Roll No. .....

Question Booklet Number

O. M. R. Serial No.

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

(Old Syllabus Effective from 2022)

(Only Back Paper Students)

MOLECULAR MEDICINE

Paper Code							
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Questions Booklet Series
B

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 most common application of PCR is :
   (A) Protein purification
   (B) Gene cloning/amplification
   (C) Cell culture
   (D) RNA splicing

2. PCR finds utility in :
   (A) Medical diagnostics
   (B) Forensic science
   (C) Agriculture
   (D) All of the above

3. What can be targeted by FISH probes ?
   (A) RNA only
   (B) DNA only
   (C) Both DNA and RNA
   (D) Proteins only

4. What is the main advantage of FISH ?
   (A) High specificity and sensitivity
   (B) Extremely low cost
   (C) Rapid results (minutes)
   (D) Non-destructive to all samples

5. Why are FISH probes fluorescently labeled ?
   (A) To increase binding strength
   (B) To protect from enzymes
   (C) To visualize under a microscope
   (D) To stabilize the DNA

6. FISH is commonly used for :
   (A) Chromosomal abnormality detection
   (B) Gene localization
   (C) Gene expression analysis
   (D) All of the above

7. The primary goal of ART in HIV patients is to :
   (A) Completely eradicate the virus
   (B) Suppress viral replication/reduce load
   (C) Prevent all bacterial infections
   (D) Cure the patient permanently

8. Which drugs inhibit the reverse transcriptase enzyme ?
   (A) PIs
   (B) INSTIs
   (C) NRTIs
   (D) Fusion inhibitors

9. Post-exposure prophylaxis (PEP) is used to :
   (A) Treat long-term HIV infection
   (B) Prevent infection after potential exposure
   (C) Boost the immune system permanently
   (D) Eliminate the need for ART

10. Essential HIV/AIDS management includes ART and :

(A) Supportive care (physical/social)
(B) Routine surgery
(C) High-dose chemotherapy
(D) Daily antibiotic use

11. To detect Trypanosoma in blood, doctors use :

(A) Urinalysis
(B) Microscopic examination of blood smears
(C) Chest X-rays
(D) ECG

12. If Trypanosoma affects the brain, what procedure is used ?

(A) Lymph node aspiration
(B) Lumbar puncture (spinal tap)
(C) Bone marrow biopsy
(D) EEG

13. Which test finds host antibodies against Trypanosoma ?

(A) Serological tests (ELISA/IFAT)
(B) PCR
(C) Blood culture
(D) Biopsy

14. Which flu vaccine is a nasal spray ?

(A) Inactivated vaccine
(B) Live attenuated vaccine
(C) Recombinant vaccine
(D) Adjuvanted vaccine

15. The influenza vaccine is typically given :

(A) Once every two years
(B) Annually
(C) Only during pandemics
(D) Once in a lifetime

16. Who is highly recommended to get the flu shot ?

(A) Healthy adults aged 20-40
(B) Pregnant women
(C) People with severe egg allergies
(D) Children under 6 months

17. Which disease is NOT linked to GPCR signaling defects ?

(A) Diabetes mellitus
(B) Hypertension
(C) Cystic fibrosis
(D) Alzheimer's disease

18. Dysregulated GPCR signaling often leads to :

(A) Improved insulin sensitivity
(B) Enhanced immune response
(C) Neurodegenerative diseases
(D) Decreased cancer risk

19. Defects in GPCR pathways are involved in :

(A) Osteoporosis
(B) Malaria
(C) Parkinson's disease
(D) Gastrointestinal bleeding

20. GPCRs regulate which of these processes ?
(A) Muscle contraction
(B) Blood clotting
(C) Oxygen transport
(D) All of the above

21. Trastuzumab (Herceptin) targets which receptor ?
(A) Estrogen receptor
(B) HER2 receptor
(C) VEGF receptor
(D) Progesterone receptor

22. How does Lapatinib work in breast cancer ?
(A) Inhibits HER2 and EGFR tyrosine kinases
(B) Stimulates HER2 gene amplification
(C) Activates HER2 signaling
(D) Blocks hormone synthesis

23. Kadcyla (T-DM1) is categorized as an :
(A) Antibody-drug conjugate
(B) Tyrosine kinase inhibitor
(C) Monoclonal antibody only
(D) Estrogen modulator

24. Which is NOT a targeted therapy for HER2+ breast cancer ?
(A) Lapatinib
(B) Pertuzumab
(C) Bevacizumab
(D) Trastuzumab

25. The main goal of functional genomics is to :
(A) Sequence the entire genome
(B) Map the protein structures
(C) Understand gene functions and interactions
(D) Track evolutionary history

26. Which is NOT a primary application of functional genomics ?
(A) Drug discovery
(B) Crop improvement
(C) Determining 3D DNA structure
(D) Identifying disease biomarkers

27. How does functional genomics assist personalized medicine ?
(A) By identifying individualized biomarkers for treatment
(B) By sequencing DNA for every human on earth
(C) By studying ancient human migration
(D) By predicting weather-related health issues

28. What is an advantage of NGS over Sanger sequencing ?
(A) Low sensitivity
(B) High throughput
(C) Higher cost
(D) Slower speed

29. Compared to Sanger, NGS provides :
(A) Lower resolution
(B) Higher scalability
(C) Less flexibility
(D) Slower processing

30. In complex genomes, NGS is superior because it can :
(A) Detect structural variations accurately
(B) Only detect common variants
(C) Reduce the accuracy of data
(D) Increase the cost per base

31. Microarray probes are designed to target :
(A) Lipid molecules
(B) Single-stranded DNA or RNA
(C) Protein sequences
(D) Whole cells

32. Microarrays detect gene expression through :
(A) Fluorescent signals from labeled samples
(B) Radioactive decay
(C) Changes in electrical conductivity
(D) Enzymatic color changes

33. Which technique detects mutations in inherited disorders ?
(A) ELISA
(B) PCR
(C) Flow cytometry
(D) Western blotting

34. Gene amplification is most valuable for :
(A) Monitoring bacterial growth
(B) Quantifying pathogen-specific genes
(C) Analyzing protein structures
(D) Identifying protein-protein interactions

35. Mutations in which gene cause Cystic Fibrosis ?
(A) BRCA1
(B) APC
(C) CFTR
(D) TP53

36. The gold standard for CF diagnosis is the :
(A) Newborn screening
(B) Sweat chloride test
(C) Chest X-ray
(D) Genetic sequencing only

37. FH is primarily caused by mutations in :
(A) Cholesterol metabolism genes
(B) Immune response genes
(C) Blood clotting genes
(D) Insulin genes

38. A common clinical feature of FH is :
(A) Reduced cardiovascular risk
(B) Elevated HDL-C
(C) Xanthomas and xanthelasma
(D) Hypotension

39. Which enzyme processes pri-miRNA in the nucleus ?
(A) Dicer
(B) Drosha
(C) Argonaute
(D) Exportin-5

40. Mature miRNAs are typically how many nucleotides long ?
(A) ~100
(B) ~10
(C) ~22
(D) ~1000

41. What is the primary mechanism of siRNA ?
(A) Transcriptional activation
(B) mRNA degradation
(C) Protein degradation
(D) RNA splicing

42. Which RISC protein cleaves mRNA during siRNA binding ?
(A) Dicer
(B) Drosha
(C) Argonaute
(D) Exportin-5

43. Which enzyme phosphorylates STAT proteins ?
(A) Protein kinase A
(B) Janus kinase (JAK)
(C) MAPK
(D) Receptor tyrosine kinase

44. The JAK-STAT pathway primarily mediates :
(A) Cellular responses to cytokines/growth factors
(B) Calcium signaling
(C) Cell membrane integrity
(D) Cell adhesion

45. Which protein inhibits GSK3β in the Wnt pathway ?
(A) Disheveled (DVL)
(B) β-catenin
(C) Axin
(D) Frizzled

46. When β-catenin moves to the nucleus, it results in :
(A) Transcriptional activation of target genes
(B) Inhibition of gene expression
(C) Cell death
(D) Inhibition of proliferation

47. Which phase confirms efficacy in a large, diverse population ?
(A) Phase I
(B) Phase II
(C) Phase III
(D) Phase IV

48. The primary goal of Phase I trials is to :
(A) Confirm long-term safety
(B) Evaluate safety, dose, and pharmacokinetics
(C) Prove the drug works better than placebos
(D) Collect post-market data

49. Phase I trials usually involve how many participants ?
(A) 500-5,000
(B) 20-100
(C) 5,000+
(D) 100-500

50. Which technique is used to derive embryonic stem cells ?
(A) Somatic cell nuclear transfer (or blastocyst extraction)
(B) PCR
(C) Western blotting
(D) Immunohistochemistry

51. Which statement regarding DNA sequencing is false ?

(A) Sequencing uses Taq polymerase, which is heat-stable and releases pyrophosphate

(B) DNA fragments from PCR or clones are purified before sequencing

(C) Fragments are turned into single strands and paired with a primer

(D) New DNA strands grow from the end of the primer

52. How is Haemophilia genetically categorized ?

(A) X-linked dominant

(B) Autosomal recessive

(C) X-linked recessive

(D) Autosomal dominant

53. Identify the incorrect statement about PCR :

(A) It is an in vivo method of DNA amplification

(B) Primer annealing depends on complementary sequences

(C) DNA synthesis typically occurs around 72-74°C

(D) RNase H digests mRNA during the RT-PCR process

54. What is the term for having two different alleles at one genetic locus ?

(A) Hemizygosity

(B) Heterozygosity

(C) Nullizygosity

(D) Homozygosity

55. Which is NOT true about Sickle Cell Anaemia ?

(A) Carriers (heterozygotes) have a 50% chance of passing the gene to offspring.

(B) It is a group of disorders affecting oxygen-carrying hemoglobin.

(C) Heterozygous individuals suffer from severe disease symptoms.

(D) Heterozygous individuals are generally not severely affected.

56. Familial Hypercholesterolemia (FH) is characterized by :

(A) Reduced LDL receptor activity and high plasma cholesterol

(B) Decreased levels of high-density lipoprotein only

(C) Normal cholesterol levels but high triglycerides

(D) Increased risk of low blood pressure

57. The FISH technique mainly involves :

(A) Using dideoxynucleotides for sequencing

(B) Chemical dyes used specifically for genetic linkage maps

(C) A labeled probe used for the physical mapping of genomes

(D) DNA polymerase for incorporating radioactive isotopes

58. What is a defining feature of a DNA Microarray ?

(A) It is larger than a standard DNA chip

(B) It contains DNA sequences used to analyze the transcriptome

(C) It contains RNA sequences used to analyze the proteome

(D) It is made of flexible plastic polymers

59. Cystic Fibrosis (CF) results from an imbalance of which substance due to a CFTR defect ?

(A) Glucose

(B) Fatty acids

(C) Chloride (Salts)

(D) Hormones

60. Where are the receptors for steroid and thyroid hormones located ?

(A) Cytosol and Nucleus respectively

(B) Nucleus and Cytosol respectively

(C) Plasma membrane for both

(D) Cytosol for both

61. What does the acronym FDA stand for ?

(A) Federal Drug Association

(B) Federal Department of Drug Administration

(C) Food and Drug Act

(D) Food and Drug Administration

62. Which is true about the drug discovery process ?

(A) It guarantees that a drug will have zero side effects

(B) It determines the safety and efficacy of potential drugs

(C) It is limited strictly to animal testing

(D) It focuses only on the manufacturing of the pill

63. Bioavailability is best defined as :

(A) The time it takes for a drug to leave the body

(B) The proportion of a dose that reaches systemic circulation to have an effect

(C) The rate at which a drug is instantly metabolized by the liver

(D) The ability of drug metabolites to cause toxic side effects

64. Which of these receptors does NOT have intrinsic tyrosine kinase activity ?

(A) Asialoglycoprotein receptor

(B) Insulin receptor

(C) Epidermal growth factor receptor

(D) Platelet-derived growth factor receptor

65. What is the correct sequence of extracellular signaling ?

(A) Release - Transport - Binding - Transduction

(B) Binding - Transduction - Release - Transport

(C) Transport - Release - Binding - Transduction

(D) Transduction - Binding - Transport - Release

66. What is the initial step in the drug discovery pipeline ?

(A) Lead Optimization

(B) Target Identification/Lead Identification

(C) Lead Validation

(D) Lead Modification

67. How do siRNA and miRNA pathways differ ?

(A) miRNA is a backup for failed siRNA silencing

(B) siRNA is a defense against foreign RNA; miRNA regulates internal gene expression

(C) Both are identical in origin and evolutionary history

(D) Both must be active simultaneously to silence a single gene

68. Order the FDA drug approval steps :

(A) IND - NDA - Animal testing - Human trials

(B) Animal testing - IND - Human trials - NDA - Approval

(C) Approval - Human trials - IND-NDA

(D) Patent - NDA - Human trials - IND

69. Which is NOT a standard molecular medicine technique ?

(A) Western blotting

(B) PCR

(C) MRI (Magnetic Resonance Imaging)

(D) ELISA

70. Which molecular pair is incorrectly matched ?

(A) Polysaccharide - Glycosidic bond

(B) Proteins - Peptide bond

(C) Phospholipids - Phosphate linkage

(D) Nucleic acid - Hydrogen bond (as the primary backbone)

71. Which method is unsuitable for separating nucleic acids ?

(A) SDS-PAGE (primarily for proteins)

(B) PAGE

(C) Northern blotting

(D) Agarose gel electrophoresis

72. What is NOT a mandatory requirement for basic DNA cloning ?

(A) DNA inserts

(B) Vectors

(C) Protein expression

(D) Molecular cutters (Restriction enzymes)

73. Dysregulated signaling in cancer is often caused by mutations in :

(A) Proto-oncogenes

(B) Tumor facilitator genes

(C) Oncosuppressor genes

(D) Structural genes

74. What causes Huntington's disease ?

(A) Genetic mutation

(B) Environmental toxins

(C) Bacterial infection

(D) Physical brain trauma

75. Which brain region is the primary target of Huntington's disease ?

(A) Frontal cortex

(B) Hippocampus

(C) Cerebellum

(D) Basal ganglia

76. Identify a hallmark symptom of Huntington's disease :

(A) Frontal cortex

(B) Hippocampus

(C) Cerebellum

(D) Basal ganglia

77. The acronym MRSA stands for :

(A) Multi-Resistant Staphylococcus aureus

(B) Methicillin-Resistant Streptococcus aureus

(C) Methicillin-Resistant Staphylococcus aureus

(D) Methicillin-Resistant Salmonella aureus

78. Which is NOT a standard way MRSA is transmitted ?

(A) Contact with contaminated surfaces

(B) Sharing personal items like razors

(C) Airborne transmission

(D) Direct contact with an infected wound

79. What makes DNA aptamers effective for therapy ?

(A) They are made of multiple DNA strands

(B) They are highly stable and specific

(C) They are resistant to all cellular degradation

(D) They are only synthesized inside bacteria

80. How are DNA aptamers produced ?

(A) SELEX process

(B) Bacterial fermentation

(C) Chemical synthesis from scratch

(D) Extraction from plant leaves

81. What is a major therapeutic use of DNA aptamers ?

(A) Structural tissue support

(B) Targeted drug delivery

(C) Cellular energy production

(D) Improved digestion

82. Which is NOT an advantage of DNA aptamers ?

(A) Reduced off-target effects

(B) Versatility in targets

(C) Low cost of production

(D) High specificity

83. Small regulatory RNAs are characterized by :

(A) Being long, single-stranded molecules

(B) Regulating gene expression post-transcriptionally

(C) Resistance to all cellular enzymes

(D) Regulation at the transcriptional level only

84. Which RNA type represses translation or degrades mRNA ?

(A) rRNAs

(B) snRNAs

(C) tRNAs

(D) miRNAs

85. The primary role of siRNA is :

(A) Maintenance of chromosome structure

(B) Defense against viruses and transposons

(C) Facilitating protein synthesis in ribosomes

(D) Activating gene transcription

86. Which of the following is NOT a regulatory RNA ?

(A) piRNAs

(B) miRNAs

(C) rRNAs

(D) siRNAs

87. Embryonic stem cells are collected from the :

(A) Blastocyst

(B) Morula

(C) Zygote

(D) Gastrula

88. Which statement about embryonic stem cells is correct ?

(A) They are derived from adult bone marrow

(B) They are multipotent only

(C) They can differentiate into all three germ layers

(D) They only differentiate into their own cell type

89. What term describes the ability of a stem cell to become any body cell ?

(A) Pluripotency

(B) Totipotency

(C) Unipotency

(D) Multipotency

90. A potential use for embryonic stem cells is :

(A) Cosmetic surgery

(B) Regenerative medicine/Organ transplantation

(C) Blood transfusion

(D) Bone fracture repair

91. Right heart failure primarily affects which chamber ?

(A) Left ventricle

(B) Right ventricle

(C) Left atrium

(D) Right atrium

92. A primary consequence of right heart failure is :

(A) Pulmonary edema

(B) Inadequate blood flow to the lungs

(C) Decreased oxygen in the brain only

(D) Systemic congestion and inadequate blood flow

93. Which symptom is a classic sign of right heart failure ?

(A) Chest pain

(B) Peripheral edema (swelling)

(C) Shortness of breath

(D) Coughing up blood

94. Tests used to diagnose right heart failure include :

(A) Echocardiogram

(B) ECG

(C) Chest X-ray

(D) All of the above

95. Which is NOT a typical function of natural metabolites ?

(A) DNA replication

(B) Cell signaling

(C) Energy production

(D) Regulation of enzymes

96. What is the main source of natural metabolites in a cell ?

(A) Cellular metabolic pathways

(B) Environmental toxins

(C) Genetic inheritance

(D) Ingested nutrients only

97. Glucose, amino acids, and fatty acids are classified as :

(A) Hormones

(B) Enzymes

(C) Small molecules

(D) Nucleotides

98. Which is an example of a plant secondary metabolite ?

(A) Caffeine

(B) Chlorophyll

(C) Hemoglobin

(D) Glucose

99. The essential enzyme for PCR is :

(A) RNA polymerase

(B) DNA polymerase

(C) DNA ligase

(D) Reverse transcriptase

100. Which of the following is NOT a PCR step ?

(A) Denaturation

(B) Ligation

(C) Annealing

(D) Extension

(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।