Roll No. .....

Question Booklet Number

O. M. R. Serial No.

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

(Old Syllabus Effective from 2022)

(Only Back Paper Students)

NANOBIOTECHNOLOGY

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. Which parameter control crystal size in solvothermal synthesis ?

(A) Temperature and pressure

(B) Gravity

(C) Sound waves

(D) Magnetic field

2. Solvothermal synthesis is carried out in :

(A) Open atmosphere

(B) High-pressure sealed vessels

(C) Vacuum chambers

(D) Ambient condition

3. Metal nanocrystals by reduction require :

(A) Reducing agents

(B) Ordizing agent

(C) Catalysts only

(D) UV radiation

4. In sol-gel synthesis, hydroysis and condensation reaction lead to :

(A) Crystal defects

(B) Network formations

(C) Phase sepration

(D) Evaporation

5. Sol-gel process involves transition from :

(A) Solid to gas

(B) Gel to solid

(C) Solution (sol) to gel

(D) Gas to liquid

6. Thermal evaporation is commonly used to produce :

(A) Bulk crystals

(B) Polymers

(C) Nanocomposites

(D) Thin films

7. Spray pyrolysis involves :

(A) Liquid droplet decomposition at high temperature

(B) Solid-state diffusion

(C) Gas phase condensation

(D) Mechanical grinding

8. Electro-deposition is based on :

(A) Thermal energy

(B) Chemical reduction without current

(C) Electric current-driven reduction

(D) Mechanical force

9. The major imitation of ball milling in

(A) Low yield

(B) High cost

(C) Contamination from milling media

(D) Low energy input

10. Ball milling is primarily classified as :

(A) Bottom-up-approach

(B) Top-down approach

(C) Biological synthesis

(D) Chemical vapour process

11. Fullerene molecules are also known as :

(A) Buckyballs

(B) Nanorods

(C) Nanocluster

(D) Quantum wells

12. Which nanostructure provides the largest surface area-to-volume ratio ?

(A) Nanospheres

(B) Nanorods

(C) Nanowires

(D) Quantum dots

13. The mechanical strength of carbon nanotubes is due to :

(A) Ionic bonding

(B) Hydrogen bonding

(C) Metallic bonding

(D) Covalent sp^2 bonding

14. Which nanostructure is used extensively in drug delivery due to tunable size ?

(A) Nanorods

(B) Quantum dots

(C) Nanowires

(D) Nanosheets

15. Bio-inspired nanomaterials are designed based on :

(A) Natural biological systems

(B) Industrial processes

(C) Synthetic polymers

(D) Metallic alloys

16. In nanosheets, which dimension is confined ?

(A) Length

(B) Width

(C) Thickness

(D) All dimensions

17. Which factor most strongly influences nanoscale properties ?

(A) Color

(B) Temperature only

(C) Pressure only

(D) Shape and size

18. Nanowires differ from nanotubes primarily in :

(A) Composition

(B) Hollow *vs.* solid structure

(C) Size

(D) Conductivity

19. Which of the following is a natural nanomaterial ?

(A) DNA

(B) Carbon nanotube

(C) Quantum dot

(D) Nanowire

20. The electronic properties of graphene are characterized by :

(A) Insulating behavior

(B) Superconductivity at room temperature

(C) Large band gap

(D) Zero band gap

21. Quantum dots exhibit size-dependent properties due to :

(A) Quantum confinement

(B) Surface tension

(C) Thermal conductivity

(D) Density variation

22. Which nanostructure exhibits anisotropic properties ?

(A) Nanospheres

(B) Quantum dots

(C) Nanorods

(D) Fullerenes

23. Nanocomposites are materials composed of :

(A) Only nanoscale materials

(B) Only bulk materials

(C) Combination of nano and bulk phases

(D) Only polymers

24. Fullerene C_{60} has what geometry ?

(A) Planar hexagonal

(B) Cylindrical

(C) Spherical

(D) Cubic

25. Which of the following has the highest aspect ratio ?

(A) Quantum dots

(B) Nanorods

(C) Nanowires

(D) Nanospheres

26. Carbon nanotubes are formed by rolling :

(A) Fullerene sheets

(B) Graphene sheets

(C) Diamond lattice

(D) Amorphous carbon

27. Graphene is best described as :

(A) 2D single layer of sp^2 carbon atoms

(B) 3D crystalline carbon

(C) 1D tubular structure

(D) 0D spherical molecule

28. Which property change is primarily due to quantum confinement in nanomaterials ?

(A) Mechanical strength

(B) Optical absorption spectrum

(C) Density

(D) Thermal expansion

29. One-dimensional nanostructures are characterized by :

(A) All three dimensions in nanoscale

(B) Two dimensions in nanoscale

(C) One dimension outside nanoscale

(D) Only length in nanoscale

30. Which nanostructure is classified as a zero-dimensional (0D) material ?

(A) Nanowires

(B) Nanotubes

(C) Quantum dots

(D) Nanosheets

31. The role of chemists in nanotechnology includes :

(A) Device fabrication only

(B) Material synthesis and functionalization

(C) Medical diagnosis

(D) Software development

32. Nanotechnology applications in drug delivery rely on :

(A) 1.arge particle size

(B) Low solubility

(C) High density

(D) Target specificity

33. Which is NOT a challenge in nanotechnology ?

(A) Standardization

(B) Toxicity assessment

(C) Scalability

(D) Infinite resource availability

34. The major advantage of nanoscale materials is :

(A) Enhanced surface area

(B) Reduced reactivity

(C) Increased weight

(D) Lower conductivity

35. Which professional contributes to nanomedicine applications ?

(A) Physicists only

(B) Engineers only

(C) Medical doctors

(D) Economists

36. The evolution of nanoscience was accelerated by invention of :

(A) Optical microscope

(B) Electron microscope

(C) Scanning tunneling microscope

(D) Telescope

37. Which manufacturing factor affects nanoparticle size distribution ?

(A) Color intensity

(B) Sound waves

(C) Gravity

(D) Reaction kinetics

38. A major ethical concern in nanotechnology is :

(A) Environmental toxicity

(B) Increased gravity

(C) Lack of energy

(D) Reduced conductivity

39. Which discipline plays a key role in designing nanoscale computational models ?

(A) Biology

(B) Medicine

(C) Computer science

(D) Agriculture

40. Gold nanoparticles appear red due to :

(A) Diffraction

(B) Surface plasmon resonance

(C) Refraction

(D) Scattering

41. Which property significantly changes at nanoscale due to quantum effects ?

(A) Density

(B) Mass

(C) Volume

(D) Color

42. The bottom-up approach involves :

(A) Assembling atoms/molecules

(B) Breaking bulk materials

(C) Mechanical cutting

(D) Thermal decomposition

43. Which of the following is a major hurdle in nanotechnology development ?

(A) High abundance of raw materials

(B) Toxicological uncertainties

(C) Low demand

(D) Lack of applications

44. Nanobiotechnology primarily integrates :

(A) Physics and mathematics

(B) Chemistry and geology

(C) Biology and nanotechnology

(D) Engineering and astronomy

45. Which factor most critically influences nanoparticle synthesis ?

(A) Surface energy

(B) Atmospheric pressure

(C) Gravity

(D) Bulk density

46. The concept of molecular manufacturing is most closely associated with :

(A) Top-down approach

(B) Bottom-up approach

(C) Lithography

(D) Electroplating

47. The term "nanotechnology" was first popularized by :

(A) Albert Einstein

(B) Richard Feynman

(C) Norio Taniguchi

(D) Eric Drexler

48. Which phenomenon becomes dominant at nanoscale ?

(A) Gravitational forces

(B) Nuclear forces

(C) Surface-to-volume ratio effects

(D) Magnetic permeability

49. Nanotechnology typically deals with structures in which size range ?

(A) 1-100 mm

(B) 1-100 μm

(C) 1-100 nm

(D) 1-100 pm

50. The primary distinguishing feature of nanoscience compared to bulk science is :

(A) Quantum confinement effects

(B) Chemical composition

(C) Thermal stability

(D) Mechanical strength

51. Which is a major concern with nanomaterials ?

(A) Low production

(B) Toxicity and environmental impact

(C) Lack of applications

(D) High availability

52. Nanoparticles used in imaging often exhibit :

(A) Low contrast

(B) Reduced sensitivity

(C) High density

(D) Enhanced optical properties

53. Cancer nanotherapy improves treatment by :

(A) Increasing side effects

(B) Reducing drug activity

(C) Increasing toxicity

(D) Targeting tumor cells

54. Which property makes nanoparticles effective in drug delivery ?

(A) Large size

(B) High surface area

(C) Low reactivity

(D) High density

55. Nanotechnology for clean environment includes :

(A) Pollutant generation

(B) Water purification

(C) Fossil fuel use

(D) Waste increase

56. Containment strategies in nanotechnology are used to :

(A) Increase production

(B) Improve conductivity

(C) Reduce cost

(D) Prevent environmental release

57. Fate of nanomaterials in environment depends on :

(A) Size. shape. and surface chemistry

(B) Color

(C) Density only

(D) Temperature only

58. Life Cycle Assessment (LCA) evaluates :

(A) Only production stage

(B) Entire life span of nanomaterials

(C) Only disposal

(D) Only usage

59. Ecotoxicity studies focus on :

(A) Human health only

(B) Chemical synthesis

(C) Environmental organisms

(D) Industrial processes

60. Cytotoxicity of nanomaterials refers to :

(A) Environmental impact

(B) Chemical stability

(C) Thermal resistance

(D) Toxicity to cells

61. Biomotors in engineered devices are inspired by :

(A) Mechanical engines

(B) Electrical circuits

(C) Thermal systems

(D) Biological molecular motors

62. Nanocarbon balls act as deodorizers due to :

(A) Chemical reactivity

(B) Magnetic properties

(C) Adsorption properties

(D) Electrical conductivity

63. Microbial nanoparticles are synthesized using :

(A) Physical force

(B) Heat only

(C) Pressure

(D) Microorganisms

64. Radioactive fullerene cages are useful because they :

(A) Increase radiation leakage

(B) Encapsulate radioactive atoms

(C) Reduce radioactivity

(D) Destroy isotopes

65. Nanomaterials used in joint replacement improve :

(A) Weight only

(B) Biocompatibility and durability

(C) Color

(D) Density only

66. Interior artery expansion using nanotechnology refers to :

(A) Nanoparticle injection

(B) Drug synthesis

(C) Gene therapy

(D) Stent development

67. Nanodiagnostics improves detection sensitivity due to :

(A) High surface area

(B) Bulk properties

(C) Low density

(D) Large size

68. Which nanomaterial is widely used in cancer therapy due to photothermal effects ?

(A) Silica nanoparticles

(B) Gold nanoparticles

(C) Polymer beads

(D) Liposomes

69. Targeted drug delivery using nanoparticles relies on :

(A) Random diffusion

(B) Gravity

(C) Temperature gradient

(D) Ligand-receptor interactions

70. Nanotechnology enhances drug solubility primarily by :

(A) Increasing molecular weight

(B) Reducing particle size

(C) Increasing density

(D) Decreasing polarity

71. DNA nano-printing enables :

(A) Bulk synthesis

(B) Mechanical shaping

(C) Random gene expression

(D) Controlled molecular patterning

72. Which factor disrupts protein nanostructure formation ?

(A) Optimal pH

(B) Stable ionic conditions

(C) Extreme temperature

(D) Controlled environment

73. Self-assembled protein structures are typically :

(A) Disordered

(B) Highly ordered

(C) Randomly arranged

(D) Amorphous

74. Which property is enhanced in nanoscale biosensors ?

(A) Size

(B) Weight

(C) Volume

(D) Sensitivity

75. Nano-biochips are mainly used for :

(A) Mechanical testing

(B) Heat transfer

(C) Molecular detection and diagnostics

(D) Structural support

76. Which protein is responsible for muscle contraction-based nanomotion ?

(A) Actin

(B) Myosin

(C) Tubulin

(D) Collagen

77. Biomolecular nanomotors are examples of :

(A) Active nanosystems

(B) Passive systems

(C) Static structures

(D) Bulk materials

78. Protein self-assembly is influenced by :

(A) pH and ionic strength

(B) Gravity

(C) Magnetic field only

(D) Pressure only

79. LOC devices primarily reduce :

(A) Sensitivity

(B) Analysis time and sample volume

(C) Accuracy

(D) Selectivity

80. Lab-on-a-chip devices integrate :

(A) Multiple laboratory functions

(B) Only chemical reactions

(C) Only biological samples

(D) Only physical processes

81. Biochemical specificity in biosensors is due to :

(A) Physical adsorption

(B) Thermal conductivity

(C) Electrical resistance

(D) Molecular recognition

82. Which technique is commonly used for nano-printing DNA ?

(A) Dip-pen nanolithography

(B) Ball milling

(C) Electrolysis

(D) Spray pyrolysis

83. Nano-printing of biomolecules requires :

(A) High temperature

(B) Random deposition

(C) Mechanical pressure only

(D) Precise spatial control

84. Which component is essential in a nanobiosensor ?

(A) Transducer

(B) Catalyst only

(C) Polymer matrix

(D) Solvent

85. Nanobiosensors operate based on :

(A) Bulk properties

(B) Mechanical cutting

(C) Biological recognition elements

(D) High temperature reactions

86. Self-assembly in protein nanostructures is governed by :

(A) Random aggregation

(B) Thermodynamic minimization

(C) External force only

(D) High pressure

87. Myosin-based nanomotors move along :

(A) Microtubules

(B) DNA strands

(C) Actin filaments

(D) Lipid membranes

88. The motility mechanism of bacterial nanomotors (e.g.. flagella) is driven by :

(A) ATP hydrolysis

(B) Light absorption

(C) Proton motive force

(D) Mechanical stress

89. Biomolecular nanomotors derive their energy mainly from :

(A) ATP hydrolysis

(B) Light energy

(C) Electrical energy

(D) Thermal energy

90. Protein-based nanostructures are primarily stabilized by :

(A) Ionic bonds only

(B) Weak intermolecular interactions

(C) Nuclear forces

(D) Metallic bonding

91. Biological synthesis often uses which agents ?

(A) Metals

(B) Plastics

(C) Ceramics

(D) Microorganisms or enzymes

92. Which method involves nucleation and growth processes ?

(A) Chemical reduction

(B) Ball milling

(C) Mechanical grinding

(D) Thermal cutting

93. In sol-gel method, drying leads to formation of :

(A) Sol

(B) Gel

(C) Xerogel

(D) Aerosol

94. A key challenge in chemical synthesis methods is :

(A) Lack of control over composition

(B) Low scalability

(C) No reaction control

(D) Agglomeration of nanoparticles

95. Spray pyrolysis is most suitable for producing :

(A) Nanowires

(B) Thin films and powders

(C) Bulk metals

(D) Polymers

96. In electro-deposition, the deposition rate depends on :

(A) Current density

(B) Light intensity

(C) Pressure

(D) Sound frequency

97. Which synthesis method is best for producing highly pure nanomaterials ?

(A) Ball milling

(B) Biological synthesis

(C) Sol-gel process

(D) Spray pyrolysis

98. DNA-templated nanostructures are based on :

(A) Random aggregation

(B) Ionic bonding

(C) Metallic bonding

(D) Base-pair specificity

99. Protein-based nanostructure formation relies on :

(A) Self-assembly

(B) Covalent polymerization

(C) Mechanical deformation

(D) Thermal evaporation

100. Biological synthesis of nanoparticles is advantageous due to :

(A) High toxicity

(B) High temperature requirement

(C) Eco-friendliness

(D) Expensive setup

(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।