**Roll No. .....**

| Question Booklet Number |
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**O. M. R. Serial No.**

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

## (New Syllabus Effective from 2023)

## INDUSTRIAL MICROBIOLOGY

| Paper Code | | | | | | | | |
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| Questions Booklet Series |
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*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. The goal of ergonomics (the study of people at work), is to reduce stress and eliminate injuries associated with :
   (A) Bad posture, overuse of muscles, and repeated tasks
   (B) Excessive workload and overtime
   (C) Gasoline
   (D) High temperature

2. Formulation of fermentation products includes :
   (A) Crystallization, desiccation, and drying
   (B) Sugars, salts, polymers
   (C) Removal of most of the water
   (D) All of the above

3. What is the objective of occupational hygiene ?
   (A) Preventing workplace accidents
   (B) Promoting environmental conservation
   (C) Enhancing workplace productivity
   (D) Protecting worker health and well-being

4. What is the temperature range at which photo-bioreactors are usually operated ?
   (A) 25-40°C
   (B) 10-20°C
   (C) 40-60°C
   (D) Above 60°C

5. Which oil is mentioned as a natural antifoaming agent ?
   (A) Polyglycols
   (B) Silicones
   (C) Phosphates
   (D) Soybean oil

6. If recovery yield increases from 50% to 80%, cost per unit will :
   (A) Increase
   (B) Double
   (C) Remain same
   (D) Decrease

7. If product is protein requiring high purity, best technique is :
   (A) Evaporation
   (B) Chromatography
   (C) Filtration
   (D) Sedimentation

8. A membrane bioreactor combines :
   (A) Anaerobic digestion + Sedimentation
   (B) Activated sludge + membrane filtration
   (C) Reverse osmosis + chlorination
   (D) Trickling filter + UV disinfection

9. If impurities differ in solubility, use :

(A) Extraction

(B) Filtration

(C) Heating

(D) Sterilization

10. Most critical step affecting final cost is :

(A) Isolation

(B) Inoculation

(C) Downstream processing

(D) Sterilization

11. For intracellular enzyme recovery, first step is :

(A) Drying

(B) Cell disruption

(C) Packaging

(D) Sterilization

12. Trickling filters are mainly used in :

(A) Food industry

(B) Sterilization

(C) Pharmaceutical production

(D) Wastewater treatment

13. Sterility is important to :

(A) Increase mutation

(B) Increase cost

(C) Reduce yield

(D) Prevent contamination

14. Hygiene in fermentation industries mainly refers to :

(A) Mutation

(B) Cleanliness and contamination control

(C) Growth rate

(D) Yield

15. Downstream processing begins after :

(A) Sterilization

(B) Media preparation

(C) Inoculation

(D) Fermentation completion

16. Immobilized enzyme reactions are best performed in :

(A) Stirred tank

(B) Packed bed reactor

(C) Bubble column

(D) Airlift fermenter

17. For large-scale astaxanthin production, the best reactor is :

(A) Trickling filter

(B) Tray fermenter

(C) Packed bed

(D) Photobioreactor

18. Selection of fermenter type depends mainly on :

(A) Color of media

(B) Type of microorganism and process requirement

(C) Size only

(D) Shape only

19. Light is an essential factor in :

(A) Trickling filter

(B) Stirred tank

(C) Photobioreactor

(D) Packed bed

20. Best fermenter for large-scale industrial production is :

(A) Packed bed

(B) Stirred tank fermenter

(C) Tray fermenter

(D) Flask

21. Baffles in a fermenter are used to :

(A) Prevent vortex formation

(B) Increase foaming

(C) Reduce oxygen

(D) Heat media

22. Batch *vs.* continuous fermentation differs in :

(A) Oxygen

(B) Input/output of nutrients

(C) Temperature

(D) Sterility

23. Airlift fermenters are preferred because they :

(A) Use high energy

(B) Have low shear stress

(C) Require impellers

(D) Produce foam

24. A fermenter designed without mechanical agitation is :

(A) Stirred tank

(B) Air lift fermentor

(C) Bubble column

(D) Photobioreactor

25. The device used for aeration is :

(A) Impeller

(B) Sparger

(C) Baffle

(D) Jacket

26. In situ sterilization means :

(A) Sterilization inside fermenter

(B) Sterilization outside fermenter

(C) Filtration

(D) Dry heat

27. Maintaining constant kLa during scale-up ensures :

(A) Mutation

(B) Same oxygen transfer

(C) Preservation

(D) Sterility

28. Batch fermentation occurs in :

(A) Open system

(B) Continuous system

(C) Closed system

(D) Semi-open system

29. Excessive heating of media can cause :

(A) Sterility

(B) Mutation

(C) Increased oxygen

(D) Caramelization of sugars

30. Heat-sensitive media components should be sterilized by :

(A) Autoclaving

(B) Radiation

(C) Boiling

(D) Filtration

31. Continuous sterilization is preferred because it :

(A) Uses more energy

(B) Saves energy and time

(C) Reduces yield

(D) Causes contamination

32. Scale-down helps in :

(A) Eliminating microbes

(B) Studying large-scale problems in lab

(C) Preservation

(D) Sterilization

33. Best system for continuous production is :

(A) Free cells

(B) Dead cells

(C) Mutated cells

(D) Immobilized cells

34. Air sterilization in fermenters is commonly done by :

(A) Heating

(B) Filtration

(C) Radiation

(D) Centrifugation

35. A fermenter is defined as :

(A) Storage vessel

(B) Sterilization chamber

(C) Special vessel for microbial growth

(D) Cooling system

36. Entrapment vs adsorption differs in :

(A) Temperature

(B) Mutation

(C) Binding strength

(D) Sterility

37. Oxygen transfer is critical during scale-up because :

(A) It causes mutation

(B) It sterilizes media

(C) It reduces yield

(D) It affects microbial growth

38. A researcher selecting microbes from oil-contaminated soil is applying :

(A) Random selection

(B) Preservation

(C) Sterilization

(D) Targeted isolation

39. Immobilization improves :

(A) Mutation

(B) Sterility

(C) Reusability of enzymes

(D) Contamination

40. Scale-up is important for :

(A) Preservation

(B) Industrial production

(C) Isolation

(D) Lab experiments only

41. Economic feasibility depends mainly on :

(A) Yield and cost of substrate

(B) Color of culture

(C) Shape of colony

(D) Size of cell

42. Scale-down studies are mainly used to :

(A) Mimic industrial conditions at lab scale

(B) Increase volume

(C) Sterilize media

(D) Improve mutation

43. Clear zone formation in agar indicates :

(A) Mutation

(B) Enzyme activity

(C) Contamination

(D) Sporulation

44. A strain producing unwanted by-products should be :

(A) Selected

(B) Modified or rejected

(C) Preserved

(D) Ignored

45. Mutation *vs.* recombination differs in :

(A) Both are identical

(B) Both reduce yield

(C) Random *vs.* targeted changes

(D) Both preserve strains

46. Strain improvement *vs.* screening differs in :

(A) Selection *vs.* enhancement

(B) Both are same

(C) Both reduce yield

(D) Both preserve strains

47. Maintenance of microorganisms ensures :

(A) Genetic stability

(B) Mutation

(C) Sterilization

(D) Contamination

48. Strain improvement helps in :

(A) Reducing productivity

(B) Enhancing metabolic efficiency

(C) Killing microbes

(D) Avoiding screening

49. Primary screening does not give information about :

(A) Detection

(B) Yield potential

(C) Presence of metabolite

(D) Initial selection

50. Microorganisms are commonly isolated from :

(A) Only clinical samples

(B) Only air

(C) Natural habitats like soil and water

(D) Only fermenters

51. Which method of virus inactivation involves attacking the viral envelope and rendering it dysfunctional ?

(A) Ultraviolet (UV) inactivation

(B) Pasteurization

(C) Acidic pH inactivation

(D) Solvent/detergent inactivation

52. Mealworm-based biological recovery techniques are employed for :

(A) PHA

(B) Xanthan

(C) Dextran

(D) All of the above

53. Which enzyme opens the β-lactam ring of penicillin and deprives it of all antibacterial activity ?

(A) Cephalosporinase

(B) Penicillinase

(C) Amidase

(D) Acylase

54. Which group of Streptomycin is essential for its antibiotic activity ?

(A) Guanido groups of streptidine

(B) Hydroxyl groups of streptidine

(C) Carboxyl groups of streptidine

(D) Aldehyde group of streptose

55. Which factor decreases with an increase in scale ?

(A) Temperature

(B) Degree of mixing

(C) Pressure

(D) pH

56. What is the constant core region found in all penicillins ?

(A) R-group

(B) Side chain

(C) β-lactam ring

(D) 6-APA

57. Which is not the carrier material used for biofertilizer development ?

(A) Peat

(B) Lignite

(C) Vermiculite

(D) Jaggery

58. Which one is an example of bottom fermenting yeast ?

(A) *Saccharomyces cerevisiae*

(B) *Saccharomyces carlsbergensis*

(C) *Saccharomyces thermophillus*

(D) None of the above

59. Curing helps in :

(A) Killing cells

(B) Uniform distribution and adaptation

(C) Reducing moisture

(D) Increasing pH

60. Blue-green algae are chiefly used as biofertilizer in the crop of :

(A) Mustard

(B) Paddy

(C) Gram

(D) Wheat

61. What is the main sugar required by *Gluconobacter oxydans* for the production of dextran ?

(A) Glucose

(B) Fructose

(C) Sucrose

(D) Dextrin

62. Shelf life of biofertilizers depends on :

(A) Temperature and carrier

(B) Oxygen only

(C) pH only

(D) Pressure

63. Carrier material in biofertilizer is used to :

(A) Kill microbes

(B) Increase pH

(C) Support microbial survival

(D) Increase temperature

64. PHA accumulation occurs under :

(A) Carbon excess and nutrient limitation

(B) Balanced growth

(C) Oxygen limitation only

(D) High nitrogen

65. Foaming in fermentation is mainly due to :

(A) Proteins and agitation

(B) Lipids

(C) Oxygen

(D) Temperature

66. Recovery of dextran involves :

(A) Distillation

(B) Filtration only

(C) Precipitation using alcohol

(D) Heating

67. The head space of fermentor left unfilled with medium to allow for :

(A) Aeration

(B) foaming

(C) Both (A) and (B)

(D) None of the above

68. First licensed drug produced using rDNA technology is :

(A) Insulin

(B) Vaccine

(C) Interferon

(D) Growth hormone

69. Major challenge in xanthan fermentation is :

(A) Low yield

(B) No oxygen

(C) Low substrate

(D) High viscosity of broth

70. High $CO_2$ levels in mushroom cultivation leads to :

(A) Better fruiting

(B) Poor development of fruit bodies

(C) Increased yield

(D) No effect

71. Substrate for dextran production is :

(A) Glucose

(B) Lactose

(C) Sucrose

(D) Molasses

72. Casing layer is added to :

(A) Maintain moisture and induce fruiting

(B) Increase nutrients

(C) Reduce contamination

(D) Increase temperature

73. Nucleic acid reduction in SCP is achieved by :

(A) Heating or enzymatic treatment

(B) Cooling

(C) Filtration only

(D) Aeration

74. The primary objective of SCP production is :

(A) Antibiotic production

(B) Vitamin synthesis

(C) Enzyme extraction

(D) Biomass production for protein source

75. The most common reaction in steroid biotransformation is :

(A) Hydroxylation

(B) Reduction only

(C) Polymerization

(D) Decarboxylation

76. Example of vaccine stabilizer is :

(A) Gelatin or sugars

(B) Antibiotics

(C) Oxygen

(D) $CO_2$

77. In early insulin production, A and B chains are combined by :

(A) Hydrogen bonds

(B) Disulfide bond formation

(C) Ionic interaction

(D) Covalent ester bond

78. The sequence in interferon production using induction method is :

(A) Induction → priming → harvesting

(B) Inhibitor addition → priming → growth

(C) Harvesting → induction → priming

(D) Priming → induction → inhibitor removal → production

79. Biopharmaceutical production success depends on :

(A) Integration of expression + fermentation + purification

(B) Only upstream

(C) Only sterilization

(D) Only media

80. Penicillin production is enhanced by addition of :

(A) Glucose

(B) Oxygen

(C) Nitrogen

(D) Phenylacetic acid

81. Adjuvants in vaccines are used to :

(A) Kill microbes

(B) Increase shelf life

(C) Enhance immune response

(D) Increase contamination

82. The role of a "priming dose" in interferon production is to :

(A) Kill cells

(B) Reduce contamination

(C) Enhance interferon yield upon induction

(D) Stop protein synthesis

83. If plasmid loss occurs in recombinant insulin production :

(A) Yield increases

(B) Yield decreases

(C) No effect

(D) Purity increases

84. Industrial penicillin production is typically carried out using :

(A) Continuous fermentation

(B) Solid-state fermentation

(C) Fed-batch fermentation

(D) Batch without aeration

85. Vaccine production involves :

(A) Only chemical synthesis

(B) Antigen preparation

(C) Only fermentation

(D) Only purification

86. Lysine production involves regulation of :

(A) Glycolysis only

(B) Pentose pathway

(C) TCA cycle only

(D) Aspartate pathway

87. Which fermentation method is used for the production of L-lysine ?

(A) Solid surface fermentation

(B) Triple fermentation

(C) Dual fermentation

(D) None of the above

88. Which phase of microbial growth is preferred for the production of secondary metabolites ?

(A) Log phase

(B) Stationary phase

(C) Lag phase

(D) Acceleration phase

89. Best economic substrate for citric acid is :

(A) Pure glucose

(B) Molasses

(C) Protein

(D) Lipid

90. L-glutamic acid is produced mainly by :

(A) *Corynebacterium glutamicum*

(B) *E. coli*

(C) *Aspergillus*

(D) *Saccharomyces*

91. Riboflavin production is commonly carried out by :

(A) *Clostridium*

(B) *Ashbya gossypii*

(C) *Pseudomonas*

(D) *Lactobacillus*

92. Which type of container is commonly used for bulk storage during wine aging ?

(A) Plastic containers

(B) Glass bottles

(C) Concrete tanks

(D) White oak barrels

93. What is the protein content range in barley grains for conventional beers ?

(A) Between 10% and 12%

(B) More than 15%

(C) Less than 10%

(D) Between 5% and 9.5%

94. Enzyme production yield is enhanced by :

(A) Excess nutrients always

(B) Sterilization

(C) Low temperature

(D) Inducers in medium

95. Why is oxygen supplied at the beginning of beer fermentation ?

(A) To sterilize medium

(B) To reduce sugar

(C) To increase ethanol

(D) For yeast growth and sterol synthesis

96. Hops in beer production primarily contribute to :

(A) Sugar

(B) Bitterness and antimicrobial compounds

(C) Ethanol

(D) Oxygen

97. Industrial enzyme production is commonly carried out using :

(A) Submerged fermentation

(B) Batch culture only

(C) Solid fermentation only

(D) Continuous filtration

98. In wine production, must refers to :

(A) Fermented liquid

(B) Crushed grape juice with skins

(C) Yeast culture

(D) Clarified wine

99. Lager beer fermentation differs from ale because of :

(A) Temperature only

(B) pH difference

(C) Oxygen requirement

(D) Top *vs.* bottom fermentation yeast

100. Moisture content in biofertilizer carrier material should be :

(A) 10%

(B) ~ 30-40%

(C) 80%

(D) Zero

*(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।