Roll No. .....

Question Booklet Number

O. M. R. Serial No.

M. Sc. (Microbiology) (Fourth Semester) EXAMINATION, 2025-26

(New Syllabus Effective from 2023)

EXTREME MICROBIOLOGY

Paper Code								
L	0	4	1	0	0	6	T	(N)

Questions Booklet Series
C

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. Extremophiles contribute to astrobiology by helping scientists understand :

(A) Crop yield

(B) Plant growth

(C) Soil fertility

(D) Life in extreme environments

2. Barophilic microbes are useful in studying :

(A) High temperature environments

(B) Deep sea environments

(C) High salt environments

(D) Acidic environments

3. Extremophilic microorganisms play a role in environmental cleanup through :

(A) Biodegradation

(B) Bioremediation

(C) Biomining

(D) All of the above

4. Which industry commonly uses enzymes from extremophiles ?

(A) Textile industry

(B) Mining industry

(C) Food industry

(D) All of the above

5. Psychrophilic microorganisms are useful in :

(A) High temperature bioreactors

(B) Cold-active enzyme production

(C) Biofuel production at high temperature

(D) Metal corrosion prevention

6. Acidophilic microbes are commonly used in :

(A) Bioleaching of metals

(B) Dairy fermentation

(C) Bread making

(D) Compost formation

7. Halophilic microorganisms are particularly useful in :

(A) Wastewater treatment

(B) Antibiotic resistance studies

(C) Biofertilizer production

(D) High salt food fermentation

8. 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

9. Microbial communities in extreme environments often display :

(A) Low diversity only

(B) High metabolic adaptation

(C) No genetic variation

(D) Slow growth only

10. Cloning-based microbial community analysis typically involves :

(A) Protein extraction

(B) 16S rRNA gene cloning

(C) Metabolite profiling

(D) Microscopy only

11. Transcriptomics focuses on the study of :

(A) DNA replication

(B) Lipid metabolism

(C) Protein folding

(D) RNA transcripts

12. Functional genomics helps in understanding :

(A) DNA size

(B) Gene function and interaction

(C) Cell structure

(D) Microbial staining

13. Next-generation sequencing (NGS) is mainly used for :

(A) Protein purification

(B) Microbial culture

(C) High-throughput DNA sequencing

(D) Enzyme activity measurement

14. DGGE stands for :

(A) Denaturing Gradient Gel Electrophoresis

(B) Double Gradient Gel Extraction

(C) DNA Gel Gradient Evaluation

(D) Denatured Gel Gene Expression

15. Which method separates DNA fragments based on sequence differences for microbial community analysis ?

(A) PCR

(B) ELISA

(C) DGGE

(D) Western blot

16. A structured microbial community embedded in extracellular matrix is known as :

(A) Colony

(B) Biofilm

(C) Planktonic culture

(D) Consortium

17. Halophiles are extremophiles that grow best in :

(A) High salt concentration

(B) High acidity

(C) High pressure

(D) Low oxygen

18. Which of the following environments is considered an extreme habitat ?

(A) Garden soil
(B) Human intestine
(C) Hydrothermal vents
(D) Freshwater pond

19. Psychrophiles are microorganisms that prefer :

(A) High temperature
(B) Low temperature
(C) High salinity
(D) High pressure

20. Organisms that grow optimally at very high temperatures are called :

(A) Psychrophiles
(B) Halophiles
(C) Thermophiles
(D) Acidophiles

21. Which domain of life contains most known extremophiles ?

(A) Bacteria
(B) Archaea
(C) Eukarya
(D) Viruses

22. Changes in mycological autoflora refer to alterations in :

(A) Bacterial population
(B) Viral population
(C) Fungal population
(D) Algal population

23. Monitoring astronaut microbial flora is important to detect :

(A) Radiation exposure
(B) Microbial population changes
(C) Oxygen deficiency
(D) Equipment malfunction

24. Pyrolytic release experiment was designed to detect :

(A) Organic synthesis from atmospheric gases
(B) DNA replication
(C) Protein formation
(D) ATP production

25. Which environment is considered a model for mars ?

(A) Sahara Desert
(B) Antarctica
(C) Amazon Forest
(D) Deep Ocean

26. 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

27. Sulphur uptake experiments are useful in detecting microorganisms that perform :

(A) Sulphur metabolism

(B) Photosynthesis

(C) Nitrogen fixation

(D) Respiration only

28. Phosphate uptake in microorganisms indicates :

(A) Cell death

(B) Active metabolism

(C) DNA degradation

(D) Protein denaturation

29. 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

30. Autotrophic microorganisms obtain carbon from :

(A) Organic compounds

(B) Carbon dioxide

(C) Amino acids

(D) Sugars

31. Which of the following is considered evidence of photosynthetic life ?

(A) Methane release

(B) Oxygen evolution

(C) Nitrogen fixation

(D) ATP hydrolysis

32. 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

33. Exomicrobiology primarily deals with the study of :

(A) Marine microorganisms

(B) Microorganisms in extreme terrestrial environments

(C) Microbial life beyond Earth

(D) Industrial microorganisms

34. Hyperthermophilic archaea maintain gene expression at high temperature by :

(A) Weak promoters

(B) Stable transcription machinery

(C) Reduced protein synthesis

(D) Degrading RNA rapidly

35. Reverse gyrase enzyme is characteristic of :

(A) Psychrophiles

(B) Hyperthermophiles

(C) Mesophiles

(D) Halophiles

36. Hyperthermophiles possess proteins that are :

(A) Less stable

(B) Easily degraded

(C) Highly stable at high temperatures

(D) Cold-sensitive

37. Which enzyme removes damaged bases during DNA repair ?

(A) DNA glycosylase

(B) RNA polymerase

(C) DNA helicase

(D) Topoisomerase

38. DNA ligase functions in DNA repair by :

(A) Breaking DNA strands

(B) Joining DNA fragments

(C) Replicating DNA

(D) Removing RNA primers

39. Hyperthermophiles typically grow at temperatures above :

(A) 30°C

(B) 45°C

(C) 60°C

(D) 80°C

40. Which of the following helps organisms survive freezing temperatures ?

(A) Antifreeze proteins

(B) Heat shock proteins

(C) Catalase

(D) Ligase

41. Heat shock proteins help in :

(A) DNA degradation

(B) Protein folding and stabilization

(C) Lipid synthesis

(D) Cell division

42. Heat shock proteins primarily function as :

(A) Enzymes

(B) Chaperone proteins

(C) Hormones

(D) Transport proteins

43. Reactive oxygen species mainly damage :

(A) DNA, proteins and lipids

(B) Carbohydrates only

(C) Water molecules

(D) Minerals

44. 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

45. Which enzyme converts superoxide radicals into hydrogen peroxide ?

(A) Superoxide dismutase

(B) Catalase

(C) Peroxidase

(D) Ligase

46. Reactive oxygen species include :

(A) CO_2 and CH_4

(B) Superoxide and hydrogen peroxide

(C) Nitrogen gas

(D) Methane

47. Efflux pumps contribute to antibiotic resistance by :

(A) Breaking antibiotics

(B) Modifying antibiotics

(C) Exporting antibiotics outside the cell

(D) Binding antibiotics permanently

48. Multidrug resistance in bacteria is commonly associated with :

(A) Ribosomal mutation

(B) Efflux pump over expression

(C) DNA replication

(D) Protein degradation

49. Efflux pumps involved in antibiotic resistance are typically located in the :

(A) Cytoplasm

(B) Ribosome

(C) Cell membrane

(D) Nucleus

50. 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

51. Two-component systems allow bacteria to :

(A) Replicate DNA

(B) Sense environmental changes

(C) Translate proteins

(D) Repair DNA

52. The molecule ppGpp affects transcription by interacting with :

(A) DNA polymerase

(B) tRNA

(C) Ribosome

(D) RNA polymerase

53. The stringent response leads to :

(A) Increased ribosome synthesis

(B) Decreased rRNA synthesis

(C) Increased DNA replication

(D) Increased translation

54. The signaling molecule of the stringent response is :

(A) cAMP

(B) ATP

(C) (p)ppGpp

(D) NADH

55. The stringent response is triggered primarily by :

(A) Excess glucose

(B) Amino acid starvation

(C) High oxygen concentration

(D) DNA damage

56. Small RNAs regulate RpoS expression mainly by :

(A) DNA methylation

(B) Translational regulation of mRNA

(C) Protein degradation

(D) DNA recombination

57. The general stress response sigma factor in bacteria is :

(A) $\sigma 70$

(B) $\sigma 54$

(C) $\sigma 32$

(D) RpoS (σ^S)

58. The response regulator protein is typically phosphorylated on :

(A) Aspartate

(B) Arginine

(C) Histidine

(D) Glycine

59. 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

60. In a two-component system, the sensor protein usually functions as a :

(A) DNA helicase

(B) Histidine kinase

(C) RNA polymerase

(D) Ligase

61. 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

62. Microbial detoxification of pesticides mainly involves :

(A) Reduction

(B) Oxidation

(C) Hydrolysis

(D) All of the above

63. Microbial degradation of xenobiotics helps in :

(A) Soil contamination

(B) Environmental pollution

(C) Bioremediation

(D) Soil erosion

64. Which environment is rich in heavy-metal tolerant microorganisms ?

(A) Forest soil

(B) Agricultural soil

(C) Mining areas

(D) Freshwater lakes

65. Microbial leaching is also known as :

(A) Biofertilization

(B) Bioleaching

(C) Biogas production

(D) Composting

66. Extremozymes are enzymes that function under :

(A) Neutral conditions

(B) Mild conditions

(C) Extreme conditions

(D) Normal temperature

67. Microorganisms that survive in high radiation environments are called :

(A) Psychrophiles

(B) Halophiles

(C) Radioresistant microbes

(D) Thermophiles

68. Microbial degradation of pesticides is an example of :

(A) Biotransformation

(B) Bioaccumulation

(C) Biomagnification

(D) Bioluminescence

69. Which of the following is a xenobiotic compound ?

(A) Glucose

(B) Cellulose

(C) DDT

(D) Amino acids

70. Which microorganism is involved in manganese oxidation ?

(A) *Pseudomonas putida*

(B) *Streptococcus*

(C) *Salmonella*

(D) *Clostridium*

71. Acid mine drainage usually results in :

(A) Neutral pH

(B) High pH

(C) Low pH

(D) Alkaline pH

72. Which metal is most commonly recovered through microbial bioleaching ?

(A) Gold

(B) Copper

(C) Aluminium

(D) Zinc

73. Which microorganism is commonly involved in bioleaching of copper from ore deposits ?

(A) *Bacillus subtilis*

(B) *Escherichia coli*

(C) *Acidithiobacillus ferrooxidans*

(D) *Rhizobium leguminosarum*

74. Extremophilic microbes are useful in :

(A) Biotechnology

(B) Medicine

(C) Environmental cleanup

(D) All of the above

75. Halophiles are used in :

(A) Bioremediation of saline soils

(B) PCR

(C) Fermentation

(D) Antibiotic production

76. Acidophilic microbes are commonly found in :

(A) Hot springs

(B) Acid mine drainage

(C) Salt lakes

(D) Desert soil

77. Acidophiles maintain internal pH by :

(A) Proton pumps

(B) Sodium pumps

(C) Potassium pumps

(D) Calcium pumps

78. Alkaliphiles grow optimally at pH :

(A) 1-3

(B) 4-6

(C) 7

(D) 9-11

79. Metal resistance in microbes often involves :

(A) Efflux pumps

(B) Increased respiration

(C) Reduced metabolism

(D) DNA fragmentation

80. Xenobiotic-utilizing microbes degrade :

(A) Synthetic chemicals

(B) Natural compounds

(C) Proteins

(D) Lipids

81. Metallophilic microbes are useful in :

(A) Food processing

(B) Bioremediation

(C) Fermentation

(D) Agriculture

82. A well-known radiophilic bacterium is :

(A) *Bacillus subtilis*

(B) *E. coli*

(C) *Deinococcus radiodurans*

(D) *Pseudomonas aeruginosa*

83. Radiophiles survive high radiation due to :

(A) Thick cell walls

(B) Efficient DNA repair systems

(C) High lipid content

(D) Reduced metabolism

84. Halophiles are commonly found in :

(A) Desert soil

(B) Deep ocean vents

(C) Glaciers

(D) Salt lakes

85. Compatible solutes in halophiles include :

(A) Glucose

(B) Glycine betaine

(C) Lactose

(D) Cellulose

86. Xerophilic microbes resist desiccation by :

(A) Producing spores

(B) Increasing metabolism

(C) Increasing respiration

(D) Decreasing membrane fluidity

87. Xerophiles grow in environments with :

(A) High moisture

(B) Low moisture

(C) High temperature

(D) High radiation

88. Halophilic enzymes remain active due to :

(A) High hydrophobic amino acids

(B) Low protein stability

(C) High acidic amino acids

(D) Reduced ionic interactions

89. Osmophiles tolerate high sugar concentrations by :

(A) Decreasing osmotic pressure

(B) Producing compatible solutes

(C) Reducing enzyme activity

(D) Increasing water loss

90. Oligotrophic microbes typically have :

(A) Slow growth rate

(B) High metabolic rate

(C) Large genome

(D) High nutrient demand

91. Oligotrophs thrive in environments with :

(A) High nutrients

(B) High salinity

(C) High temperature

(D) Low nutrients

92. Which enzyme from thermophiles is widely used in PCR ?

(A) DNA ligase

(B) Taq polymerase

(C) RNA polymerase

(D) Reverse transcriptase

93. Heat-stable enzymes from thermophiles are known as :

(A) Psychrozymes

(B) Thermozymes

(C) Isozymes

(D) Metalloenzymes

94. Thermophiles stabilize proteins using :

(A) Weak ionic bonds

(B) Reduced disulfide bonds

(C) Reduced hydrophobic interactions

(D) Increased hydrogen bonding

95. Cryophilic microbes maintain membrane fluidity by :

(A) Increasing saturated fatty acids

(B) Increasing cholesterol

(C) Increasing unsaturated fatty acids

(D) Increasing proteins

96. Cryophiles are microorganisms that grow best at :

(A) 0-15°C

(B) 25-30°C

(C) 40-60°C

(D) 60-80°C

97. 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

98. Barophiles are organisms that thrive under :

(A) High temperature

(B) High salinity

(C) High radiation

(D) High pressure

99. Anaerobic microbes typically generate energy through :

(A) Oxidative phosphorylation

(B) Aerobic respiration

(C) Fermentation

(D) Photorespiration

100. 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

(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।