Roll No.----------

प्रश्नपुस्तिका क्रमांक
Question Booklet No.

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

K-1369

B.Sc. (Biotech.) (Fourth Semester) Examination, 2025-26

(NEP)

(BBT4001)

BIOANALYTICAL TOOLS

Paper Code
BBT4001

(To be filled in the OMR Sheet)

प्रश्नपुस्तिका सीरीज
Question 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.

(Remaining instructions on the 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 हो या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(शेष निर्देश अन्तिम पृष्ठ पर)

1. The resolving power of a microscope increases with:

(A) Increase in wavelength

(B) Decrease in numerical aperture

(C) Increase in numerical aperture

(D) Decrease in magnification

2. Which microscope is best suited to observe living, unstained cells?

(A) Bright field microscope

(B) Phase contrast microscope

(C) Electron microscope

(D) Fluorescence microscope

3. The limit of resolution (d) is inversely proportional to:

(A) Numerical aperture

(B) Wavelength

(C) Refractive index

(D) Magnification

4. In fluorescence microscopy, excitation light is usually:

(A) Infrared

(B) Visible red

(C) Microwave

(D) Ultraviolet

5. The main difference between TEM and SEM is that:

(A) TEM shows surface, SEM shows internal structure

(B) SEM uses light, TEM uses electrons

(C) Both give same images

(D) TEM shows internal structure, SEM shows surface

6. pH of a solution with $[H^+] = 10^{-7}M$ is:

(A) 5

(B) 6

(C) 7

(D) 8

7. The glass electrode in pH meter is selective for:

(A) Na^+ ions

(B) Cl^- ions

(C) H^+ ions

(D) OH^- ions

8. Absorbance is defined as:

(A) $\log I_0/I$

(B) $\log I/I_0$

(C) I_0/I

(D) I/I_0

9. Beer-Lambert law is valid only when:

(A) Light is monochromatic

(B) Concentration is very high

(C) Solution is opaque

(D) Temperature is zero

10. If path length doubles and concentration remain same, absorbance will:

(A) Halve

(B) Double

(C) Remain same

(D) Become zero

11. Electron microscopes use:

(A) Photons

(B) Protons

(C) Neutrons

(D) Electrons

12. Why do electron microscopes require vacuum?

(A) To prevent electron scattering

(B) To cool sample

(C) To increase magnification

(D) To increase contrast

13. In fluorescence, emitted light has:

(A) Shorter wavelength

(B) Same wavelength

(C) Longer wavelength

(D) No wavelength

14. Numerical aperture depends on:

(A) Refractive index and angle

(B) Lens thickness

(C) Magnification

(D) Tube length

15. Phase contrast microscope enhances contrast due to differences in:

(A) Amplitude of light

(B) Phase of light waves

(C) Frequency

(D) Intensity only

16. Which region is used for studying molecular vibrations?

(A) UV

(B) Visible

(C) X-ray

(D) Infrared

17. A fluorophore absorbs energy and then:

(A) Stores it permanently

(B) Emits lower energy light

(C) Emits same energy light

(D) Emits higher energy light

18. Oil immersion lens improves resolution by:

(A) Increasing wavelength

(B) Decreasing refractive index

(C) Increasing refractive index

(D) Reducing light

19. Which factor does NOT affect absorbance?

(A) Concentration

(B) Path length

(C) Wavelength

(D) Density of solvent

20. Emission spectroscopy is based on:

(A) Absorption of energy

(B) Reflection of energy

(C) Emission after excitation

(D) Refraction

21. Visible light range is approximately:

(A) l00-200 nm

(B) 200-400 nm

(C) 400-700 nm

(D) 700-1000 nm

22. Resolution improves when wavelength:

(A) Increases

(B) Decreases

(C) Remains constant

(D) Becomes zero

23. Which instrument measures hydrogen ion activity directly?

(A) Spectrophotometer

(B) Colorimeter

(C) pH meter

(D) Fluorimeter

24. In absorption spectroscopy, transmitted light intensity:

(A) Increases

(B) Decreases

(C) Remains same

(D) Becomes zero

25. In SEM, image formation is mainly due to:

(A) Transmitted electrons

(B) X-rays

(C) Photons

(D) Secondary electrons

26. Colorimetry is based on measurement of:

(A) Fluorescence

(B) Refraction

(C) Emission

(D) Absorbance in visible region

27. Fluorimetry is more sensitive because it measures:

(A) Transmitted light

(B) Reflected light

(C) Emitted light

(D) Scattered light

28. Which cuvette is used in UV spectroscopy?

(A) Glass

(B) Plastic

(C) Quartz

(D) Metal

29. Beer-Lambert law fails at:

(A) Low concentration

(B) High concentration

(C) Low wavelength

(D) High temperature

30. If absorbance is 0, transmittance is:

(A) 0%

(B) 50%

(C) 100%

(D) 10%

31. Spectrophotometer primarily measures:

(A) Density

(B) Size

(C) Charge

(D) Absorbance

32. In centrifugation, sedimentation depends on:

(A) Color

(B) Shape only

(C) Mass and density

(D) Temperature only

33. Unit of sedimentation coefficient:

(A) Joule

(B) Pascal

(C) Watt

(D) Svedberg

34. Differential centrifugation separates particles by:

(A) Charge

(B) Size

(C) Color

(D) Solubility

35. In density gradient centrifugation, particles move until:

(A) They stop rotating

(B) Density equals medium

(C) Temperature drops

(D) Pressure increases

36. Supernatant refers to:

(A) Sediment

(B) Solid

(C) Gas

(D) Liquid above sediment

37. Rotor speed is measured in:

(A) rpm

(B) m/s

(C) kg

(D) J

38. Which organelle sediments first?

(A) Ribosome

(B) Mitochondria

(C) Nucleus

(D) Lysosome

39. Blank solution is used to:

(A) Increase absorbance

(B) Calibrate instrument

(C) Reduce light

(D) Increase noise

40. Absorbance is proportional to:

(A) 1/concentration

(B) log concentration

(C) Concentration

(D) Temperature

41. Fluorescence occurs within:

(A) Seconds

(B) Minutes

(C) Nanoseconds

(D) Hours

42. Visible light region is used in:

(A) Colorimetry

(B) IR spectroscopy

(C) NMR

(D) X-ray

43. Quartz cuvette is required because it:

(A) Absorbs UV

(B) Transmits UV

(C) Reflects UV

(D) Blocks light

44. Relative centrifugal force depends on:

(A) Radius and speed

(B) Temperature

(C) Volume

(D) Color

45. Pellet consists of:

(A) Liquid

(B) Gas

(C) Solid particles

(D) Ions only

46. Spectrophotometer detector converts light into:

(A) Heat

(B) Motion

(C) Sound

(D) Electrical signal

47. UV absorption in proteins is mainly due to:

(A) Lipids

(B) Water

(C) Sugars

(D) Aromatic amino acids

48. Which factor does NOT affect sedimentation?

(A) Density

(B) Shape

(C) Color

(D) Size

49. Path length is generally:

(A) 0.1 cm

(B) 1 cm

(C) 10 cm

(D) 100 cm

50. Centrifuge separates particles using:

(A) Magnetic force

(B) Gravitational force

(C) Centrifugal force

(D) Electric force

51. Chromatography is used for:

(A) Heating

(B) Mixing

(C) Cooling

(D) Separation

52. Mobile phase in chromatography is:

(A) Stationary

(B) Moving

(C) Solid

(D) Fixed

53. Rf value ranges between:

(A) 0-1

(B) 1-2

(C) 2-3

(D) >3

54. In TLC, stationary phase is:

(A) Paper

(B) Silica gel

(C) Gas

(D) Liquid

55. Lower Rf value indicates:

(A) High mobility

(B) High solubility

(C) Weak interaction

(D) Strong adsorption

56. Paper chromatography is based on:

(A) Partition

(B) Adsorption

(C) Ion exchange

(D) Affinity

57. Ion exchange chromatography separates based on:

(A) Charge

(B) Size

(C) Density

(D) Shape

58. Gel filtration separates molecules by:

(A) Charge

(B) Density

(C) Polarity

(D) Size

59. Affinity chromatography uses:

(A) Charge interaction

(B) Specific binding

(C) Size difference

(D) Density

60. In GC, stationary phase is usually:

(A) Liquid on solid support

(B) Gas

(C) Solid

(D) Plasma

61. HPLC operates at:

(A) High pressure

(B) Low pressure

(C) No pressure

(D) Variable temperature

62. Retention time depends on:

(A) Interaction with stationary phase

(B) Color

(C) Shape only

(D) Density

63. Elution refers to:

(A) Binding

(B) Absorption

(C) Adsorption

(D) Washing out

64. Chromatogram shows:

(A) Spots

(B) Colors

(C) Lines

(D) Peaks

65. Which technique is best for volatile compounds?

(A) TLC

(B) HPLC

(C) GC

(D) Paper chromatography

66. Stationary phase remains:

(A) Fixed

(B) Moving

(C) Liquid

(D) Gas

67. Solvent front is:

(A) Starting point

(B) Baseline

(C) Middle

(D) End point of solvent

68. High Rf value indicates:

(A) Strong adsorption

(B) Weak adsorption

(C) No movement

(D) Low solubility

69. Partition chromatography involves:

(A) Solid-solid

(B) Ion exchange

(C) Gas-solid

(D) Liquid-liquid

70. Silica gel is:

(A) Non-polar

(B) Polar

(C) Neutral

(D) Charged

71. Eluent is:

(A) Detector

(B) Column

(C) Stationary phase

(D) Mobile phase

72. Detector in HPLC commonly uses:

(A) UV

(B) IR

(C) X-ray

(D) NMR

73. Which does NOT affect separation?

(A) Flow rate

(B) Temperature

(C) Color of sample

(D) Solvent polarity

74. Column chromatography uses:

(A) Plate

(B) Gel sheet

(C) Paper

(D) Column

75. TLC stands for:

(A) Thin layer chromatography

(B) Thick layer chromatography

(C) Total layer chromatography

(D) None

76. Electrophoresis separates molecules based on:

(A) Charge

(B) Color

(C) Density

(D) Temperature

77. Agarose gel is commonly used for:

(A) Proteins

(B) Sugars

(C) Lipids

(D) DNA

78. SDS gives proteins:

(A) Positive charge

(B) Negative charge

(C) Neutral

(D) No charge

79. SDS-PAGE separates proteins by:

(A) Charge

(B) Size and shape

(C) Color

(D) Density

80. Native PAGE differs because it:

(A) Denatures proteins

(B) Maintains native structure

(C) Adds charge

(D) Uses heat

81. Electric field is required for:

(A) Electrophoresis

(B) Diffusion

(C) Osmosis

(D) Filtration

82. Isoelectric focusing separates based on:

(A) Size

(B) Charge

(C) pI

(D) Density

83. Western blot detects:

(A) DNA

(B) RNA

(C) Proteins

(D) Lipids

84. Immunoelectrophoresis uses:

(A) DNA hybridization

(B) Charge only

(C) Size exclusion

(D) Antigen-antibody reaction

85. Pulse field gel electrophoresis is used for:

(A) Large DNA

(B) Small DNA

(C) Proteins

(D) Lipids

86. Buffer maintains:

(A) Pressure

(B) pH

(C) Volume

(D) Mass

87. Migration rate in electrophoresis depends on:

(A) Size

(B) Charge

(C) Shape

(D) All

88. Polyacrylamide gel is mainly used for:

(A) DNA

(B) Proteins

(C) Lipids

(D) Sugars

89. Smaller molecules migrate:

(A) Faster

(B) Slower

(C) Same

(D) Random

90. Which factor does NOT affect electrophoresis?

(A) Voltage

(B) Buffer pH

(C) Molecular size

(D) Color

91. Biosensor consists of:

(A) Receptor

(B) Transducer

(C) Both

(D) None

92. Glucose biosensor is used in:

(A) Medicine and health

(B) Agriculture

(C) Industry

(D) Space

93. Nanotechnology deals with:

(A) Macro scale

(B) Micro scale

(C) Nano scale

(D) Mega scale

94. Western blot involves transfer to:

(A) Agarose

(B) Nitrocellulose membrane

(C) Glass

(D) Plastic

95. Agarose gel concentration affects:

(A) Charge

(B) Pore size

(C) Voltage

(D) Color

96. Direction of migration depends on:

(A) Charge

(B) Color

(C) Shape

(D) Density

97. Transducer converts:

(A) Signal

(B) Energy

(C) Both

(D) None

98. Nanoparticles size range is:

(A) 1-100 nm

(B) 100-l000nm

(C) 1-10 μm

(D) >10 μm

99. Electrophoresis buffer example is:

(A) NaC1

(B) TAE

(C) HCl

(D) NaOH

100. Western blot uses:

(A) Antibody

(B) DNA probe

(C) RNA probe

(D) Lipid probe

******

Rough Work / रफ कार्य

4. Four alternative answers are mentioned for each question as – A, B, C & D in the question 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 एक 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, उत्तर 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।