

Roll. No.

Question Booklet Number

O.M.R. Serial No.

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M.Sc. (SEM.-IV) (NEP) (SUPPLE.) EXAMINATION, 2024-25

MICROBIOLOGY

(Industrial Microbiology)

Paper Code

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**Question Booklet
Series**

A

Time : 1 : 30 Hours

Max. 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.
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 :

(Remaining instructions on last page)

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, उसे तुरन्त बदल लें।
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 छँटना है। उत्तर को OMR उत्तर-पत्रक में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

(शेष निर्देश अन्तिम पृष्ठ पर)

1. The main material used for constructing large-scale fermentors is :
 (A) Copper
 (B) Stainless steel
 (C) Plastic
 (D) Aluminum
2. Air-lift fermentors belong to which type of system?
 (A) Stirred tank
 (B) Photobioreactor
 (C) Packed bed
 (D) Pneumatic fermentor
3. In packed bed fermentors, microorganisms are generally :
 (A) Suspended
 (B) Free floating
 (C) Immobilized on support material
 (D) Washed away
4. In a stirred tank fermentor, baffles are usually fixed to the :
 (A) Impeller
 (B) Shaft
 (C) Fermentor wall
 (D) Sparger
5. Which of the following best describes the function of impellers in a baffled stirred tank fermentor?
 (A) Supply sterile air
 (B) Support baffles
 (C) Maintain sterility
 (D) Provide agitation and mixing
6. Without baffles, the liquid inside a stirred tank fermentor tends to move in a :
 (A) Axial flow
 (B) Circular motion with vortex formation
 (C) Radial turbulent flow
 (D) Upward flow only
7. Carbon source in fermentation media is commonly provided by :
 (A) Peptone
 (B) Glucose
 (C) Ammonium sulfate
 (D) Yeast extract
8. The nitrogen source in media can be :
 (A) Sodium chloride
 (B) Glycerol
 (C) Agar
 (D) Ammonium salts
9. Complex media are different from defined media because they :
 (A) Contain natural ingredients of unknown composition
 (B) Contain chemically defined compounds only
 (C) Contain only inorganic salts
 (D) Lack carbon source
10. The most common method for sterilizing fermentation media is :
 (A) UV radiation
 (B) Autoclaving
 (C) Filtration
 (D) Dry heat

11. Heat-sensitive vitamins in the medium are sterilized by :
 - (A) Radiation
 - (B) Autoclaving
 - (C) Dry heat
 - (D) Filtration
12. The main purpose of inoculum preparation is :
 - (A) Reduce contamination
 - (B) Replace sterilization
 - (C) Ensure sufficient biomass
 - (D) Increase temperature
13. For fungal fermentations, inoculum is often prepared in the form of :
 - (A) Spores
 - (B) Single cells
 - (C) Biofilms
 - (D) None of these
14. Immobilized cells are used mainly because:
 - (A) They are easy to sterilize
 - (B) They need no nutrients
 - (C) They grow faster than free cells
 - (D) They can be reused and stabilized
15. Oxygen transfer rate in fermentors depends on :
 - (A) Agitation speed
 - (B) Aeration rate
 - (C) Solubility of oxygen
 - (D) All of the above
16. Spargers in fermentors are used for ;
 - (A) Heating
 - (B) Sterilization
 - (C) Introduction of sterile air
 - (D) Agitation
17. Increasing agitation speed in fermentors generally :
 - (A) Kills microbes directly
 - (B) Reduces oxygen transfer
 - (C) Has no effect
 - (D) Increases oxygen transfer
18. The most commonly used foam control agent is :
 - (A) Silicones
 - (B) Glucose
 - (C) Ammonium sulfate
 - (D) All of the above
19. Excessive foam formation can lead to :
 - (A) Increased oxygen transfer
 - (B) Loss of culture
 - (C) Increased biomass only
 - (D) No effect on fermentation
20. Cell disruption methods are classified as :
 - (A) Mechanical and non-mechanical
 - (B) Batch and continuous
 - (C) Open and closed
 - (D) Reversible and irreversible

21. Precipitation of proteins is commonly done using :
- (A) Ammonium sulfate
 - (B) Sodium chloride
 - (C) Glucose
 - (D) Silica
22. The last step in downstream processing of biologicals is usually :
- (A) Crystallization
 - (B) Drying and formulation
 - (C) Extraction
 - (D) Sterilization
23. The principle behind an autoclave is :
- (A) Dry heat sterilization
 - (B) Ultraviolet radiation
 - (C) Moist heat under pressure
 - (D) Filtration
24. Standard operating conditions of an autoclave for sterilization are :
- (A) 100 °C, 15 minutes, normal pressure
 - (B) 121 °C, 15 psi, 15–20 minutes
 - (C) 160 °C, 2 hours, dry heat
 - (D) 37 °C, 24 hours, incubation
25. Which of the following items is not suitable for autoclave sterilization?
- (A) Culture media
 - (B) Glassware
 - (C) Heat-sensitive plastic materials
 - (D) Surgical dressings
26. Primary screening of microorganisms is done to :
- (A) Detect industrially important traits in mixed cultures
 - (B) Compare yields of improved strains
 - (C) Maintain strain stability
 - (D) Scale-up process
27. The main purpose of secondary screening is :
- (A) To isolate pure cultures
 - (B) To prepare starter cultures
 - (C) To measure cell morphology
 - (D) To identify high-yielding strains with industrial potential
28. Which of the following is not a method of strain improvement?
- (A) Mutagenesis
 - (B) Genetic recombination
 - (C) Protoplast fusion
 - (D) Filtration

29. Which of the following is a classical method for strain improvement?
- (A) Recombinant DNA technology
 - (B) Adaptive evolution
 - (C) CRISPR-Cas9
 - (D) Genetic engineering
30. Cryopreservation maintains microorganisms at :
- (A) -20°C
 - (B) -80°C
 - (C) -196°C
 - (D) 4°C
31. Strain degeneration refers to :
- (A) Loss of production ability with repeated culturing
 - (B) Increase in product yield
 - (C) Growth of contaminant microorganisms
 - (D) Overproduction of secondary metabolites
32. Scale-up in fermentation means :
- (A) Increasing product purity
 - (B) Reducing production costs
 - (C) Transferring process from small scale to larger scale
 - (D) Maintaining cultures on agar slants
33. Which of the following is the correct order in scale-up?
- (A) Production $\rightarrow$ Pilot plant $\rightarrow$ Shake flask $\rightarrow$ Lab fermenter
 - (B) Shake flask $\rightarrow$ Lab fermenter $\rightarrow$ Pilot plant $\rightarrow$ Production fermenter
 - (C) Lab fermenter $\rightarrow$ Shake flask $\rightarrow$ Pilot plant $\rightarrow$ Production
 - (D) Shake flask $\rightarrow$ Pilot plant $\rightarrow$ Lab fermenter $\rightarrow$ Production
34. Scale-down studies are important for :
- (A) Understanding metabolic regulation under stress
 - (B) Reducing production cost
 - (C) Simulating large-scale conditions in lab
 - (D) Both (A) and (C)
35. The most common shake flask volume used for inoculum development is :
- (A) 50 mL
 - (B) 100–250 mL
 - (C) 1–2 L
 - (D) 10 L
36. Which factor is most critical when scaling up aerobic fermentations?
- (A) Temperature
 - (B) pH electrodes
 - (C) Media color
 - (D) Aeration and agitation

37. Which parameter is often used as a criterion for scale-up of aerobic fermentations?
- Mixing time
 - Power input per volume (P/V)
 - Volumetric oxygen transfer coefficient (kLa)
 - All of the above
38. Inoculum size is generally :
- 1–5% of fermenter volume
 - 10–50% of fermenter volume
 - 0.01–0.1% of fermenter volume
 - Equal to fermenter volume
39. Foam formation in large fermenters is controlled by :
- Agitation speed
 - Antifoam agents
 - Decreasing aeration
 - Reducing inoculum
40. A challenge during scale-up of fermentation is :
- Maintaining uniform oxygen transfer and mixing
 - Avoiding contamination
 - Sterilizing large volumes of media
 - All of the above
41. Heat removal becomes a critical issue in :
- Shake flask culture
 - Large-scale production fermenters
 - Lab-scale stirred tanks
 - Agar slant cultures
42. The main advantage of pilot plant studies is :
- Reduced contamination chances
 - Cost minimization
 - Predicting performance at industrial scale
 - Faster product formation
43. In media optimization during scale-up, which component is most critical for cost reduction?
- Carbon source
 - Vitamins
 - Trace elements
 - Buffers
44. The key factor for industrial strain maintenance programs is :
- Maintaining product yield and genetic stability
 - Easy nutrient availability
 - Rapid cell growth
 - Continuous culture only

45. The main microorganism used in beer production is :
- (A) *Aspergillus niger*
 - (B) *Lactobacillus bulgaricus*
 - (C) *Saccharomyces cerevisiae*
 - (D) None of the above
46. In wine production, the substrate used is :
- (A) Malted barley
 - (B) Rice
 - (C) Grapes
 - (D) Corn mash
47. The anaerobic conversion of sugars into ethanol and CO₂ by yeast is called :
- (A) Respiration
 - (B) Fermentation
 - (C) Distillation
 - (D) Hydrolysis
48. The enzyme complex responsible for starch breakdown during beer brewing is :
- (A) Protease
 - (B) Zymase
 - (C) Amylase
 - (D) Cellulase
49. The aging of wine in wooden barrels mainly affects its :
- (A) Alcohol content
 - (B) Flavor and aroma
 - (C) Yeast growth
 - (D) Sugar content
50. Protease enzymes are industrially used in :
- (A) Baking industry
 - (B) Brewing industry
 - (C) Leather tanning
 - (D) None of the above
51. Which microorganism is commonly used for commercial amylase production?
- (A) *Bacillus subtilis*
 - (B) *Streptococcus thermophilus*
 - (C) *Pseudomonas aeruginosa*
 - (D) *Escherichia coli*
52. Which fungal species is known for acid-stable amylase production?
- (A) *Aspergillus oryzae*
 - (B) *Rhizopus stolonifer*
 - (C) *Penicillium chrysogenum*
 - (D) *Candida albicans*

53. Citric acid is produced industrially by :
- (A) *Saccharomyces cerevisiae*
 - (B) *Aspergillus niger*
 - (C) *Acetobacter aceti*
 - (D) *Bacillus subtilis*
54. Which pathway is primarily involved in citric acid production?
- (A) Glycolysis
 - (B) TCA cycle
 - (C) Pentose phosphate pathway
 - (D) Entner-Doudoroff pathway
55. Citric acid is widely used in industry as :
- (A) Antibiotic
 - (B) Plasticizer
 - (C) Flavoring agent
 - (D) Sweetener
56. Glutamic acid is mainly produced by :
- (A) *Corynebacterium glutamicum*
 - (B) *Bacillus subtilis*
 - (C) *Pseudomonas fluorescens*
 - (D) *Lactobacillus casei*
57. Overproduction of amino acids in microbes is often achieved by :
- (A) Mutagenesis and selection
 - (B) Use of antibiotics
 - (C) Heat shock
 - (D) Plasmid curing
58. Which amino acid is widely added to animal feed?
- (A) Glycine
 - (B) Histidine
 - (C) Lysine
 - (D) Alanine
59. Vitamin B2 is also known as :
- (A) Thiamine
 - (B) Riboflavin
 - (C) Niacin
 - (D) Cobalamin
60. Vitamin B12 is also called :
- (A) Riboflavin
 - (B) Cobalamin
 - (C) Folic acid
 - (D) Nicotinamide

61. Industrial production of vitamin B2 involves :
- (A) *Ashbya gossypii*
 - (B) *Bacillus subtilis*
 - (C) *Corynebacterium glutamicum*
 - (D) *Saccharomyces cerevisiae*
62. Which microorganism is widely used for vitamin B12 production?
- (A) *Acetobacter aceti*
 - (B) *Propionibacterium freudenreichii*
 - (C) *Bacillus subtilis*
 - (D) *Rhizopus stolonifer*
63. Vitamin B12 contains which metallic ion at its core?
- (A) Iron
 - (B) Magnesium
 - (C) Cobalt
 - (D) Copper
64. A deficiency of vitamin B12 in humans primarily causes :
- (A) Night blindness
 - (B) Scurvy
 - (C) Pernicious anemia
 - (D) Rickets
65. The industrial production of penicillin is carried out by :
- (A) *Penicillium roquefortii*
 - (B) *Penicillium chrysogenum*
 - (C) *Penicillium notatum*
 - (D) *Aspergillus niger*
66. Penicillin production in industry occurs mainly during :
- (A) Lag phase
 - (B) Log phase
 - (C) Stationary phase
 - (D) Death phase
67. Streptomycin is produced by :
- (A) *Streptococcus lactis*
 - (B) *Aspergillus fumigatus*
 - (C) *Bacillus subtilis*
 - (D) *Streptomyces griseus*
68. Penicillin is classified as a
- (A) Cephalosporin
 - (B) Macrolide
 - (C) β -lactam antibiotic
 - (D) Tetracycline

69. The fermentation method commonly used in industrial antibiotic production is :
- (A) Surface fermentation
 - (B) Submerged fermentation
 - (C) Solid-state fermentation
 - (D) Anaerobic digestion
70. Which is not an antibiotic-producing genus?
- (A) *Streptomyces*
 - (B) *Penicillium*
 - (C) *Saccharomyces*
 - (D) *Bacillus*
71. Interferons are classified as :
- (A) Growth factors
 - (B) Antiviral proteins
 - (C) Antibiotics
 - (D) Enzymes
72. The recombinant production of interferons is carried out in :
- (A) *Streptomyces spp.*
 - (B) *E. coli* or yeast
 - (C) *Bacillus anthracis*
 - (D) Cyanobacteria
73. The primary use of interferons is in the treatment of :
- (A) Bacterial infections
 - (B) Autoimmune diseases only
 - (C) Fungal infections
 - (D) Viral infections and cancers
74. The first recombinant DNA-derived therapeutic protein produced was :
- (A) Streptokinase
 - (B) Human insulin
 - (C) Interferon- α
 - (D) Erythropoietin
75. The advantage of recombinant insulin over animal-derived insulin is
- (A) Cheaper production
 - (B) Faster fermentation
 - (C) Reduced immune reactions
 - (D) Longer shelf life
76. Attenuated vaccines are prepared from :
- (A) Killed pathogens
 - (B) Live but weakened pathogens
 - (C) Only proteins
 - (D) Toxins only

77. Which vaccine is a recombinant subunit vaccine?
- (A) BCG
 - (B) Polio (OPV)
 - (C) Hepatitis B vaccine
 - (D) Rabies vaccine
78. The DPT vaccine protects against :
- (A) Diphtheria, Pertussis, Tetanus
 - (B) Dengue, Polio, Typhoid
 - (C) Diphtheria, Plague, Typhoid
 - (D) Dysentery, Pertussis, Tetanus
79. Microorganisms are used in steroid biotransformation mainly for :
- (A) Increasing solubility
 - (B) Adding hydroxyl groups (hydroxylation)
 - (C) Increasing toxicity
 - (D) Destroying activity
80. Cortisone is produced by microbial hydroxylation of :
- (A) Cholesterol
 - (B) Progesterone
 - (C) Testosterone
 - (D) Prednisone
81. The main advantage of microbial steroid transformation is :
- (A) Cost reduction and specificity
 - (B) Faster growth of microbes
 - (C) Less need for fermentation
 - (D) Reduced immune response
82. The industrial steroid biotransformations are usually catalyzed by :
- (A) Extracellular enzymes
 - (B) Intracellular enzymes like hydroxylases
 - (C) Plasmids
 - (D) Toxins
83. Biotransformation of steroids is important in :
- (A) Enzyme engineering
 - (B) Food preservation
 - (C) Fuel production
 - (D) Hormone synthesis and pharmaceuticals
84. Xanthan gum is mainly produced by :
- (A) *Bacillus subtilis*
 - (B) *Xanthomonas campestris*
 - (C) *Lactobacillus bulgaricus*
 - (D) *Aspergillus niger*

85. The main industrial application of dextran is :
- (A) Biodegradable plastic
 - (B) Food thickener
 - (C) Blood plasma substitute
 - (D) Antibiotic production
86. Xanthan gum is widely used as :
- (A) Anticoagulant
 - (B) Vitamin supplement
 - (C) Antibiotic
 - (D) Emulsifier and stabilizer
87. Which sugar is the primary substrate for dextran production?
- (A) Maltose
 - (B) Sucrose
 - (C) Glucose
 - (D) Lactose
88. PHB (polyhydroxybutyrate) belongs to which group of bioplastics?
- (A) Polylactic acids
 - (B) Polyurethanes
 - (C) Polyhydroxyalkanoates
 - (D) Polyvinyl alcohols
89. PHB is accumulated in microorganisms as :
- (A) Enzyme
 - (B) Protein granules
 - (C) Intracellular carbon and energy reserve
 - (D) Extracellular polysaccharide
90. Which property makes PHB attractive for medical applications?
- (A) Biodegradability and biocompatibility
 - (B) Non-biodegradability
 - (C) Water solubility
 - (D) Toxicity to microbes
91. Single Cell Protein refers to :
- (A) Protein from plant seeds
 - (B) Protein extracted from microbial biomass
 - (C) Protein from animal tissues
 - (D) Protein supplements from algae only
92. Cyanobacterium widely used in SCP is :
- (A) *Spirulina*
 - (B) *Nostoc*
 - (C) *Anabaena*
 - (D) *Chlorella*

93. SCP is mainly used as :
- (A) Fuel
 - (B) Food and feed supplement
 - (C) Plastic substitute
 - (D) Pesticide
94. The most commonly cultivated edible mushroom worldwide is :
- (A) *Agaricus bisporus*
 - (B) *Pleurotus ostreatus*
 - (C) *Volvariella volvacea*
 - (D) *Lentinula edodes*
95. Mushroom cultivation primarily uses :
- (A) Soil medium
 - (B) Compost or lignocellulosic wastes
 - (C) Synthetic agar medium
 - (D) Hydroponic systems
96. *Azolla-Anabaena* symbiosis provides :
- (A) Potassium fixation
 - (B) Nitrogen fixation
 - (C) Phosphate solubilization
 - (D) Zinc mobilization
97. Mycorrhizal biofertilizers improve :
- (A) Nitrogen fixation
 - (B) Protein synthesis
 - (C) Potassium fixation
 - (D) Phosphorus uptake
98. Vesicular-arbuscular mycorrhiza (VAM) belongs to :
- (A) Ascomycota
 - (B) Glomeromycota
 - (C) Basidiomycota
 - (D) Zygomycota
99. Cyanobacteria used as biofertilizers are primarily :
- (A) Non-photosynthetic
 - (B) Antibiotic producers
 - (C) Fungal symbionts
 - (D) Nitrogen-fixing
100. A major advantage of algal biofertilizers in rice fields is :
- (A) Increase in soil salinity
 - (B) Addition of toxic metabolites
 - (C) Sustainable nitrogen input
 - (D) Depletion of organic matter

ROUGH WORK

Example :

Question :

Q.1 (A) ● (C) (D)

Q.2 (A) (B) ● (D)

Q.3 (A) ● (C) (D)

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 & 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.

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ● (C) (D)

प्रश्न 2 (A) (B) ● (D)

प्रश्न 3 (A) ● (C) (D)

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।
6. सभी उत्तर केवल ओ०एम०आर० 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. ओ०एम०आर० 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 में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।
11. परीक्षा-कक्ष में लॉग-बुक, कैल्कुलेटर, 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 प्रश्नपुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरिज की दूसरी प्रश्नपुस्तिका प्राप्त कर लें।