

Roll No. ....

Question Booklet Number

O. M. R. Serial No.

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Question Booklet Number
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**M. Sc. (Microbiology) (Fourth Semester)**  
**EXAMINATION, 2025-26**  
**(New Syllabus Effective from 2023)**  
**EXTREME MICROBIOLOGY**

Paper Code								
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Questions Booklet Series
<b>B</b>

Time : 1:30 Hours ]

[ Maximum Marks : 75

**Instructions to the Examinee :**

1. Do not open the booklet unless you are asked to do so.
2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.
3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

**परीक्षार्थियों के लिए निर्देश :**

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।
2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।
3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(Remaining instructions on the last page)

(शेष निर्देश अन्तिम पृष्ठ पर)

***(Only for Rough Work)***

1. Which mechanism allows bacteria to resist antibiotics by removing them from the cell ?
  - (A) Enzymatic degradation
  - (B) Reduced membrane permeability
  - (C) Mutation of ribosomes
  - (D) Efflux pump system
2. Efflux pumps involved in antibiotic resistance are typically located in the :
  - (A) Cytoplasm
  - (B) Ribosome
  - (C) Cell membrane
  - (D) Nucleus
3. Multidrug resistance in bacteria is commonly associated with :
  - (A) Ribosomal mutation
  - (B) Efflux pump over expression
  - (C) DNA replication
  - (D) Protein degradation
4. Efflux pumps contribute to antibiotic resistance by :
  - (A) Breaking antibiotics
  - (B) Modifying antibiotics
  - (C) Exporting antibiotics outside the cell
  - (D) Binding antibiotics permanently
5. Reactive oxygen species include :
  - (A) CO<sub>2</sub> and CH<sub>4</sub>
  - (B) Superoxide and hydrogen peroxide
  - (C) Nitrogen gas
  - (D) Methane
6. Which enzyme converts superoxide radicals into hydrogen peroxide ?
  - (A) Superoxide dismutase
  - (B) Catalase
  - (C) Peroxidase
  - (D) Ligase
7. Catalase enzyme helps cells by converting :
  - (A) Superoxide into oxygen
  - (B) Hydrogen peroxide into water and oxygen
  - (C) Oxygen into hydrogen
  - (D) Carbon dioxide into oxygen
8. Reactive oxygen species mainly damage :
  - (A) DNA, proteins and lipids
  - (B) Carbohydrates only
  - (C) Water molecules
  - (D) Minerals

9. Heat shock proteins primarily function as :
- (A) Enzymes
  - (B) Chaperone proteins
  - (C) Hormones
  - (D) Transport proteins
10. Heat shock proteins help in :
- (A) DNA degradation
  - (B) Protein folding and stabilization
  - (C) Lipid synthesis
  - (D) Cell division
11. Which of the following helps organisms survive freezing temperatures ?
- (A) Antifreeze proteins
  - (B) Heat shock proteins
  - (C) Catalase
  - (D) Ligase
12. Hyperthermophiles typically grow at temperatures above :
- (A) 30°C
  - (B) 45°C
  - (C) 60°C
  - (D) 80°C
13. DNA ligase functions in DNA repair by :
- (A) Breaking DNA strands
  - (B) Joining DNA fragments
  - (C) Replicating DNA
  - (D) Removing RNA primers
14. Which enzyme removes damaged bases during DNA repair ?
- (A) DNA glycosylase
  - (B) RNA polymerase
  - (C) DNA helicase
  - (D) Topoisomerase
15. Hyperthermophiles possess proteins that are :
- (A) Less stable
  - (B) Easily degraded
  - (C) Highly stable at high temperatures
  - (D) Cold-sensitive
16. Reverse gyrase enzyme is characteristic of :
- (A) Psychrophiles
  - (B) Hyperthermophiles
  - (C) Mesophiles
  - (D) Halophiles

17. Hyperthermophilic archaea maintain gene expression at high temperature by :
- (A) Weak promoters
  - (B) Stable transcription machinery
  - (C) Reduced protein synthesis
  - (D) Degrading RNA rapidly
18. Exomicrobiology primarily deals with the study of :
- (A) Marine microorganisms
  - (B) Microorganisms in extreme terrestrial environments
  - (C) Microbial life beyond Earth
  - (D) Industrial microorganisms
19. Evidence of metabolism as a life detection method mainly involves detection of :
- (A) DNA replication
  - (B) Protein synthesis
  - (C) Cell morphology
  - (D) Gas production or consumption
20. Which of the following is considered evidence of photosynthetic life ?
- (A) Methane release
  - (B) Oxygen evolution
  - (C) Nitrogen fixation
  - (D) ATP hydrolysis
21. Autotrophic microorganisms obtain carbon from :
- (A) Organic compounds
  - (B) Carbon dioxide
  - (C) Amino acids
  - (D) Sugars
22. ATP production is considered a strong indicator of life because ATP is :
- (A) A structural molecule
  - (B) A storage polymer
  - (C) An energy currency of cells
  - (D) A genetic molecule
23. Phosphate uptake in microorganisms indicates :
- (A) Cell death
  - (B) Active metabolism
  - (C) DNA degradation
  - (D) Protein denaturation
24. Sulphur uptake experiments are useful in detecting microorganisms that perform :
- (A) Sulphur metabolism
  - (B) Photosynthesis
  - (C) Nitrogen fixation
  - (D) Respiration only

25. Hyper-extremophiles are organisms that :
- (A) Grow only in soil
  - (B) Survive under moderate conditions
  - (C) Thrive in extremely harsh environments
  - (D) Require laboratory conditions
26. Which environment is considered a model for mars ?
- (A) Sahara Desert
  - (B) Antarctica
  - (C) Amazon Forest
  - (D) Deep Ocean
27. Pyrolytic release experiment was designed to detect :
- (A) Organic synthesis from atmospheric gases
  - (B) DNA replication
  - (C) Protein formation
  - (D) ATP production
28. Monitoring astronaut microbial flora is important to detect :
- (A) Radiation exposure
  - (B) Microbial population changes
  - (C) Oxygen deficiency
  - (D) Equipment malfunction
29. Changes in mycological autoflora refer to alterations in :
- (A) Bacterial population
  - (B) Viral population
  - (C) Fungal population
  - (D) Algal population
30. Which domain of life contains most known extremophiles ?
- (A) Bacteria
  - (B) Archaea
  - (C) Eukarya
  - (D) Viruses
31. Organisms that grow optimally at very high temperatures are called :
- (A) Psychrophiles
  - (B) Halophiles
  - (C) Thermophiles
  - (D) Acidophiles
32. Psychrophiles are microorganisms that prefer :
- (A) High temperature
  - (B) Low temperature
  - (C) High salinity
  - (D) High pressure
33. Which of the following environments is considered an extreme habitat ?
- (A) Garden soil
  - (B) Human intestine
  - (C) Hydrothermal vents
  - (D) Freshwater pond

34. Halophiles are extremophiles that grow best in :
- (A) High salt concentration
  - (B) High acidity
  - (C) High pressure
  - (D) Low oxygen
35. A structured microbial community embedded in extracellular matrix is known as :
- (A) Colony
  - (B) Biofilm
  - (C) Planktonic culture
  - (D) Consortium
36. Which method separates DNA fragments based on sequence differences for microbial community analysis ?
- (A) PCR
  - (B) ELISA
  - (C) DGGE
  - (D) Western blot
37. DGGE stands for :
- (A) Denaturing Gradient Gel Electrophoresis
  - (B) Double Gradient Gel Extraction
  - (C) DNA Gel Gradient Evaluation
  - (D) Denatured Gel Gene Expression
38. Next-generation sequencing (NGS) is mainly used for :
- (A) Protein purification
  - (B) Microbial culture
  - (C) High-throughput DNA sequencing
  - (D) Enzyme activity measurement
39. Functional genomics helps in understanding :
- (A) DNA size
  - (B) Gene function and interaction
  - (C) Cell structure
  - (D) Microbial staining
40. Transcriptomics focuses on the study of :
- (A) DNA replication
  - (B) Lipid metabolism
  - (C) Protein folding
  - (D) RNA transcripts
41. Cloning-based microbial community analysis typically involves :
- (A) Protein extraction
  - (B) 16S rRNA gene cloning
  - (C) Metabolite profiling
  - (D) Microscopy only
42. Microbial communities in extreme environments often display :
- (A) Low diversity only
  - (B) High metabolic adaptation
  - (C) No genetic variation
  - (D) Slow growth only

43. Thermophilic microorganisms are mainly used in biotechnology for :
- (A) Antibiotic production at low temperature
  - (B) Enzymatic reactions at high temperature
  - (C) Fermentation at neutral pH
  - (D) Nitrogen fixation in soil
44. Halophilic microorganisms are particularly useful in :
- (A) Wastewater treatment
  - (B) Antibiotic resistance studies
  - (C) Biofertilizer production
  - (D) High salt food fermentation
45. Acidophilic microbes are commonly used in :
- (A) Bioleaching of metals
  - (B) Dairy fermentation
  - (C) Bread making
  - (D) Compost formation
46. Psychrophilic microorganisms are useful in :
- (A) High temperature bioreactors
  - (B) Cold-active enzyme production
  - (C) Biofuel production at high temperature
  - (D) Metal corrosion prevention
47. Which industry commonly uses enzymes from extremophiles ?
- (A) Textile industry
  - (B) Mining industry
  - (C) Food industry
  - (D) All of the above
48. Extremophilic microorganisms play a role in environmental cleanup through :
- (A) Biodegradation
  - (B) Bioremediation
  - (C) Biomining
  - (D) All of the above
49. Barophilic microbes are useful in studying :
- (A) High temperature environments
  - (B) Deep sea environments
  - (C) High salt environments
  - (D) Acidic environments
50. Extremophiles contribute to astrobiology by helping scientists understand :
- (A) Crop yield
  - (B) Plant growth
  - (C) Soil fertility
  - (D) Life in extreme environments

51. Which adaptation allows obligate anaerobes to survive in oxygen-free environments ?
- (A) Presence of catalase enzyme
  - (B) Absence of oxygen-sensitive enzymes
  - (C) Oxygen-dependent respiration
  - (D) High membrane fluidity
52. Anaerobic microbes typically generate energy through :
- (A) Oxidative phosphorylation
  - (B) Aerobic respiration
  - (C) Fermentation
  - (D) Photorespiration
53. Barophiles are organisms that thrive under :
- (A) High temperature
  - (B) High salinity
  - (C) High radiation
  - (D) High pressure
54. Piezophilic microbes adapt to high pressure by :
- (A) Increasing unsaturated fatty acids
  - (B) Increasing membrane rigidity
  - (C) Producing thick cell walls
  - (D) Decreasing protein flexibility
55. Cryophiles are microorganisms that grow best at :
- (A) 0-15°C
  - (B) 25-30°C
  - (C) 40-60°C
  - (D) 60-80°C
56. Cryophilic microbes maintain membrane fluidity by :
- (A) Increasing saturated fatty acids
  - (B) Increasing cholesterol
  - (C) Increasing unsaturated fatty acids
  - (D) Increasing proteins
57. Thermophiles stabilize proteins using :
- (A) Weak ionic bonds
  - (B) Reduced disulfide bonds
  - (C) Reduced hydrophobic interactions
  - (D) Increased hydrogen bonding
58. Heat-stable enzymes from thermophiles are known as :
- (A) Psychrozymes
  - (B) Thermozymes
  - (C) Isozymes
  - (D) Metalloenzymes

59. Which enzyme from thermophiles is widely used in PCR ?
- (A) DNA ligase
  - (B) Taq polymerase
  - (C) RNA polymerase
  - (D) Reverse transcriptase
60. Oligotrophs thrive in environments with :
- (A) High nutrients
  - (B) High salinity
  - (C) High temperature
  - (D) Low nutrients
61. Oligotrophic microbes typically have :
- (A) Slow growth rate
  - (B) High metabolic rate
  - (C) Large genome
  - (D) High nutrient demand
62. Osmophiles tolerate high sugar concentrations by :
- (A) Decreasing osmotic pressure
  - (B) Producing compatible solutes
  - (C) Reducing enzyme activity
  - (D) Increasing water loss
63. Halophilic enzymes remain active due to :
- (A) High hydrophobic amino acids
  - (B) Low protein stability
  - (C) High acidic amino acids
  - (D) Reduced ionic interactions
64. Xerophiles grow in environments with :
- (A) High moisture
  - (B) Low moisture
  - (C) High temperature
  - (D) High radiation
65. Xerophilic microbes resist desiccation by :
- (A) Producing spores
  - (B) Increasing metabolism
  - (C) Increasing respiration
  - (D) Decreasing membrane fluidity
66. Compatible solutes in halophiles include :
- (A) Glucose
  - (B) Glycine betaine
  - (C) Lactose
  - (D) Cellulose

67. Halophiles are commonly found in :
- (A) Desert soil
  - (B) Deep ocean vents
  - (C) Glaciers
  - (D) Salt lakes
68. Radiophiles survive high radiation due to :
- (A) Thick cell walls
  - (B) Efficient DNA repair systems
  - (C) High lipid content
  - (D) Reduced metabolism
69. A well-known radiophilic bacterium is :
- (A) *Bacillus subtilis*
  - (B) *E. coli*
  - (C) *Deinococcus radiodurans*
  - (D) *Pseudomonas aeruginosa*
70. Metallophilic microbes are useful in :
- (A) Food processing
  - (B) Bioremediation
  - (C) Fermentation
  - (D) Agriculture
71. Xenobiotic-utilizing microbes degrade :
- (A) Synthetic chemicals
  - (B) Natural compounds
  - (C) Proteins
  - (D) Lipids
72. Metal resistance in microbes often involves :
- (A) Efflux pumps
  - (B) Increased respiration
  - (C) Reduced metabolism
  - (D) DNA fragmentation
73. Alkaliphiles grow optimally at pH :
- (A) 1-3
  - (B) 4-6
  - (C) 7
  - (D) 9-11
74. Acidophiles maintain internal pH by :
- (A) Proton pumps
  - (B) Sodium pumps
  - (C) Potassium pumps
  - (D) Calcium pumps
75. Acidophilic microbes are commonly found in :
- (A) Hot springs
  - (B) Acid mine drainage
  - (C) Salt lakes
  - (D) Desert soil
76. Halophiles are used in :
- (A) Bioremediation of saline soils
  - (B) PCR
  - (C) Fermentation
  - (D) Antibiotic production

77. Extremophilic microbes are useful in :
- (A) Biotechnology
  - (B) Medicine
  - (C) Environmental cleanup
  - (D) All of the above
78. Which microorganism is commonly involved in bioleaching of copper from ore deposits ?
- (A) *Bacillus subtilis*
  - (B) *Escherichia coli*
  - (C) *Acidithiobacillus ferrooxidans*
  - (D) *Rhizobium leguminosarum*
79. Which metal is most commonly recovered through microbial bioleaching ?
- (A) Gold
  - (B) Copper
  - (C) Aluminium
  - (D) Zinc
80. Acid mine drainage usually results in :
- (A) Neutral pH
  - (B) High pH
  - (C) Low pH
  - (D) Alkaline pH
81. Which microorganism is involved in manganese oxidation ?
- (A) *Pseudomonas putida*
  - (B) *Streptococcus*
  - (C) *Salmonella*
  - (D) *Clostridium*
82. Which of the following is a xenobiotic compound ?
- (A) Glucose
  - (B) Cellulose
  - (C) DDT
  - (D) Amino acids
83. Microbial degradation of pesticides is an example of :
- (A) Biotransformation
  - (B) Bioaccumulation
  - (C) Biomagnification
  - (D) Bioluminescence
84. Microorganisms that survive in high radiation environments are called :
- (A) Psychrophiles
  - (B) Halophiles
  - (C) Radioresistant microbes
  - (D) Thermophiles

85. Extremozymes are enzymes that function under :
- (A) Neutral conditions
  - (B) Mild conditions
  - (C) Extreme conditions
  - (D) Normal temperature
86. Microbial leaching is also known as :
- (A) Biofertilization
  - (B) Bioleaching
  - (C) Biogas production
  - (D) Composting
87. Which environment is rich in heavy-metal tolerant microorganisms ?
- (A) Forest soil
  - (B) Agricultural soil
  - (C) Mining areas
  - (D) Freshwater lakes
88. Microbial degradation of xenobiotics helps in :
- (A) Soil contamination
  - (B) Environmental pollution
  - (C) Bioremediation
  - (D) Soil erosion
89. Microbial detoxification of pesticides mainly involves :
- (A) Reduction
  - (B) Oxidation
  - (C) Hydrolysis
  - (D) All of the above
90. Two-component regulatory systems in bacteria typically consist of :
- (A) DNA polymerase and sigma factor
  - (B) Sensor kinase and response regulator
  - (C) Ribosome and tRNA
  - (D) Promoter and operator
91. In a two-component system, the sensor protein usually functions as a :
- (A) DNA helicase
  - (B) Histidine kinase
  - (C) RNA polymerase
  - (D) Ligase
92. The response regulator in a two-component system commonly acts as :
- (A) Ribosomal protein
  - (B) Enzyme inhibitor
  - (C) Membrane transporter
  - (D) DNA-binding transcription factor

93. The response regulator protein is typically phosphorylated on :
- (A) Aspartate
  - (B) Arginine
  - (C) Histidine
  - (D) Glycine
94. The general stress response sigma factor in bacteria is :
- (A)  $\sigma_{70}$
  - (B)  $\sigma_{54}$
  - (C)  $\sigma_{32}$
  - (D) RpoS ( $\sigma^S$ )
95. Small RNAs regulate RpoS expression mainly by :
- (A) DNA methylation
  - (B) Translational regulation of mRNA
  - (C) Protein degradation
  - (D) DNA recombination
96. The stringent response is triggered primarily by :
- (A) Excess glucose
  - (B) Amino acid starvation
  - (C) High oxygen concentration
  - (D) DNA damage
97. The signaling molecule of the stringent response is :
- (A) cAMP
  - (B) ATP
  - (C) (p)ppGpp
  - (D) NADH
98. The stringent response leads to :
- (A) Increased ribosome synthesis
  - (B) Decreased rRNA synthesis
  - (C) Increased DNA replication
  - (D) Increased translation
99. The molecule ppGpp affects transcription by interacting with :
- (A) DNA polymerase
  - (B) tRNA
  - (C) Ribosome
  - (D) RNA polymerase
100. Two-component systems allow bacteria to :
- (A) Replicate DNA
  - (B) Sense environmental changes
  - (C) Translate proteins
  - (D) Repair DNA

***(Only for Rough Work)***

4. Four alternative answers are mentioned for each question as—A, B, C & D in the booklet. The candidate has to choose the correct answer and mark the same in the OMR Answer-Sheet as per the direction :

**Example :**

**Question :**

- Q. 1 (A) ● (C) (D)  
 Q. 2 (A) (B) ● (D)  
 Q. 3 (A) ● (C) (D)

Illegible answers with cutting and over-writing or half filled circle will be cancelled.

5. Each question carries equal marks. Marks will be awarded according to the number of correct answers you have.
6. All answers are to be given on OMR Answer Sheet only. Answers given anywhere other than the place specified in the answer sheet will not be considered valid.
7. Before writing anything on the OMR Answer Sheet, all the instructions given in it should be read carefully.
8. After the completion of the examination candidates should leave the examination hall only after providing their OMR Answer Sheet to the invigilator. Candidate can carry their Question Booklet.
9. There will be no negative marking.
10. Rough work, if any, should be done on the blank pages provided for the purpose in the booklet.
11. To bring and use of log-book, calculator, pager and cellular phone in examination hall is prohibited.
12. In case of any difference found in English and Hindi version of the question, the English version of the question will be held authentic.

**Impt. :** On opening the question booklet, first check that all the pages of the question booklet are printed properly. If there is any discrepancy in the question Booklet, then after showing it to the invigilator, get another question Booklet of the same series.

4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर—A, B, C एवं D हैं। परीक्षार्थी को उन चारों विकल्पों में से सही उत्तर छाँटना है। उत्तर को OMR आन्सर-शीट में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

**उदाहरण :**

**प्रश्न :**

- प्रश्न 1 (A) ● (C) (D)  
 प्रश्न 2 (A) (B) ● (D)  
 प्रश्न 3 (A) ● (C) (D)

अपठनीय उत्तर या ऐसे उत्तर जिन्हें काटा या बदला गया है, या गोले में आधा भरकर दिया गया, उन्हें निरस्त कर दिया जाएगा।

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।
6. सभी उत्तर केवल ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर ही दिये जाने हैं। उत्तर-पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।
7. ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाये।
8. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी OMR Answer Sheet उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें। परीक्षार्थी अपने साथ प्रश्न-पुस्तिका ले जा सकते हैं।
9. निगेटिव मार्किंग नहीं है।
10. कोई भी रफ कार्य, प्रश्न-पुस्तिका के अन्त में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।
11. परीक्षा-कक्ष में लॉग-बुक, कैलकुलेटर, पेजर तथा सेल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।
12. प्रश्न के हिन्दी एवं अंग्रेजी रूपान्तरण में भिन्नता होने की दशा में प्रश्न का अंग्रेजी रूपान्तरण ही मान्य होगा।

**महत्वपूर्ण :** प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्न-पुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरीज की दूसरी प्रश्न-पुस्तिका प्राप्त कर लें।