-04-2026 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

**Instructions:** 1) All questions are compulsory.
2) Figures to the right indicate full marks.

**Q.1 A) Choose correct alternative. (MCQ)** **08**

1) Southern blotting is primarily used for the detection of _____.
   a) RNA b) DNA
   c) Proteins d) Lipids

2) The first DNA sequencing method developed by Frederick Sanger used ____.
   a) Next-generation sequencing b) Dideoxynucleotides
   c) RNA primers d) Restriction enzymes

3) Type II restriction enzymes are most widely used because they ____.
   a) Cut DNA at random sites
   b) Cut DNA at defined recognition sites
   c) Cut RNA instead of DNA
   d) Only methylate DNA

4) Which enzyme catalyzes the addition of nucleotides without a template?
   a) DNA polymerase I
   b) Terminal deoxynucleotidyl transferase
   c) Reverse transcriptase
   d) KIenow fragment

5) pUC 18 vector contains _____.
   a) lacZ gene for blue-white screening
   b) Antibiotic resistance only
   c) $\lambda$ phage genes
   d) M13 bacteriophage genes

6) The Ti plasmid vector is derived from _____.
   a) Bacillus subtilis
   b) Agrobacterium tumefaciens
   c) E. coli
   d) M13 phage

7) Rational design in protein engineering is based on _____.
   a) Random mutagenesis
   b) Detailed structural knowledge of protein
   c) Directed evolution
   d) In vivo selection

8) The main goal of metabolic engineering is _____.
   a) To study protein folding
   b) To optimize metabolic pathways for desired products
   c) To design primers for PCR
   d) To perform genome sequencing

**B) Write true/false:** **04**

1) Real-time PCR uses fluorescent dyes to monitor DNA amplification.
2) pBR322 contains genes for resistance to ampicillin and tetracycline.
3) Protein engineering cannot be applied in medicine.
4) Alkaline phosphatase adds phosphate groups to DNA ends.

**Q.2 Answer the following. (Any Six)** **12**

**a)** Define DNA fingerprinting.
**b)** Enlist all the vectors used in the preparation of rDNA molecules.
**c)** What is the function of DNA Ligase?
**d)** Define Restriction Endonucleases.
**e)** What is Protein engineering?
**f)** What are DNA adaptors?
**g)** Give the role of T4 polynucleotide kinase in molecular Biology.
**h)** Write any two applications of the Genomic library.

**Q.3 Answer the following. (Any Three)** **12**

**a)** Write a short note on the Cosmid vectors.
**b)** Explain the various applications of RFLP.
**c)** Write a short note on DNA sequencing by the Sanger's dideoxy method.
**d)** Enlist all types of Restriction endonucleases and write the information on their nomenclature.

**Q.4 Answer the following. (Any Two)** **12**

**a)** Explain in detail the DNA foot printing as a molecular biology technique
**b)** Describe the structure, features, and applications of the pBR322 vector.
**c)** Describe the various applications of Genetic engineering in Agriculture and Medicine.

**Q.5 Answer the following. (Any Two)** **12**

**a)** Explain in detail gene therapy and its applications.
**b)** Discuss the applications of protein engineering in industry, medicine, and research.
**c)** Explain the mechanism of Ti plasmid-mediated gene transfer in plants.

**SLR-PP-16**

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# M.Sc. (Microbiology) (Semester - IV) (New) (NEP CBCS) Examination: March/April - 2026
## Agricultural Microbiology (2316405)

Day & Date: Tuesday, 21-04-2026 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

**Instructions:** 1) All questions are compulsory.
2) Figures to the right indicate full marks.

**Q.1 A) Choose correct alternative. (MCQ)** **08**

1) _____ is a major factor affecting rhizosphere microflora.
   a) Soil texture b) Root exudates
   c) Air temperature d) Wind speed

2) _____ is a phyllosphere biocontrol agent used to suppress plant pathogens.
   a) *Pseudomonas fluorescens* b) *Escherichia coli*
   c) *Clostridium botulinum* d) *Bacillus anthracis*

3) Mycorrhizal biofertilizers primarily help plants in _____.
   a) Nitrogen fixation
   b) Uptake of phosphorus and water
   c) Potassium solubilization
   d) Carbon dioxide absorption

4) _____ is a combined application of IAA and GA in horticulture.
   a) Enhancing fruit set and size in apple
   b) Inducing flowering in short-day plants
   c) Increasing chlorophyll content in leaves
   d) Delaying fruit ripening

5) Unlike nitrogen, phosphorus has no significant _____.
   a) Atmospheric reservoir b) Biological role
   c) Geological cycle d) Microbial activity

6) Carrier materials used for biofertilizers inoculants include _____.
   a) Peat soil and lignite b) Sand only
   c) Plastic pellets d) Charcoal alone

7) The next generation of biofertilizers increasingly focuses on _____.
   a) Pure chemical nutrients b) Multi-strain microbial consortia
   c) Synthetic pesticides d) Heavy metal additives

8) Plant tissue culture is based on _____ fundamental principle.
   a) Law of Segregation b) Totipotency of plant cells
   c) Mutation theory d) Endosymbiotic theory

**B) Write True or False.** **04**

1) Vermiculite and biochar are emerging as an eco-friendly alternative in biofertilizers.
2) Designer biofertilizer is customized microbial blends for specific cropand soil.
3) Nuclear polyhedrosis virus (NPV) is mainly used to control aphids.
4) Callus is a mass of undifferentiated plant cells produced in vitro.

**Q.2 Answer the following. (Any Six)** **12**

**a)** Give any two limitations of Biofertilizers.
**b)** Green manure.
**c)** Vermicomposting.
**d)** Formulation of Growth media for Tissue culture.
**e)** Mosquito control by fungi.
**f)** Define Rhizosphere and Phyllosphere.
**g)** Blue green algae as a biofertilizers.
**h)** Significance of biopesticides.

**Q.3 Answer the following. (Any Three)** **12**

**a)** Write on Pest control of crop by using *B. thuringiensis* and NPVs.
**b)** Role of antibiotics and siderophores in biocontrol of plant pathogens.
**c)** Methods of application of biofertilizers.
**d)** Write in detail on scarification of cellulosic wastes.

**Q.4 Answer the following. (Any Two)** **12**

**a)** Give the details of economic and future prospects of biopesticides.
**b)** Discuss scope, merits and limitations of Phosphate solubilizing bacteria and mycorrhizae as a biofertilizers.
**c)** Write on toxin produced by bacteria and fungi.

**Q.5 Answer the following. (Any Two)** **12**

**a)** Take detailed account on plant tissue culture techniques and applications.
**b)** Write on Nitrogen cycle.
**c)** Take a detailed account on Azotobacter and Rhizobium as biofertilizers.

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Set **P**

# M.Sc. (Microbiology) (Semester - IV) (New) (NEP CBCS)
# Examination: March/April - 2026
# Environmental Microbiology (2316406)

Day & Date: Tuesday, 21-04-2026 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

**Instructions:** 1) All questions are compulsory.
2) Draw neat labelled diagram wherever necessary.
3) Figures to the right indicate full marks.
4) Use of log table is allowed.

**Q.1 A) Rewrite the sentence by choosing correct alternative. 08**

1) _____ is the purpose of the transition zone in a biosphere reserve.
   a) To prevent all human activity
   b) To promote industrial development
   c) To support sustainable economic and social activities
   d) To conduct extensive mining operations

2) _____ of the following is the primary nutrient causing eutrophication in aquatic ecosystems.
   a) Carbon dioxide b) Nitrogen and phosphorus
   c) Dissolved oxygen d) Sulfur

3) The biological process where organic waste is broken down in the absence of oxygen to produce biogas is called ____.
   a) Incineration b) Composting
   c) Anaerobic digestion d) Landfilling

4) Bioremediation is the process of using microorganisms to ____.
   a) Burn waste at high temperatures
   b) Decompose organic waste in a landfill
   c) Clean up environmental pollutants
   d) Convert waste into fertilizer

5) What is the name for the process where microorganisms in the root zone convert nitrate ($NO_3$) back into gaseous nitrogen ($N_2$)?
   a) Nitrification b) Denitrification
   c) Ammonification d) Assimilation

6) High concentrations of heavy metals like lead and cadmium in soil can inhibit the activity of key soil enzymes, leading to _____.
   a) Increased microbial growth
   b) Enhanced decomposition of organic matter
   c) Reduced nutrient cycling
   d) Improved soil fertility

7) _____ is a cost-effective and environment-friendly biological technique for waste water treatment utilizes the catabolic reactions of microorganisms.
   a) Filtration b) Chlorination
   c) Composting d) Incineration

8) BOD value of less than 5 ppm indicates _____ about a water sample.
   a) High pollution b) Poor in dissolved oxygen
   c) Rich in dissolved oxygen d) Not suitable for aquatic life

**B) Write True/False** **04**

1) Increased nitrogen availability can lead to higher rates of $N_2O$ production by soil microbes through nitrification and denitrification.
2) Environmental audits only cover financial aspects.
3) Microbes can be modified to act as biosensors, using their genetic machinery to indicate the presence of a contaminant.
4) Many industrial wastes are toxic, including heavy metals and chemicals, which are detrimental to the beneficial bacteria and fungi that are crucial for natural soil and water processes.

**Q.2 Answer the following. (Any Six)** **12**

**a)** Enlist the components of ecological pyramids.
**b)** What are the different types of industrial waste.
**c)** What is the concept of genetically engineered microorganisms.
**d)** Enlist the hydraulic characters of reactor.
**e)** Write short note on Environmental Impact Assessment.
**f)** What is the difference between the biotic and abiotic environment.
**g)** What is environmental audit?
**h)** Write an account on COD.
**I)** What is acclimatisation?

**Q.3 Answer the following. (Any Three)** **12**

**a)** Write an account on acid rain and its significance.
**b)** Write a short note on characteristics of industrial waste.
**c)** Discuss in detail about enzymes used in pollution control.
**d)** Write an account on types of aquatic plants used for purifying water.

**Q.4 Answer the following. (Any Two)** **12**

**a)** Write an essay on environmental control bodies - State, National and International.
**b)** What is global warming? Write in detail causes, effect and remedies of global warming.
**c)** Write an account on water pollution and its control.

**Q.5 Answer the following. (Any Two)** **12**

**a)** Write an account on eutrophication.

**b)** Explain in short, the waste treatment of sugar, textile and paper and pulp industry.

**c)** Explain the process of Vermicomposting.

**SLR-PP-18**

| Seat No. | |
|---|---|

**Set P**

# M.Sc. (Microbiology) (Semester - III) (New) (NEP CBCS)
# Examination: March/April – 2026
# Environment and Waste Management Technology (MSC023311)

Day & Date: Monday, 20-04-2026 Max. Marks: 80
Time: 11:00 AM To 02:00 PM

**Instructions:** 1) Questions no. 1 & 2 are compulsory.
2) Attempt any Three Question from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

**Q.1 A) Choose correct alternative.** **10**

1) _____ is major gas present in earth's atmosphere.
   a) Oxygen b) Carbon dioxide
   c) Nitrogen d) Ozone

2) Strength to sewage is measured by _____ test.
   a) BOD b) MPN
   c) MPRT d) SPC

3) Whey is waste from _____ industry.
   a) Sugar b) Dairy
   c) Paper & Pulp d) Tannery

4) _____ is a sphere of life.
   a) Lithosphere b) Hydrosphere
   c) Atmosphere d) Biosphere

5) Chemical dyes mainly found in waste from _____.
   a) Textile b) Dairy
   c) Sugar d) Distillery

6) Paper and pulp industry releases _____ in environment.
   a) Nitrogen oxide b) Hydrogen Sulphide
   c) Carban monoxide d) Oxygen

7) _____ ecosystem has the maximum biomass.
   a) Grassland b) Lake
   c) Pond d) River

8) _____ pollutant is responsible for ozone depletion.
   a) Carbon dioxide b) Oxygen
   c) Methane d) Chlorofluorocarbons

9) _____ pollutant is responsible for acid rain.
   a) $SO_2$ b) $CO_2$
   c) Ozone d) Oxygen

10) _____ emerging method uses genetically engineered microbes for pollutant degradation.

a) Sedimentation b) Filtration
c) Biostimulation d) Genetic bioremediation

**B) Write True or False.** **06**

1) Algae has a major role in eutrophication.
2) Vermicomposting is used for pollution control.
3) Increased oxygen level is responsible for green house effect.
4) Activated sludge treatment is chemical method of waste treatment.
5) In biotic environment nonliving activities are occurring.
6) COD is used for assessment of air quality.

**Q.2 Answer the following.** **16**

**a)** Write note on biotic and abiotic environment.
**b)** Give the working of state level environmental control body.
**c)** Write in short on dairy waste treatment.
**d)** Write short note in Mean Cell Residence Time.

**Q.3 Answer the following.** **16**

**a)** Describe in detail Global warming.
**b)** Describe in detail Textile waste treatment.

**Q.4 Answer the following.** **16**

**a)** Describe in detail Eutrophication process.
**b)** Describe in detail microorganisms in waste water treatment.

**Q.5 Answer the following.** **16**

**a)** Comment on waste disposal control and regulations.
**b)** Describe in detail enzymes in pollution control.

**Q.6 Answer the following.** **16**

**a)** Write in detail on Environmental Impact Assessment.
**b)** Describe in detail Environmental Segments.

**Q.7 Answer the following.** **16**

**a)** Comment on Malfunctioning of treatment systems.
**b)** Describe in detail Microbiology & Biochemistry of waste water treatment.

**SLR-PP-19**

| Seat No. | |
|---|---|

**Set P**

# M.Sc. (Microbiology) (Semester - III) (New) (NEP CBCS) Examination: March/April – 2026
## Immunology and Immunotechnology (MSC023306)

Day & Date: Wednesday, 22-04-2026 Max. Marks: 80
Time: 11:00 AM To 02:00 PM

**Instructions:** 1) Questions no. 1 & 2 are compulsory.
2) Attempt any three questions from Q No.3 to Q No.7
3) Figures to the right indicate full marks.
4) Draw neat labeled diagrams wherever necessary.

**Q.1 A) Choose correct alternative. (MCQ)** **10**

1) _____ of the following is an example of innate immunity.
   a) Antibody production b) Skin barrier
   c) Memory cells d) Vaccination

2) Primary lymphoid organs include _____.
   a) Spleen and lymph nodes b) Thymus and bone marrow
   c) Tonsils and appendix d) Peyer's patches

3) The first antibody produced in primary response is _____.
   a) IgM b) IgG
   c) IgA d) IgD

4) Interleukins are mainly produced by _____.
   a) Leukocytes b) RBC's
   c) Platelets d) Neurons

5) X-linked agammaglobulinemia is caused by defect in _____.
   a) T-cells b) Neutrophils
   c) Complement proteins d) B-cell maturation

6) Wiskott-Aldrich syndrome is associated with _____.
   a) High platelet count b) Leukocytosis
   c) Polycythemia d) Thrombocytopenia

7) Recombinant antigen vaccines are produced by _____.
   a) Chemical synthesis b) Heat killing
   c) Genetic engineering d) Radiation

8) RIA uses _____.
   a) Enzymes b) Fluorescent dyes
   c) Radioisotopes d) DNA probes

9) FISH stands for _____.
   a) Fluorescent In Situ Hybridization
   b) Fast Immune System Handling
   c) Fluorescent Immune Signal
   d) Functional In Situ Histology

10) Tumor Necrosis Factor (TNF) is mainly involved in _____.
   a) Blood clotting b) Inflammation
   c) Digestion d) Vision

**B) Write True/False.** **06**

1) Flow cytometry analyzes physical and chemical properties of cells.
2) Precipitation occurs with insoluble antigens.
3) TNF is involved in inflammation.
4) HLA genes are located on chromosome 6.
5) Active immunization induces immunological memory.
6) Western blot detects RNA molecules.

**Q.2 Answer the following.** **16**

**a)** Write an account on primary lymphoid organs, it's structure and function.
**b)** Write a short note on immunoglobulin gene structure.
**c)** Write an account on ELISA.
**d)** Write a short note on common immunization program.

**Q.3 Answer the following.** **16**

**a)** Explain primary immunodeficiency disorders with any one example.
**b)** Explain immune response to infectious bacterial diseases.

**Q.4 Answer the following.** **16**

**a)** Explain recombinant Ag vaccines and synthetic peptide vaccines.
**b)** Explain techniques like FISH and immunoblotting.

**Q.5 Answer the following.** **16**

**a)** What is autoimmunity? Explain the mechanism of organ specific autoimmune disease.
**b)** What are the different types of grafts? Explain graft rejection mechanism.

**Q.6 Answer the following.** **16**

**a)** What is major histocompatibility complex? Explain H2 and HLA complex.
**b)** Write an account on secondary immunodeficiency disorder.

**Q.7 Answer the following.** **16**

**a)** What are the different types of cells in immune system? Give the types with its function.
**b)** Write an account on different types of immunoglobulins.