

Roll. No.

Question Booklet Number

O.M.R. Serial No.

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

BIOTECHNOLOGY

(Bioprocess Technology)

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 छानना है। उत्तर को OMR उत्तर-पत्रक में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

(शेष निर्देश अन्तिम पृष्ठ पर)

1. An example of primary metabolite is
 - (A) Antibiotic
 - (B) Ethanol
 - (C) Pigments
 - (D) Tannins
2. Starch can be biotransformed into
 - (A) Glucose
 - (B) Maltose
 - (C) Ethanol
 - (D) All of these
3. In industrial fermentation, productivity is
 - (A) Product formed per unit volume
 - (B) Substrate consumed per unit time
 - (C) Product formed per unit time
 - (D) Substrate consumed per unit volume
4. Cellulose and hemicellulose are
 - (A) Homopolymeric sugar and Heteropolymeric sugar
 - (B) Heteropolymeric sugar and Homopolymeric sugar
 - (C) oligo-polymeric sugar and Homopolymeric sugar
 - (D) mono-polymeric sugar and oligo-polymeric sugar
5. If a bacterium produced intracellular enzyme then its downstream processing will involve
 - (A) Centrifugation, concentration and purification
 - (B) Cell disruption, centrifugation, concentration and purification
 - (C) Fermentation, centrifugation, concentration and purification
 - (D) Filtration, centrifugation, concentration and purification
6. Upstream process consists of
 - (A) Inoculum preparation
 - (B) Purification of product
 - (C) Both of these
 - (D) None of these
7. Which type of bioreactor design relies on the buoyancy of bubbles to circulate the culture medium?
 - (A) Stirred tank bioreactor
 - (B) Airlift bioreactor
 - (C) Packed bed bioreactor
 - (D) Fluidized bed bioreactor
8. Lyophilization is based on the principle of
 - (A) Oxidation
 - (B) Evaporation
 - (C) Reduction
 - (D) Sublimation

9. Stirred tank bioreactor works by stirring cultured substance using
- (A) Heat
 - (B) Impeller
 - (C) Air
 - (D) None of these
10. Which of the following is not a fermented product
- (A) Beer
 - (B) Sugar
 - (C) Lactic acid
 - (D) Bread
11. In which of the following the microorganisms grow on the surface of the medium?
- (A) Submerged fermentation
 - (B) Fed-fermentation
 - (C) Solid state fermentation
 - (D) Batch fermentation
12. In which of the following the microorganisms grow in suspension state?
- (A) Submerged fermentation
 - (B) Surface fermentation
 - (C) Solid state fermentation
 - (D) Batch fermentation
13. Which of the following process occurs in the absence of free liquid?
- (A) Submerged fermentation
 - (B) Batch fermentation
 - (C) Solid state fermentation
 - (D) Continuous fermentation
14. Full-form of MTCC is _____
- (A) Microbial Type Culture Collection
 - (B) Microorganism Type Counter & Classifier
 - (C) Media Type Counter Collection
 - (D) Miscellaneous Type Classifier and Collection
15. Which of the following are criterias for the choice of an organism?
- (A) The organism must be genetically stable
 - (B) The organism must be able to produce a high yield of product
 - (C) The organism must be able to grow in an easily available nutrient medium
 - (D) All of these
16. A bioreactor is not capable of _____
- (A) Producing aseptic conditions
 - (B) Meeting containment regulations
 - (C) Controlling pH
 - (D) Produce electricity

17. The science of fermentation is called as
- (A) Enzymology
 - (B) Fermentology
 - (C) Zymology
 - (D) Limnology
18. What is the basic function of the fermenter?
- (A) To sterilize the medium
 - (B) To recover the product
 - (C) To provide optimum growth conditions to organisms and obtain the desired product
 - (D) To purify the product
19. Which of the following material is preferable for the construction of small-scale fermenter?
- (A) Quartz
 - (B) Glass
 - (C) Copper
 - (D) Wood
20. Which of the following component is used to prevent vortexing in fermenter?
- (A) Baffles
 - (B) Sparger
 - (C) Impeller
 - (D) Cooling Jacket
21. Which of the following is used to introduce sterile air in fermenter?
- (A) Rotameter
 - (B) Sparger
 - (C) Impeller
 - (D) Baffles
22. Structural components which are involve in aeration and agitation in fermenter are
- (A) Impeller
 - (B) Baffles
 - (C) Sparger
 - (D) All of these
23. In cryopreservation, glycerol acts as a
- (A) Solvent
 - (B) Cryo-protectant
 - (C) Solidifying agent
 - (D) Crystallization agent
24. Which of the following is/are applications of microbial preservation?
- (A) Research purpose
 - (B) Fermentation Industry
 - (C) Biotechnology industry
 - (D) All of these.
25. Lyophilisation is
- (A) Freeze-drying
 - (B) Oxidation
 - (C) Reduction
 - (D) Crystallization

26. Which of the following techniques is commonly used for cell disruption in downstream processing?
- (A) Filtration
 - (B) Centrifugation
 - (C) Lyophilization
 - (D) Ultrasonication
27. Which of the following is NOT an environmental application of bioprocess technology?
- (A) Bioremediation of polluted soil
 - (B) Extraction of fossil fuels
 - (C) Waste treatment using anaerobic digestion
 - (D) Carbon capture and storage
28. Which type of chromatography depends on the principle of charge based separation of particles?
- (A) Affinity chromatography
 - (B) Gel- filtration chromatography
 - (C) Ion- exchange chromatography
 - (D) Multimodal chromatography
29. Bioprocess technology plays a significant role in the Pharmaceutical application of Bioprocess technology is
- (A) Producing vaccines and antibiotics
 - (B) Producing recombinant insulin
 - (C) Both of these
 - (D) None of these
30. What does KLa represent in bioprocess engineering?
- (A) Mass Transfer Coefficient for Oxygen Transfer
 - (B) Krypton Loading Activity
 - (C) Kinetic Law of Aeration
 - (D) Kilogram of Lactose
31. Which of the following is a step of downstream process?
- (A) Selection of a suitable enzyme
 - (B) Process development
 - (C) Concentration and primary purification of enzymes
 - (D) Large scale production
32. Which type of fermentation is used for large-scale manufacturing of enzymes?
- (A) Solid-state fermentation
 - (B) Submerged fermentation
 - (C) Solid-Gas state fermentation
 - (D) Gas-state fermentation
33. What does the term "seed culture" refer to in upstream processing?
- (A) The initial culture inoculated into the fermentation vessel
 - (B) The final culture before harvesting bioproducts
 - (C) The culture used for downstream processing
 - (D) The culture used for quality control testing

34. Which phase has the condition of specific growth rate " $\mu \sim \mu_{max}$ "?
- Lag phase
 - Log phase
 - Stationary phase
 - Death phase
35. The lag phase constitute of _____
- No change in number, but an increase in mass
 - Change in number but decrease in mass
 - No change in number and decrease in mass
 - Constant number and mass
36. Ethanol fermentation occurs in
- Aerobic condition
 - Anaerobic condition
 - Gaseous state
 - Solid State
37. Which of the following is an upstream process?
- Product recovery
 - Product purification
 - Media formulation
 - Cell lysis
38. Naturally, alcoholic fermentation is carried by
- Pseudomonas
 - Cornyobacterium
 - Saccharomyces cerevisiae
 - Solmonella sp.
39. In which phase of microbial growth does the population size remain constant due to a balance between cell division and cell death?
- Lag phase
 - Log phase
 - Stationary phase
 - Decline phase
40. A fermentation process with multiple feed input and single product output is
- Batch
 - Continuous
 - Fed-batch
 - All of these
41. Autoclaving is:
- Steam sterilization
 - Dry heat sterilization
 - Filter sterilization
 - Microwave sterilization
42. The transfer of a process from small-scale laboratory equipment to large-scale commercial equipment is called as:
- Lab scale
 - Scale up
 - Scale mix
 - Scale down

43. The sequence of processes occurs in a typical bioprocess is:
- (A) Upstream, Downstream, Fermentation, Effluent treatment
 - (B) Fermentation, Upstream, Downstream, Effluent treatment
 - (C) Upstream, Fermentation, Downstream, Effluent treatment
 - (D) Effluent treatment, Downstream, Fermentation and Upstream
44. The nature of microbial growth curve is:
- (A) Sigmoid
 - (B) Straight line
 - (C) Hyperbola
 - (D) Parabola
45. Microorganisms produces secondary metabolites in:
- (A) Lag Phase
 - (B) Exponential Phase
 - (C) Stationary phase
 - (D) Log phase
46. Diauxic growth is
- (A) Any cell growth characterized by cellular growth in two phases.
 - (B) Any cell growth characterized by cellular growth in one phase.
 - (C) Any cell growth characterized by bidirectional cellular growth.
 - (D) Any cell growth characterized by unidirectional cellular growth.
47. An ideal fermentation process should demonstrate
- (A) High growth rate
 - (B) High product yield
 - (C) High substrate consumption
 - (D) High biomass
48. Bioprocess technology can be applied in
- (A) Bioremediation
 - (B) Agriculture
 - (C) Pharmaceuticals
 - (D) All of these
49. Antibiotics can be sterilized by
- (A) Autoclaving
 - (B) Hot Air Oven
 - (C) Filtration
 - (D) Acid addition
50. Which bioreactor design is suitable for the culture of mammalian cells for biopharmaceutical production?
- (A) Stirred tank bioreactor
 - (B) Airlift bioreactor
 - (C) Packed bed bioreactor
 - (D) Perfusion bioreactor
51. CSTR is
- (A) Continuous Stirred Tank Reactor
 - (B) Continuous Shaking Tank Reactor
 - (C) Continuous Speed Tank Reactor
 - (D) Continuous Static Tank Reactor

52. Baker's yeast is
- Saccharomyces cerevisiae*
 - Candida tropicalis*
 - Candida albicans*
 - E. coli*
53. Which of the following is a carbohydrate
- Cellulose
 - Hemicellulose
 - Starch
 - All of these
54. Agricultural wastes are preferred Carbon source in
- Batch fermentation
 - Submerged fermentation
 - Solid state fermentation
 - Continuous fermentation
55. What is the purpose of enrichment cultures in microbial isolation?
- To deplete the microbial population
 - To promote the growth of specific microorganisms by providing optimal conditions
 - To sterilize the culture medium
 - To inhibit microbial growth
56. What is the primary role of a sparger in a bioreactor?
- To control pH levels
 - To monitor temperature
 - To provide agitation
 - To facilitate gas dispersion into the culture medium
57. What is the typical mode of operation for a continuous bioreactor?
- Culture is grown until all nutrients are depleted, then harvested
 - Culture is inoculated and allowed to grow without interruption
 - Culture is periodically replenished and harvested continuously
 - Culture is grown under controlled light conditions
58. Which type of bioreactor is best suited for growing photosynthetic microorganisms?
- Stirred tank bioreactor
 - Packed bed bioreactor
 - Photobioreactor
 - Membrane bioreactor
59. Which type of bioreactor is commonly used for large-scale fermentation processes?
- Membrane bioreactor
 - Membrane bioreactor
 - Air-lift bioreactor
 - Stirred tank bioreactor
60. In a bioreactor, what is the purpose of adding antifoam agents?
- To increase gas-liquid mass transfer
 - To promote cell growth
 - To prevent foaming caused by agitation
 - To enhance nutrient uptake by cells

61. Which of the following steps is NOT typically part of upstream processing?
- (A) Harvesting and recovery of cells or microorganisms
 - (B) Cell culture and fermentation
 - (C) Purification of the target product
 - (D) Media preparation and sterilization
62. Which of the following techniques is commonly used for cell separation during downstream processing?
- (A) Centrifugation
 - (B) Filtration
 - (C) Chromatography
 - (D) All of the above
63. Components of fermenter are
- (A) Vessel
 - (B) Sparger
 - (C) Baffles
 - (D) All of these
64. What is the role of agitation in a bioreactor?
- (A) To facilitate gas exchange between the culture medium and the atmosphere
 - (B) To provide nutrients to the cells
 - (C) To prevent contamination of the culture
 - (D) To maintain uniform distribution of cells and nutrients in the medium
65. In which of the following, glucose residues are linked by β -1,4 glycosidic bonds?
- (A) Starch
 - (B) Glycogen
 - (C) Cellulose
 - (D) Amylose
66. Which of the following is unit operation?
- (A) Centrifugation
 - (B) Filtration
 - (C) Chromatography
 - (D) All of these
67. Internal mechanical agitation is involved in
- (A) Cyclone column bioreactor
 - (B) Air-lift Bioreactor
 - (C) Packed column bioreactor
 - (D) Stirred tank bioreactor
68. What is the term used to describe the time required for a microbial population to double in number?
- (A) Propagation time
 - (B) Doubling time
 - (C) Growth rate
 - (D) Lag time

69. Antibiotic production occurs in which growth phase?
- (A) Lag phase
 - (B) Log phase
 - (C) Stationary phase
 - (D) Death phase
70. Which process is also called product recovery and purification?
- (A) Upstream processing
 - (B) Mid-stream processing
 - (C) Downstream processing
 - (D) Biological processing
71. The scale-up process is preferred to which condition?
- (A) The migration of a process from the lab-scale to the pilot plant-scale
 - (B) The migration of a process from the bench-scale to the lab-scale
 - (C) The migration of a process from the small-scale to the lab-scale
 - (D) The migration of a process from the bench-scale to the small-scale
72. Which of the following phase is known as the "Maximum population phase"?
- (A) Lag phase
 - (B) Log phase
 - (C) Exponential phase
 - (D) Stationary phase
73. In Fermentation, Product yield is
- (A) Amount of product produced per gram of substrate consumed
 - (B) Amount of sugar consumed per unit time
 - (C) Amount of product produced per unit time
 - (D) None of these
74. What is the primary mechanism of action of antimicrobial agents?
- (A) Inhibition of cell wall synthesis
 - (B) Inhibition of protein synthesis
 - (C) Disruption of cell membrane integrity
 - (D) All of the above
75. Which of the following is/are alcoholic beverages
- (A) Wine
 - (B) Beer
 - (C) Whisky
 - (D) All of these
76. Agar –Agar is used in growth media as
- (A) Carbon source
 - (B) Nitrogen source
 - (C) Solidifying agent
 - (D) Micronutrient

77. Which of the following are approaches for strain improvement
- (A) Mutant selection
 - (B) Recombination
 - (C) Recombinant DNA Technology
 - (D) All of these
78. Chromatography involves size based separation of biomolecules is
- (A) Affinity
 - (B) Gel filtration
 - (C) Ion-exchange
 - (D) Hydrophobic interaction
79. What are the various properties of a good microbial strain that may be used as an industrial strain for fermentation in industries?
- (A) Ability to grow in culture.
 - (B) Genetic stability.
 - (C) Ability to efficiently produce a target product in a short period.
 - (D) All of the above
80. Example of distilled beverage is
- (A) Whisky
 - (B) Rum
 - (C) Beer
 - (D) Vodka
81. Enzyme used in cell lysis is
- (A) Protease
 - (B) Lysozyme
 - (C) Both of these
 - (D) None of these
82. Starch to glucose hydrolysis involves
- (A) α -amylase
 - (B) β -amylase
 - (C) None of these
 - (D) All of these.
83. Which of the following is not a sterilization method
- (A) Autoclaving
 - (B) Filtration
 - (C) Centrifugation
 - (D) All of these
84. Which of the following method of cell disruption is/are non-mechanical?
- (A) Chemical and enzymatic methods
 - (B) Homogenization
 - (C) Grinding with glass beads
 - (D) Both (A) and (B)

85. In industrial fermenters we can control
- (A) Media pH
 - (B) Temperature
 - (C) Dissolved oxygen
 - (D) All of these
86. Finding best suitable operational parameters for industrial microorganism is called as
- (A) Fermentation
 - (B) Media preparation
 - (C) Process optimization
 - (D) Lyophilisation
87. An organism's production potential can be increased through
- (A) Strain improvement
 - (B) Process parameters optimization
 - (C) Both (A) and (B)
 - (D) None of these
88. Which of the following is a biofuel
- (A) Bioethanol
 - (B) Gasoline
 - (C) Diesel
 - (D) Kerosine
89. Industrial effluent treatment can be performed by
- (A) Bacteria and Fungi
 - (B) Algae
 - (C) All of these
 - (D) None of these
90. Glycolysis involves in
- (A) Anaerobic fermentation
 - (B) Aerobic fermentation
 - (C) Both of these
 - (D) None of these
91. Sequence of events occurring in conversion of glucose to ethanol is
- (A) Glucose, Pyruvate, Acetaldehyde, Ethanol
 - (B) Glucose, Phosphoenol pyruvate, Acetaldehyde, Ethanol
 - (C) Glucose, Acetaldehyde, Ethanol
 - (D) Glucose, Pyruvate, Citrate, Acetaldehyde, Ethanol
92. Alcohol dehydrogenase enzyme is present in
- (A) *Bacillus* sp.
 - (B) *Aspergillus niger*
 - (C) *Saccharomyces cerevisiae*
 - (D) *Pseudomonas* sp.

93. Settling of solids and centrifugal filtration occurs in
- (A) Filtration
 - (B) Chromatography
 - (C) Sterilization
 - (D) Autoclaving
94. In baker's yeast fermentation, high oxygen supply suppresses which metabolic pathway?
- (A) TCA cycle
 - (B) Glycolysis
 - (C) Ethanol fermentation
 - (D) Pentose phosphate pathway
95. Wine production primarily involves fermentation of:
- (A) Rice starch
 - (B) Grape juice
 - (C) Barley malt
 - (D) Corn mash
96. Amylase production occurs in
- (A) Aerobic process
 - (B) Solid state fermentation
 - (C) Submerged process
 - (D) All of these
97. Which of the following is secondary metabolite?
- (A) Antibiotics and Vitamins
 - (B) Ethanol and Lactic acid
 - (C) Both (A) and (B)
 - (D) None
98. Carbon source for production of amylase is/are
- (A) Starch
 - (B) Cellulose
 - (C) Pectin
 - (D) Lactose
99. In brewing, the process of converting starch from malted grains into fermentable sugars is known as:
- (A) Malting
 - (B) Distillation
 - (C) Mashing
 - (D) Clarification
100. In protein purification, ammonium sulfate precipitation is mainly used for:
- (A) Sterilization
 - (B) Concentration and partial purification
 - (C) Chromatographic separation
 - (D) Removing endotoxins

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।