Roll No. .....

Question Booklet Number

O. M. R. Serial No. | | | | | | | |

M. Sc. (Fourth Semester)

(NEP) EXAMINATION, 2025-26

BOTANY

(Environmental & Applied Microbiology)

Paper Code							
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Questions Booklet Series

A

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 microbial process is primarily responsible for the removal of organic pollutants in wastewater treatment plants ?
   (A) Aerobic heterotrophic metabolism
   (B) Nitrogen fixation
   (C) Methanogenesis
   (D) Sulfur oxidation

2. Bio-indicators are most useful because they :
   (A) Directly degrade pollutants
   (B) Replace chemical analysis
   (C) Reflect cumulative environmental stress over time
   (D) Only indicate the presence of heavy metals

3. Lichens are considered excellent bio-indicators of :
   (A) Water pollution
   (B) Soil fertility
   (C) Air pollution (especially SO_2 levels)
   (D) Radioactive contamination

4. In biodegradation, xenobiotics are difficult to degrade because they :
   (A) Are always inorganic
   (B) Have unusual chemical bonds not recognized by enzymes
   (C) Are highly soluble
   (D) Are rapidly assimilated

5. Which enzyme group is crucial for the breakdown of aromatic hydrocarbons ?
   (A) Proteases
   (B) Lipases
   (C) Oxygenases
   (D) Transferases

6. Bioremediation is most effective when :
   (A) Microbial diversity is low
   (B) Pollutants are inorganic
   (C) Oxygen is absent
   (D) Environmental conditions favor microbial activity

7. The term 'biostimulation' in bioremediation refers to :
   (A) Enhancing the activity of native microbes using nutrients/ conditions
   (B) Adding genetically modified microbes
   (C) Killing indigenous microbes
   (D) Removing contaminants physically

8. Which of the following is a major biogenic gas produced under anaerobic conditions ?
   (A) Oxygen
   (B) Nitrogen dioxide
   (C) Methane
   (D) Ozone

9. Methanogens belong to which domain ?

(A) Bacteria

(B) Eukarya

(C) Protista

(D) Archaea

10. Denitrification results in the production of :

(A) Ammonia

(B) Nitrogen gas (N_2)

(C) Nitrite

(D) Sulfate

11. Which condition favours biodegradation of oil spills in marine environments ?

(A) Low temperature and low oxygen

(B) High salinity and no nutrients

(C) Presence of oxygen and nitrogen/phosphorus nutrients

(D) Complete darkness

12. Microbial restoration of degraded ecosystems often involves :

(A) Only chemical fertilisers

(B) Removal of all microbes

(C) Reintroduction of beneficial microbial consortia

(D) Sterilisation of soil

13. Which group of microbes is most associated with sulfur cycling and production of H_2S ?

(A) Sulfate-reducing bacteria

(B) Actinomycetes

(C) Cyanobacteria

(D) Mycorrhizae

14. A key limitation of bioremediation is :

(A) Slow rate under unfavorable environmental conditions

(B) Lack of microbes

(C) High cost

(D) Excess oxygen

15. Which characteristic makes a microorganism suitable for use as a bioindicator ?

(A) High pathogenicity

(B) Sensitivity to specific environmental changes

(C) Rapid mutation rate

(D) Ability to form spores

16. In biological warfare, microbes are selected based on :

(A) Nutritional value

(B) Ease of cultivation only

(C) High infectivity, stability, and transmission efficiency

(D) Low virulence

17. Which of the following best distinguishes biodegradation from bioremediation ?

(A) Both are identical

(B) Biodegradation is abiotic

(C) Bioremediation occurs only in soil

(D) Biodegradation is a natural process; bioremediation is its applied use

18. Which type of fermentation is most suitable for antibiotic production ?

(A) Continuous fermentation

(B) Fed-batch fermentation

(C) Batch fermentation

(D) Solid-state fermentation

19. In batch fermentation, the stationary phase is typically associated with :

(A) Maximum cell growth

(B) Nutrient abundance

(C) Secondary metabolite production

(D) Zero metabolic activity

20. The primary advantage of fed-batch fermentation over batch fermentation is :

(A) Reduced contamination risk

(B) Continuous product removal

(C) Control over substrate concentration to avoid inhibition

(D) No need for monitoring

21. Continuous fermentation systems are most prone to :

(A) Contamination due to prolonged operation

(B) Product inhibition

(C) Substrate limitation

(D) Oxygen toxicity

22. Which parameter is most critical for oxygen transfer in aerobic fermentations ?

(A) pH

(B) Agitation and aeration rate

(C) Temperature

(D) Substrate concentration

23. The term kLa in bioreactors refers to :

(A) Rate of substrate consumption

(B) Volumetric oxygen transfer coefficient

(C) Biomass yield coefficient

(D) Enzyme activity constan

24. Which type of bioreactor is commonly used for shear-sensitive cells (e.g., animal cells) ?

(A) Stirred tank reactor

(B) Packed bed reactor

(C) Airlift bioreactor

(D) Fluidised bed reactor

25. Foam formation in fermenters is problematic because it :

(A) Increases oxygen transfer

(B) Enhances microbial growth

(C) Reduces agitation

(D) Leads to contamination and loss of culture

26. Which component is essential for maintaining sterile conditions in a bioreactor ?

(A) Impeller

(B) Sparger

(C) HEPA-filtered air inlet

(D) Cooling jacket

27. In industrial fermentation, downstream processing refers to :

(A) Product recovery and purification

(B) Sterilization

(C) Inoculum preparation

(D) Medium formulation

28. Which fermentation type is best suited for fungal enzyme production on solid substrates ?

(A) Submerged fermentation

(B) Continuous fermentation

(C) Solid-state fermentation

(D) Fed-batch fermentation

29. The Monod equation describes the relationship between :

(A) Temperature and growth rate

(B) Substrate concentration and microbial growth rate

(C) pH and enzyme activity

(D) Oxygen and biomass

30. A chemostat maintains microbial growth by :

(A) Periodic nutrient addition

(B) Static conditions

(C) Continuous input of fresh medium and removal of culture

(D) High pressure

31. Which factor primarily determines the dilution rate in a continuous culture ?

(A) Biomass concentration

(B) Reactor volume only

(C) Oxygen supply

(D) Flow rate of medium relative to reactor volume

32. In a stirred tank bioreactor, baffles are used to :

(A) Prevent vortex formation and improve mixing

(B) Reduce contamination

(C) Increase temperature

(D) Control pH

33. Which is a key limitation of continuous fermentation ?

(A) Low productivity

(B) High labor requirement

(C) Genetic instability of micro-organisms overtime

(D) Lack of automation

34. Industrial production of ethanol commonly uses which microorganism ?

(A) *Escherichia coli*

(B) *Saccharomyces cerevisiae*

(C) *Bacillus subtilis*

(D) *Aspergillus niger*

35. Which process converts atmospheric nitrogen into a biologically usable form ?

(A) Ammonification

(B) Nitrification

(C) Nitrogen fixation

(D) Denitrification

36. The enzyme complex responsible for nitrogen fixation is :

(A) Nitrate reductase

(B) Nitrite reductase

(C) Nitrogenase

(D) Dehydrogenase

37. Nitrogenase is highly sensitive to :

(A) Carbon dioxide

(B) Oxygen

(C) Temperature

(D) Light

38. In legume root nodules, oxygen is regulated by :

(A) Chlorophyll

(B) Leghemoglobin

(C) Hemoglobin

(D) Cytochrome

39. Which of the following is a free-living nitrogen-fixing bacterium ?

(A) Rhizobium

(B) Frankia

(C) Nitrosomonas

(D) Azotobacter

40. Nitrification is a two-step process involving :

(A) Nitrogen → Ammonia → Nitrite

(B) Ammonia → Nitrogen → Nitrate

(C) Ammonia →Nitrite → Nitrate

(D) Nitrate → Nitrite → Ammonia

41. Which microorganism is primarily responsible for the conversion of ammonia to nitrite ?

(A) Nitrosomonas

(B) Rhizobium

(C) Nitrobacter

(D) Azospirillum

42. Denitrification mainly occurs under :

(A) Aerobic conditions
(B) Anaerobic conditions
(C) High oxygen levels
(D) Neutral pH only

43. Mycorrhizae enhance plant growth primarily by :

(A) Nitrogen fixation
(B) Producing toxins
(C) Reducing root surface area
(D) Increasing phosphorus uptake

44. Plant Growth-Promoting Rhizobacteria (PGPR) help plants by :

(A) Causing disease resistance only
(B) Producing phytohormones and enhancing nutrient uptake
(C) Fixing carbon
(D) Decreasing soil fertility

45. Which genus is widely used as a biofertilizer in leguminous crops ?

(A) Bacillus
(B) Pseudomonas
(C) Rhizobium
(D) Clostridium

46. Biological control of plant pathogens involves :

(A) Chemical pesticides
(B) Physical removal
(C) Use of beneficial microbes to suppress pathogens
(D) Genetic modification of plants only

47. Trichoderma species are commonly used as :

(A) Nitrogen fixers
(B) Biocontrol agents against fungal pathogens
(C) Nitrifying bacteria
(D) Denitrifiers

48. Which mechanism is used by biocontrol microbes to suppress pathogens ?

(A) Photosynthesis
(B) Competition and antibiosis
(C) Fermentation
(D) Nitrogen fixation

49. Cyanobacteria contribute to agriculture mainly by :

(A) Decomposing pesticides
(B) Producing methane
(C) Increasing soil salinity
(D) Fixing atmospheric nitrogen in paddy fields

50. Ammonification refers to :

(A) Conversion of ammonia to nitrate
(B) Conversion of nitrogen gas to ammonia
(C) Conversion of organic nitrogen to ammonia
(D) Conversion of nitrate to nitrogen gas

51. Which of the following best describes siderophores in plant health ?

(A) Enzymes degrading cellulose

(B) Nitrogen carriers

(C) Plant hormones

(D) Iron-chelating compounds that limit pathogen growth

52. Which microorganism is primarily used in yoghurt production ?

(A) *Saccharomyces cerevisiae*

(B) *Aspergillus niger*

(C) *Lactobacillus bulgaricus* (*with Streptococcus thermophilus*)

(D) *Penicillium roqueforti*

53. The sour taste in fermented dairy products is mainly due to :

(A) Lactic acid

(B) Acetic acid

(C) Ethanol

(D) Citric acid

54. Which fungus is used in blue cheese production ?

(A) *Aspergillus flavus*

(B) *Penicillium roqueforti*

(C) *Rhizopus stolonifer*

(D) *Candida albicans*

55. Mushroom cultivation commonly involves which group of fungi ?

(A) Ascomycetes

(B) Basidiomycetes

(C) Zygomycetes

(D) Deuteromycetes

56. Food spoilage is often detected by :

(A) Increased nutrient content

(B) Reduced microbial load

(C) Off-odours, discolouration, and texture changes

(D) Increased pH only

57. Which bacterium is commonly associated with milk spoilage under refrigeration ?

(A) *Clostridium botulinum*

(B) *Lactobacillus* spp.

(C) *Pseudomonas* spp.

(D) *Bacillus anthracis*

58. Aflatoxins are produced by :

(A) *Penicillium roqueforti*

(B) *Rhizopus*

(C) *Saccharomyces*

(D) *Aspergillus flavus*

59. Aflatoxins primarily affect :

(A) Liver (hepatotoxic and carcinogenic)

(B) Lungs

(C) Kidneys

(D) Heart

60. Which preservation method inhibits microbial growth by reducing water activity ?

(A) Drying (dehydration)

(B) Irradiation

(C) Pasteurization

(D) Fermentation

61. Pasteurisation primarily aims to :

(A) Sterilise food completely

(B) Reduce pathogenic microbes without major quality loss

(C) Enhance flavor

(D) Increase nutrient content

62. Which organism is used in bread fermentation ?

(A) *Lactobacillus*

(B) *Penicillium*

(C) *Saccharomyces cerevisiae*

(D) *Aspergillus*

63. Food intoxication differs from food infection in that it involves :

(A) Live pathogens multiplying in the host

(B) Viral agents

(C) Only fungal contamination

(D) Preformed toxins in food

64. Clostridium botulinum produces a toxin that causes :

(A) Flaccid paralysis

(B) Fever

(C) Diarrhea

(D) Skin lesions

65. Which of the following is an example of fermented food involving mixed microbial culture ?

(A) Curd (yogurt)

(B) Beer

(C) Bread

(D) Vinegar

66. Rancidity in fatty foods is often due to :

(A) Protein degradation

(B) Lipid oxidation and microbial lipase activity

(C) Carbohydrate fermentation

(D) Mineral loss

67. Which microorganism is associated with vinegar production ?

(A) *Lactobacillus*

(B) *Saccharomyces*

(C) *Acetobacter*

(D) *Clostridium*

68. Psychrotrophic microorganisms are significant in food microbiology because they :

(A) Grow only at high temperatures

(B) Cannot survive refrigeration

(C) Produce only toxins

(D) Can grow at low temperatures and spoil refrigerated foods

69. Extremophiles are organisms that :

(A) Grow only in moderate environments

(B) Cannot survive outside labs

(C) Thrive in extreme environmental conditions

(D) Are always pathogenic

70. Thermophiles are best adapted to :

(A) Low temperature

(B) Neutral pH

(C) High temperature environments

(D) High salinity

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

(A) DNA ligase

(B) RNA polymerase

(C) Restriction enzyme

(D) Taq DNA polymerase

72. Psychrophiles are characterised by :

(A) Heat-resistant enzymes

(B) Optimal growth at low temperatures

(C) High salt tolerance

(D) Acidic environment preference

73. Halophiles require :

(A) High salt concentration

(B) Low pH

(C) High temperature

(D) High pressure

74. Acidophiles grow best at :

(A) Neutral pH

(B) Low pH (acidic conditions)

(C) Alkaline pH

(D) High temperature only

75. Alkaliphiles are commonly found in :

(A) Deep-sea vents

(B) Acidic mines

(C) Alkaline lakes and soils

(D) Frozen environments

76. Barophiles (piezophiles) are adapted to :

(A) Low pressure

(B) High temperature

(C) High hydrostatic pressure (deep sea)

(D) Dry conditions

77. Which of the following is a key industrial application of extremozymes ?

(A) Food spoilage

(B) Pathogenicity

(C) Antibiotic resistance

(D) Functioning under extreme industrial conditions

78. Enzymes from psychrophiles are particularly useful because they :

(A) Work only at high temperatures

(B) Are highly stable at heat

(C) Have high activity at low temperatures

(D) Require high pressure

79. Thermophilic enzymes are preferred in industry because they :

(A) Are stable and active at high temperatures

(B) Require refrigeration

(C) Denature quickly

(D) Are inactive in solutions

80. Which extremophile is most likely used in the bioremediation of saline environments ?

(A) Thermophile

(B) Halophile

(C) Acidophile

(D) Psychrophile

81. Acidophilic microbes are important in :

(A) Bread making

(B) Bioleaching of metals

(C) Alcohol fermentation

(D) Nitrogen fixation

82. Which feature is typical of extremophiles at the molecular level ?

(A) Specialized protein structures for stability

(B) Weak cell membranes

(C) Unstable proteins

(D) Lack of enzymes

83. Methanogens are considered extremophiles because they :

(A) Live only in oxygen-rich environments

(B) Cannot tolerate anaerobic conditions

(C) Thrive in anaerobic and often extreme habitats

(D) Produce oxygen

84. Which extremophile would most likely survive in Antarctic ice ?

(A) Thermophile

(B) Halophile

(C) Psychrophile

(D) Acidophile

85. A biosensor primarily consists of :

(A) Only a detector

(B) Only biological material

(C) A fermenter

(D) A bioreceptor and a transducer

86. In a glucose biosensor, the biological component is usually :

(A) Lipase

(B) Protease

(C) Glucose oxidase

(D) Amylase

87. The function of a transducer in a biosensor is to :

(A) Convert a biological signal into a measurable signal

(B) Produce enzymes

(C) Bind the analyte

(D) Store data

88. Which type of biosensor measures electrical changes due to biochemical reactions ?

(A) Electrochemical biosensor

(B) Thermal biosensor

(C) Optical biosensor

(D) Piezoelectric biosensor

89. Immobilized enzymes are preferred in industry because they :

(A) Are easily degraded

(B) Can be reused and are more stable

(C) Cannot be reused

(D) Require more energy

90. Which method is commonly used for enzyme immobilization ?

(A) Filtration

(B) Entrapment in gels

(C) Distillation

(D) Centrifugation

91. Recombinant DNA technology allows :

(A) Only natural gene expression

(B) Protein degradation

(C) Removal of all DNA

(D) Insertion of foreign genes into host organismns

92. Which microorganism is widely used for recombinant protein production ?

(A) *Bacillus anthracis*

(B) *Clostridium botulinum*

(C) *Escherichia coli*

(D) *Vibrio cholerae*

93. Single-cell protein (SCP) refers to :

(A) Proteins from plants

(B) Animal-derived proteins

(C) Synthetic amino acids

(D) Microbial biomass used as a protein source

94. Which of the following is an example of a SCP-producing microorganism ?

(A) *Spirulina*

(B) *Nitrosomonas*

(C) *Rhizobium*

(D) *Penicillium*

95. Microbial enzymes are preferred in industry because they :

(A) Are always pathogenic

(B) Can be produced in large quantities and are cost-effective

(C) Work only in vivo

(D) Are unstable

96. Which enzyme is commonly used in detergents to remove protein stains ?

(A) Lipase

(B) Protease

(C) Amylase

(D) Cellulase

97. Lactase enzyme is used industrially to :

(A) Break proteins

(B) Produce ethanol

(C) Convert lactose into glucose and galactose

(D) Synthesize fats

98. Biosensors are widely used in :

(A) Only agriculture

(B) Only medicine

(C) Medical diagnostics, environmental monitoring, and food analysis

(D) Only fermentation

99. Which biomolecule produced by microbes is widely used as an antibiotic ?

(A) Ethanol

(B) Citric acid

(C) Glucose

(D) Penicillin

100. Major advantage of microbial production of biomolecules is :

(A) Slow growth rate

(B) High contamination

(C) Scalability and controlled production

(D) Limited applications

(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।