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

प्रश्नपुस्तिका क्रमांक
Question Booklet No.

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

K-1367

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

(NEP)

(BBT2004A) BACK PAPER

GENE ORGANISATION EXPRESSION AND REGULATION

Paper Code
BBT2004A

(To be filled in the OMR Sheet)

प्रश्नपुस्तिका सीरीज
Question 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.

(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. Which DNA repair mechanism removes uracil mistakenly incorporated into DNA?
   (A) Homologous recombination
   (B) Mismatch repair
   (C) Base excision repair
   (D) Direct repair
2. How is transcription terminated in prokaryotes?
   (A) $5'$ cap formation
   (B) RNA polymerase I
   (C) Rho factor or hairpin loop formation
   (D) Sigma factor
3. Which ribosomal subunits are present in prokaryotes?
   (A) 50S and 30S
   (B) 60S and 40S
   (C) 70S and 80S
   (D) 23S and 18S
4. Under which condition is the lac operon activated?
   (A) Lactose absent
   (B) Glucose high
   (C) Lactose present and glucose low
   (D) Tryptophan present
5. The Pribnow box is located at which position?
   (A) Poly-A site
   (B) -10 region in prokaryotes
   (C) Termination region
   (D) $+1$ transcription start site
6. Polycistronic mRNA is commonly found in:
   (A) Eukaryotes
   (B) Viruses
   (C) Prokaryotes
   (D) Mitochondria only

7. The complete ribosome in prokaryotes is referred to as:
   (A) 60S
   (B) 70S
   (C) 80S
   (D) 100S
8. Which RNA polymerase synthesizes tRNA in eukaryotes?
   (A) RNA Pol I
   (B) RNAPo1II
   (C) RNAPo1 III
   (D) DNA polymerase
9. Which feature increases mRNA stability?
   (A) Exonuclease activity
   (B) 5′ cap and poly-A tail
   (C) 3′ UTR shortening
   (D) tRNA methylation
10. Which antibiotic inhibits peptidyl transferase activity?
   (A) Rifampicin
   (B) Penicillin
   (C) Chloramphenicol
   (D) Tetracycline
11. The Svedberg (S) unit is a measure of:
   (A) Mass
   (B) Volume
   (C) Density
   (D) Sedimentation rate
12. The anticodon loop of tRNA is responsible for:
   (A) Binding the amino acid
   (B) Termination of translation
   (C) Recognizing the codon on mRNA
   (D) Stabilizing ribosome structure

13. Which end of the tRNA carries the amino acid?

(A) 3’ end

(B) 5’ end

(C) Anticodon loop

(D) D-loop

14. Charging of tRNA refers to:

(A) Recognition by ribosome

(B) Binding to rRNA

(C) Degradation of tRNA

(D) Attachment of amino acid to tRNA

15. The high-energy bond formed during tRNA charging is used during.

(A) Ribosome assembly

(B) mRNA degradation

(C) Peptide bond formation

(D) Transcription

16. Which is a linker histone?

(A) H2B

(B) H3

(C) H1

(D) H2A

17. Correct order of transcription initiation in eukaryotes:

(A) TBP binds TATA → TFIIB recruits RNA Pol II→ TFIIH unwinds DNA

(B) TFIIH binds first → TBP melts DNA → TFIIA adds ribosomes

(C) RNA Pol II binds first → TFIIH elongates

(D) TFIID binds → RNA Pol I initiates

18. Which base pairs with adenine in DNA?

(A) Guanine

(B) Thymine

(C) Cytosine

(D) Uracil

19. CGA → UGA mutation is:
    (A) Silent mutation
    (B) Frameshift mutation
    (C) Missense mutation
    (D) Nonsense mutation
20. RNA interference is mediated by:
    (A) mRNA
    (B) siRNA
    (C) tRNA
    (D) snRNA
21. Which mutation is inheritable?
    (A) Germline
    (B) Somatic
    (C) Silent
    (D) Missense
22. In prokaryotes, genes are often organized into:
    (A) Introns
    (B) Operons
    (C) Enhancers
    (D) Chromatin
23. Ribosome catalytic molecule is:
    (A) mRNA
    (B) rRNA
    (C) tRNA
    (D) Protein
24. 3′ end modification of eukaryotic mRNA:
    (A) Splicing
    (B) 5′ capping
    (C) Polyadenylation
    (D) Methylation

25. RNA secondary structure stabilized by:
    (A) Hydrogen bonds
    (B) Covalent bonds
    (C) Peptide bonds
    (D) Phosphodiester bonds
26. Which of the following is not involved in transcription regulation?
    (A) Enhancer
    (B) TATA box
    (C) Start codon
    (D) Operator
27. Peptide bond formation catalyzed by:
    (A) Ligase
    (B) RNA polymerase
    (C) Peptidyl transferase
    (D) DNA polymerase
28. What type of bond links nucleotides together in the DNA strand backbone?
    (A) Hydrogen bond
    (B) Disulfide bond
    (C) Ionic bond
    (D) Phosphodiester bond
29. Which enzyme seals the nicks between DNA fragments?
    (A) Primase
    (B) DNA polymerase I
    (C) DNA ligase
    (D) Helicase
30. Simultaneous transcription-translation due to:
    (A) Introns
    (B) Absence of nuclear envelope
    (C) Poly-A tail
    (D) Spliceosome

31. Which enzyme is responsible for unwinding DNA during transcription?

(A) RNA polymerase

(B) Ligase

(C) Topoisomerase

(D) DNA helicase

32. A defect in nucleotide excision repair makes an individual highly sensitive to which of the following?

(A) Ionizing radiation

(B) X-rays

(C) Ethidium bromide

(D) UV radiation causing thymine dimers

33. Which DNA polymerase is mainly responsible for leading strand synthesis in eukaryotes?

(A) DNA polymerase δ

(B) DNA polymerase α

(C) DNA polymerase γ

(D) DNA polymerase ε

34. What is a key difference between transcription in prokaryotes and eukaryotes?

(A) Prokaryotes perform transcription in the nucleus

(B) Eukaryotes possess multiple RNA polymerases (I, II, III)

(C) Eukaryotes use only one RNA polymerase

(D) All of the above

35. A mutation in the Shine-Dalgarno sequence would most likely result in:

(A) Enhanced polyadenylation

(B) Improper RNA splicing

(C) Failure of translation initiation

(D) Incorrect transcription

36. What is the primary function of the $5'$ cap added to eukaryotic mRNA?

(A) Initiate splicing

(B) Assist DNA polymerase recognition

(C) Protect mRNA and promote ribosome binding

(D) Signal nuclear export only

37. A eukaryotic gene expressed in *E. coli* with a prokaryotic promoter still fails to express. What is the most likely reason?

(A) *E. coli* cannot initiate transcription without introns

(B) Codon usage incompatibility

(C) RNA splicing cannot occur in *E. coli*

(D) *E. coli* lacks transcription factors

38. Loss of $3' \rightarrow 5'$ exonuclease activity of DNA polymerase would lead to:

(A) Increased transcription efficiency

(B) Faster DNA replication

(C) No significant effect

(D) Increased point mutations during replication

39. Why is lagging strand synthesis discontinuous during DNA replication?

(A) DNA helicase frequently stalls

(B) Antiparallel orientation requires Okazaki fragments

(C) Primase cannot function on lagging strand

(D) Leading strand blocks polymerase

40. Which of the following is not a eukaryotic general transcription factor?

(A) TFIIB

(B) TFIID

(C) σ factor

(D) TFIIH

41. Disabling alternative splicing would most likely cause:

(A) Reduced protein diversity

(B) Larger proteins formed

(C) Incorrect translation start sites

(D) Shift to transcriptional regulation

42. A mutation affecting the ribosomal E-site would cause:

(A) Failure of tRNA entry

(B) Premature stop codons

(C) Impaired exit of tRNA, slowing translation

(D) No transcription

43. A gene highly expressed in neurons but not in skin cells is likely due to:

(A) Absence of gene in skin cells

(B) Different operons

(C) Cell-specific transcription factors

(D) Ribosome differences

44. What is the intermediate between a gene and its polypeptide?

(A) mRNA

(B) tRNA

(C) rRNA

(D) siRNA

45. If ribosomes are inhibited, which process continues normally?

(A) mRNA translation

(B) Protein synthesis

(C) Peptide bond formation

(D) Transcription of mRNA

46. The end of all tRNAs is:

(A) 5’ ACC 3’

(B) 5’ CCA 3’

(C) 3’ CAC 5’

(D) 3’ GAG 5’

47. Which of the following is not a component of the eukaryotic 60S subunit?

(A) 5S rRNA

(B) 5.8S rRNA

(C) 18S rRNA

(D) 28S rRNA

48. Which region of eukaryotic genes is transcribed but not translated?

(A) Promoter

(B) Coding exon

(C) Enhancer

(D) Intron

49. Which of the following occurs during elongation in transcription?

(A) Sigma binding

(B) Nucleotide addition to RNA

(C) CTD dephosphorylation

(D) Formation of poly-A tail

50. DNA wraps around histones to form:

(A) Chromosomes

(B) Nucleosomes

(C) Spliceosomes

(D) Okazaki fragments

51. Which DNA repair pathway removes thymine dimers formed by UV radiation?

(A) Mismatch repair

(B) Direct repair

(C) Nucleotide excision repair

(D) Base excision repair

52. TATA box is a type of:

(A) Enhancer

(B) Silencer

(C) Ribosome binding site

(D) Promoter sequence

53. In *E. coli*, promoter recognition during transcription is carried out by which RNA polymerase subunit?

(A) β'

(B) σ

(C) α

(D) β

54. Which of the following is an initiation codon?

(A) AAA

(B) AUG

(C) AGU

(D) AGG

55. During $5'$ end processing, which modification is added to eukaryotic mRNA?

(A) Poly-A tail

(B) Adenine

(C) Thymidine

(D) Methylguanosine cap

56. Alternative splicing leads to:

(A) tRNA production

(B) mRNA degradation

(C) Formation of multiple proteins from one gene

(D) Expression of different genes

57. Peptidyl transferase activity is associated with:

(A) tRNA

(B) rRNA

(C) Ribosomal protein

(D) mRNA

58. Identify the stop codon.

(A) UAA

(B) UAG

(C) UGA

(D) All of the above

59. Which of the following RNAs' structure is similar to clover leaf?

(A) tRNA

(B) rRNA

(C) mRNA

(D) hnRNA

60. Regulation of the trp operon mainly occurs through:

(A) Lactose concentration

(B) Positive regulation

(C) Repression and attenuation

(D) cAMP level

61. The synthesis of polynucleotide chain of mRNA is catalyzed by the enzyme:
    (A) RNA helicase
    (B) RNA polymerase
    (C) DNA polymerase
    (D) DNA helicase
62. Which feature is unique to eukaryotic chromosomes?
    (A) Origin of replication
    (B) Circular DNA
    (C) Presence of plasmids
    (D) Centromeres and telomeres
63. Highly condensed, transcriptionally inactive chromatin is known as:
    (A) Telomere
    (B) Euchromatin
    (C) Promoter
    (D) Heterochromatin
64. A nucleosome is best described as:
    (A) DNA-protein loop
    (B) DNA wrapped around histone octamer
    (C) RNA-protein complex
    (D) DNA wrapped around a single histone
65. The 30-nm chromatin fiber is stabilized mainly by:
    (A) RNA polymerase
    (B) Histone H2A
    (C) Histone H1
    (D) DNA polymerase
66. Regulatory proteins that increase transcription are called:
    (A) Repressors
    (B) Silencers
    (C) Activators
    (D) Insulators

67. The centromere is essential for:
    (A) Chromosome segregation
    (B) RNA processing
    (C) DNA replication
    (D) Intron removal
68. Which structure protects chromosome ends?
    (A) Introns
    (B) Promoters
    (C) CpG islands
    (D) Telomeres
69. Sister chromatids are held together by:
    (A) Histone
    (B) Cohesin
    (C) Condensin
    (D) Topoisomerase
70. In eukaryotes, transcription occurs in the:
    (A) Nucleolus
    (B) Cytoplasm
    (C) Ribosome
    (D) Nucleus
71. DNA synthesis proceeds in which direction?
    (A) $3' \rightarrow 5'$
    (B) Random
    (C) Bidirectional
    (D) $5' \rightarrow 3'$
72. Which DNA polymerase has both $3' \rightarrow 5'$ and $5' \rightarrow 3'$ exonuclease activity?
    (A) DNA polymerase I
    (B) DNA polymerase II
    (C) DNA polymerase III
    (D) DNA polymerase IV

73. Replication begins at a specific site known as the:

(A) Origin of replication

(B) Start codon

(C) Operator

(D) Enhancer

74. The lagging strand is synthesized :

(A) Continuously

(B) Without primers

(C) Discontinuously as Okazaki fragments

(D) From $3'$ to $5'$

75. High fidelity of DNA replication is ensured by:

(A) Helicase activity

(B) Ligase activity

(C) Okazaki fragments

(D) $3' \rightarrow 5'$ exonuclease proofreading

76. What is the primary role of the sliding clamp protein (β-clamp) in *E. coli* DNA replication?

(A) Enhancing ligase activity

(B) Increasing DNA polymerase processivity

(C) Promoting primer degradation

(D) Assisting helicase unwinding

77. DNA replication is described as:

(A) Conservative

(B) Dispersive

(C) Semi-conservative

(D) Semi-dispersive

78. What is the major function of DNA polymerase I in prokaryotes?

(A) Removing RNA primers and filling gaps

(B) Ligating Okazaki fragments

(C) Unwinding DNA strands

(D) Synthesizing leading strand

79. Which statement correctly describes replication forks?

(A) They contain RNA polymerase

(B) They move only in one direction

(C) Two replication forks arise from each origin

(D) They form only at chromosome ends

80. Which base pairing rule is correct for DNA?

(A) A pairs with G, T pairs with C

(B) A pairs with U, G pairs with T

(C) A pairs with T, G pairs with C

(D) A pairs with C, T pairs with G

81. Hydrogen bonds between base pairs in DNA contribute to:

(A) DNA replication only

(B) DNA denaturation

(C) Stability of the double helix

(D) Formation of the sugar-phosphate backbone

82. Which enzyme is responsible for mitochondrial DNA replication in eukaryotes?

(A) DNA polymerase δ

(B) DNA polymerase ε

(C) DNA polymerase γ

(D) DNA polymerase α

83. Eukaryotic genes are typically interrupted by:

(A) Operons

(B) Introns

(C) Codons

(D) tRNAs

84. Which protein initiates homologous recombination in *E. coli*?

(A) DnaA

(B) RecA

(C) RecB

(D) DNA polymerase III

85. The Holliday junction refers to:

(A) A branched DNA intermediate during recombination

(B) A transcription start region

(C) A peptide bond structure

(D) A telomeric repeat

86. Which enzyme resolves Holliday junctions in *E. coli*?

(A) Topoisomerase

(B) RecBCD

(C) RecA

(D) RuvC

87. In the absence of tryptophan, the trp operon is:

(A) Repressed

(B) Active

(C) Mutated

(D) Blocked

88. Site-specific recombination differs from homologous recombination because:

(A) It uses non-homologous sequences

(B) It requires RecA protein

(C) It occurs only in meiosis

(D) It involves RNA intermediates

89. Transposons are defined as DNA elements that:

(A) Move only during meiosis

(B) Require sequence homology

(C) Move to new locations without homology

(D) Function as RNA viruses

90. Non-homologous end joining (NHEJ) in eukaryotes:

(A) Uses homologous sequences

(B) Occurs only in mitochondria

(C) Repairs double-strand breaks without homology

(D) Is highly accurate

91. Which gene codes for β-galactosidase in the lac operon?

(A) lacA

(B) lacY

(C) lacZ

(D) lacI

92. Which of the following is an inducible operon?

(A) Trp operon

(B) Lac operon

(C) His operon

(D) Arg operon

93. Translation of proteins takes place in the:

(A) Vacuole

(B) Cytoplasm

(C) Nucleus

(D) Golgi apparatus

94. Regulation of the lac operon involves:

(A) Only negative regulation

(B) RNA splicing

(C) Both positive and negative regulation

(D) Only positive regulation

95. The complete RNA polymerase in bacteria is called the:
(A) Core enzyme
(B) Holoenzyme
(C) Ribosome
(D) Transcriptase

96. What is the function of the sigma factor in bacteria?
(A) Promoter recognition
(B) Introns removal
(C) mRNA capping
(D) Elongation

97. Which of the following is true about transcription in prokaryotes?
(A) mRNA undergoes extensive modification before translation
(B) Transcription and translation are spatially separated
(C) Translation begins before transcription ends
(D) Transcription uses three different RNA polymerases

98. What is the primary function of elongation factors in transcription?
(A) Remove introns
(B) Stabilize RNA polymerase movement and prevent pausing
(C) Bind promoters
(D) Recruit ribosomes

99. Rifampicin inhibits:
(A) Ribosome assembly
(B) DNA replication
(C) Prokaryotic transcription
(D) Eukaryotic transcription

100. The Shine-Dalgarno sequence is involved in:
(A) RNA splicing
(B) mRNA stability
(C) DNA replication
(D) Translation initiation in prokaryotes

******

Rough Work / रफ कार्य

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।