Roll No. .....

Question Booklet Number

O. M. R. Serial No.

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

(New Syllabus Effective from 2023)

NANOBIOTECHNOLOGY

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. The invention of STM is credited to :

(A) Binnig and Rohrer

(B) Drexler and Feynman

(C) Smalley and Curl

(D) Gerber and Quate

2. Fullerenes are best represented by :

(A) C60

(B) C40

(C) C20

(D) C120

3. Nanopore sequencing detects biomolecules by :

(A) Electrical current variation

(B) Magnetic resonance

(C) Optical fluorescence

(D) Acoustic signals

4. Which technique is commonly used in nanofabrication ?

(A) Chemical vapor deposition

(B) Atomic layer deposition

(C) Self-assembly

(D) All of the above

5. Nanosensors are devices that :

(A) Detect physical signals

(B) Analyze chemical changes

(C) Monitor biological systems

(D) All of the above

6. Unique nanoscale properties arise due to :

(A) Quantum effects

(B) Increased surface area

(C) Both (A) and (B)

(D) None of the above

7. "Engines of Creation" was authored by :

(A) Mihail Roco

(B) Don Eigler

(C) Eric Drexler

(D) Ray Kurzweil

8. Buckminsterfullerene is commonly known as :

(A) Quantum dot

(B) Nanowire

(C) Buckyball

(D) Nanorod

9. The lecture "There's Plenty of Room at the Bottom" was delivered by :

(A) Drexler

(B) Taniguchi

(C) Feynman

(D) Smalley

10. Nanopore sequencing technology is commercialized by :

(A) Illumina

(B) PacBio

(C) Oxford Nanopore Technologies

(D) Thermo Fisher

11. Nanoparticles may originate as :

(A) Natural

(B) Engineered

(C) Incidental

(D) All of the above

12. Who is regarded as the father of modern nanotechnology ?

(A) Taniguchi

(B) Drexler

(C) Feynman

(D) None of the above

13. DNA nanostructures are useful due to :

(A) Programmability

(B) Stability

(C) Biocompatibility

(D) All of the above

14. Enhanced drug delivery using nanotechnology helps to :

(A) Increase drug efficiency

(B) Reduce toxicity

(C) Both (A) and (B)

(D) None of the above

15. EPR effect is an example of :

(A) Direct targeting

(B) Passive targeting

(C) Hybrid targeting

(D) Active targeting

16. Nanoparticles enter cells mainly through :

(A) Endocytosis

(B) Diffusion

(C) Osmosis

(D) Exocytosis

17. STM inventors received Nobel Prize in :

(A) 1987

(B) 1986

(C) 1993

(D) 1990

18. Nanospheres are best defined as :

(A) Hollow tubular nanostructures

(B) Solid spherical nanoparticles

(C) Wire-like nanomaterials

(D) Flat layered nanostructures

19. Carbon nanotubes are characterized by :

(A) 1-dimensional cylindrical structure

(B) 2-dimensional sheet structure

(C) 3-dimensional bulk structure

(D) 0-dimensional structure

20. Nanorods differ from nanowires mainly in :

(A) Aspect ratio and length

(B) Crystallinity

(C) Chemical composition

(D) Surface charge

21. Nanowires are widely used in electronics because of their :

(A) Optical inactivity

(B) Low surface area

(C) Large volume

(D) Quantum confinement and conductivity

22. Nanosheets such as graphene are classified as :

(A) 3-D nanostructures

(B) 1-D nanostructures

(C) 0-D nanostructures

(D) 2-D nanostructures

23. Quantum dots exhibit unique optical properties due to :

(A) Quantum confinement effect

(B) Magnetic properties

(C) Surface roughness

(D) High density

24. Carbon nanotubes are stronger than steel primarily due to :

(A) Covalent sp^2 bonding

(B) Metallic bonding

(C) Hydrogen bonding

(D) Ionic bonding

25. The emission wavelength of quantum dots depends mainly on :

(A) Temperature

(B) Particle size

(C) Pressure

(D) Shape

26. At the nanoscale, materials exhibit enhanced reactivity primarily due to :

(A) Reduced quantum effects

(B) Reduced density

(C) Decreased atomic interactions

(D) Increased surface area-to-volume ratio

27. Quantum confinement becomes significant when :

(A) Pressure decreases

(B) Particle size approaches nanoscale dimensions

(C) Temperature increases

(D) Particle size increases

28. Optical properties of nanoparticles differ from bulk materials due to :

(A) Increased mass

(B) Reduced conductivity

(C) Quantum size effects

(D) Surface defects only

29. Mechanical strength of nanomaterials is often higher because :

(A) Increased porosity

(B) Smaller grain size and fewer dislocations

(C) Presence of defects

(D) Reduced bonding

30. Which property is most affected by nanoscale dimensions in semiconductor nanoparticles ?

(A) Density

(B) Color and band gap

(C) Volume

(D) Mass

31. Bioinspired nanomaterials are best described as :

(A) Only polymer-based materials

(B) Synthetic materials unrelated to biology

(C) Materials mimicking natural biological structures or processes

(D) Only metallic nanoparticles

32. Lotus leaf-inspired nanomaterials are known for :

(A) High conductivity

(B) High density

(C) Magnetic behaviour

(D) Self-cleaning and hydrophobic properties

33. Ball milling is categorized under which synthesis approach ?

(A) Biological

(B) Hybrid

(C) Bottom-up

(D) Top-down

34. The principle of ball milling involves :

(A) Vapor condensation

(B) Chemical reduction

(C) Mechanical grinding and size reduction

(D) Electrochemical deposition

35. Electrodeposition is based on :

(A) Reduction of metal ions using electric current

(B) Biological enzymes

(C) Thermal decomposition

(D) Mechanical forces

36. Thermal evaporation is commonly used for :

(A) Polymer synthesis

(B) Bulk material synthesis

(C) Biological fabrication

(D) Thin film deposition

37. In thermal evaporation, material is deposited due to :

(A) Chemical reaction

(B) Vaporization followed by condensation

(C) Mechanical force

(D) Electrical current

38. The sol-gel process involves :

(A) Electrochemical reaction

(B) Formation of colloidal solution followed by gelation

(C) Direct crystallization

(D) Mechanical grinding

39. In the sol-gel method, the "gel" is formed due to :

(A) Thermal melting

(B) Polymerization and cross-linking reactions

(C) Ion exchange

(D) Evaporation of solvent

40. Metal nanocrystals by reduction are synthesized by :

(A) Reduction of metal ions using reducing agents

(B) Mechanical milling

(C) Vapor deposition

(D) Oxidation of metals

41. Biological synthesis of nanoparticles utilizes :

(A) High temperature

(B) Mechanical grinding

(C) Vacuum deposition

(D) Microorganisms or plant extracts

42. Green synthesis of nanoparticles is preferred because it is :

(A) Energy intensive

(B) Environmentally friendly

(C) Expensive

(D) Toxic

43. Protein-based nanostructures are formed due to :

(A) Thermal evaporation

(B) Mechanical force

(C) Random aggregation

(D) Self-assembly of protein molecules

44. DNA template-based nanostructure formation relies on :

(A) Ionic bonding

(B) Base-pairing interactions

(C) Hydrogen gas

(D) Metallic bonding

45. DNA nanotechnology is widely used because of its :

(A) High density

(B) Electrical conductivity

(C) Programmable structure and specificity

(D) Magnetic properties

46. Protein-based nanostructures are primarily formed through :

(A) Mechanical grinding

(B) Thermal evaporation

(C) Covalent polymerization

(D) Self-assembly of amino acid chains

47. Which property makes proteins suitable for nanostructure formation ?

(A) High density

(B) Low solubility

(C) Specific folding and functional groups

(D) Metallic bonding

48. Biomolecular motors convert energy from ATP into :

(A) Light

(B) Heat

(C) Mechanical work

(D) Electrical energy

49. In E. coli, the flagellar motor is driven by :

(A) ATP hydrolysis

(B) Light energy

(C) Proton motive force

(D) Magnetic field

50. The rotation of bacterial flagella helps in :

(A) DNA replication

(B) Locomotion

(C) Protein synthesis

(D) Cell division

51. Myosin-based nanostructures in mammals are associated with :

(A) Muscle contraction

(B) Immune response

(C) DNA replication

(D) Signal transduction

52. Nanobiosensors are devices that detect :

(A) Only electrical signals

(B) Biological, chemical, or physical signals

(C) Only physical signals

(D) Only chemical signals

53. A key advantage of nanobiosensors is :

(A) High sensitivity and specificity

(B) Large size

(C) Low sensitivity

(D) Slow response time

54. Self-assembled structures are formed by :

(A) Spontaneous organization of molecules

(B) High temperature only

(C) External mechanical force

(D) Electric field

55. Self-assembly in biological systems is mainly driven by :

(A) Mechanical forces

(B) Nuclear reactions

(C) Ionic and non-covalent interactions

(D) High pressure

56. Nanoprinting of DNA refers to :

(A) DNA replication

(B) DNA degradation

(C) Patterning DNA on surfaces at nanoscale

(D) DNA sequencing

57. RNA nanoprinting is useful in :

(A) Metal fabrication

(B) Structural engineering

(C) Thermal insulation

(D) Gene regulation studies

58. Protein nanoprinting is commonly used in :

(A) Agriculture only

(B) Construction

(C) Biosensor fabrication

(D) Electronics only

59. Biochips are miniaturized devices used for :

(A) Biological analysis and detection

(B) Chemical storage

(C) Mechanical testing

(D) Thermal processing

60. Biochips at nanoscale improve detection by :

(A) Eliminating signal

(B) Reducing specificity

(C) Enhancing sensitivity and speed

(D) Increasing size

61. Lab-on-chip (LOC) technology integrates :

(A) Mechanical operations only

(B) Only chemical reactions

(C) Only biological storage

(D) Multiple laboratory functions on a single chip

62. LOC devices are advantageous because they require :

(A) High cost equipment

(B) Large sample volumes

(C) Small sample volumes

(D) Long processing time

63. Integration of nanotechnology with biochips enables :

(A) Reduced accuracy

(B) Increased size of devices

(C) Faster and more precise detection

(D) Lower sensitivity

64. Nanotechnology improves drug solubility primarily by :

(A) Reducing surface area

(B) Increasing molecular weight

(C) Increasing particle size

(D) Reducing particle size and increasing surface area

65. Which nanocarrier is widely used for enhancing solubility of poorly water-soluble drugs ?

(A) Nanocrystals

(B) Liposomes

(C) Polymeric nanoparticles

(D) All of the above

66. Targeted drug delivery using nanoparticles helps to :

(A) Deliver drugs specifically to diseased tissues

(B) Eliminate drug activity

(C) Reduce drug absorption

(D) Increase side effects

67. In nanotechnology-based diagnosis, nanoparticles are used as :

(A) Structural materials only

(B) Heat insulators

(C) Imaging agents and biosensors

(D) Mechanical tools

68. Nanotherapy for cancer treatment primarily works by :

(A) Delivering drugs specifically to cancer cells

(B) Reducing blood flow to all tissues

(C) Eliminating immune response

(D) Increasing tumor size

69. Nanotechnology-assisted interior artery expansion (e.g., stents) helps in :

(A) Restoring normal blood flow

(B) Increasing blood viscosity

(C) Reducing oxygen supply

(D) Blocking blood vessels

70. Replacement of joints using nanomaterials improves performance due to :

(A) Increased brittleness

(B) Higher corrosion rate

(C) Reduced durability

(D) Enhanced strength and biocompatibility

71. Radioactive materials enclosed in fullerene cages are used in :

(A) Nuclear medicine for targeted therapy

(B) Textile industry

(C) Agriculture

(D) Food preservation

72. Nanotechnology-based cancer therapy reduces side effects by :

(A) Targeted delivery and controlled release

(B) Non-specific drug distribution

(C) Increasing drug dosage

(D) Eliminating drug metabolism

73. Nanotechnology contributes to a cleaner environment by :

(A) Enhancing pollutant degradation

(B) Reducing filtration efficiency

(C) Increasing waste generation

(D) Increasing pollution

74. Nanomaterials used for environmental remediation are known as :

(A) Nanocatalysts

(B) Nanotools

(C) Nanofilters

(D) Nanoremediators

75. Which nanomaterial is widely used for water purification ?

(A) Gold nanoparticles

(B) Iron oxide nanoparticles

(C) Carbon nanotubes

(D) Both (B) and (C)

76. Nanotechnology improves water treatment by :

(A) Reducing efficiency

(B) Enhancing adsorption and filtration

(C) Increasing contaminants

(D) Preventing chemical reactions

77. Nanoscale membranes are advantageous because they :

(A) Provide high permeability and selectivity

(B) Have low selectivity

(C) Increase energy consumption

(D) Reduce filtration capacity

78. Microbial nanoparticles are synthesized using :

(A) Microorganisms such as bacteria and fungi

(B) Thermal evaporation

(C) High pressure systems

(D) Mechanical grinding

79. Biomolecular motors can be used in engineered devices for :

(A) Structural rigidity

(B) Heat generation

(C) Electrical insulation

(D) Mechanical movement at nanoscale

80. ATP-driven biomotors are important because they :

(A) Break down proteins

(B) Store energy

(C) Convert chemical energy into motion

(D) Produce heat only

81. A major concern regarding nanomaterials in the environment is :

(A) Their large size

(B) Their persistence and bioaccumulation

(C) Their color

(D) Their shape

82. The fate of nanomaterials in the environment includes :

(A) Aggregation

(B) Degradation

(C) Transport

(D) All of the above

83. Cytotoxicity of nanomaterials refers to :

(A) Electrical properties

(B) Beneficial effects on cells

(C) Toxic effects on living cells

(D) Mechanical strength

84. Cytotoxicity assays are used to evaluate :

(A) Optical properties

(B) Mechanical properties

(C) Environmental stability

(D) Biological safety of nanomaterials

85. Life cycle assessment (LCA) of nanomaterials evaluates :

(A) Only synthesis stage

(B) Environmental impact from production to disposal

(C) Only usage phase

(D) Only recycling

86. Contaminants removed by nanotechnology in water include :

(A) Organic pollutants

(B) Microorganisms

(C) Heavy metals

(D) All of the above

87. Silver nanoparticles are widely used in water treatment due to their :

(A) Optical transparency

(B) Electrical conductivity

(C) Magnetic properties

(D) Antimicrobial activity

88. Aggregation of nanoparticles in the environment can lead to :

(A) Reduced reactivity and mobility

(B) Increased toxicity

(C) Increased stability

(D) No effect

89. Reactive oxygen species (ROS) generation by nanoparticles can cause :

(A) Cytotoxic effects

(B) Improved metabolism

(C) Cell growth

(D) Increased immunity

90. Engineered nanomaterials may enter the environment through :

(A) Consumer products

(B) Industrial waste

(C) Medical applications

(D) All of the above

91. One of the key challenges in environmental nanotechnology is :

(A) High availability

(B) Low efficiency

(C) Understanding long-term environmental impact

(D) Lack of applications

92. Biological synthesis of nanoparticles is considered eco-friendly because it :

(A) Produces hazardous waste

(B) Uses toxic chemicals

(C) Requires high energy

(D) Uses natural reducing agents

93. Reactive oxygen species (ROS) generation by nanoparticles can cause :

(A) Cell growth

(B) Improved metabolism

(C) Increased immunity

(D) Cytotoxic effects

94. Which nanomaterial is commonly used for air purification ?

(A) Iron Rods

(B) Calcium carbonate

(C) Sodium chloride

(D) Titanium dioxide (TiO_2)

95. Nanotechnology can help in soil remediation by :

(A) Increasing contamination

(B) Destroying soil structure

(C) Immobilizing heavy metals

(D) Reducing nutrients

96. Carbon nanotubes primarily consist of :

(A) Silicon

(B) Carbon

(C) Nitrogen

(D) Phosphorus

97. One nanometer corresponds to :

(A) 10^{-3} meter

(B) 10^{-6} meter

(C) 10^{-9} meter

(D) 10^{-12} meter

98. Instruments capable of imaging nanoscale structures include :

(A) Atomic Force Microscope

(B) Scanning Electron Microscope

(C) Transmission Electron Microscope

(D) All of the above

99. The term "nanotechnology" was first introduced by :

(A) Eric Drexler

(B) Norio Taniguchi

(C) Richard Feynman

(D) Robert Hooke

100. Which of the following best describes the top-down approach in nanomaterial synthesis ?

(A) Building materials atom by atom

(B) Breaking bulk materials into nanosized particles

(C) Using biological systems for synthesis

(D) Self-assembly of molecules

(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।