

Roll No. ....

Question Booklet Number

O. M. R. Serial No.

--	--	--	--	--	--	--	--

## M. Sc. (Biotechnology) (Second Semester)

### EXAMINATION, July, 2022

#### MOLECULAR BIOLOGY & GENETICS

##### Paper Code

MBT	2	0	0	1
-----	---	---	---	---

Questions Booklet  
Series

C

Time : 1:30 Hours ]

[ Maximum Marks : 100

##### Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.
2. The booklet contains 60 questions. Examinee is required to answer any 50 questions in the OMR Answer-Sheet provided and not in the question booklet. If more than 50 questions are attempted by student, then the first attempted 50 questions will be considered for evaluation. 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 60 प्रश्न हैं। परीक्षार्थी को किन्हीं 50 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। यदि छात्र द्वारा 50 से अधिक प्रश्नों को हल किया जाता है तो प्रारम्भिक हल किये हुए 50 उत्तरों को ही मूल्यांकन हेतु सम्मिलित किया जाएगा। 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)

1. All of the following statements about Type I topoisomerase (Topo I) are true except :
  - (A) topo I removes DNA supercoils in an ATP-dependent reaction
  - (B) topo I from eukaryotic cells can remove both positive and negative supercoils
  - (C) topo I from *E. coli* can remove only negative supercoils
  - (D) topo I is essential for viability in *E. coli*
2. DNA helicase in *E. coli* :
  - (A) moves in the direction opposite of replication fork
  - (B) binds with template of the leading strand
  - (C) is a hexameric protein with ATPase activity
  - (D) catalyzes formation of primer
3. Ricin, a toxic molecule isolated from *Ricinus communis*, inactivates eukaryotic :
  - (A) 28s ribosomal RNA
  - (B) polymerase
  - (C) None of the above
  - (D) ligases
4. Which among the following acts as the initiator codon ?
  - (A) AUG
  - (B) GUG
  - (C) UUG
  - (D) All of the above
5. The SOS repair mechanism is activated by :
  - (A) 5-bromouracil
  - (B) 2-aminopurine
  - (C) hydroxylamine
  - (D) thymine dimers
6. In Rho-independent transcription termination, stem and loop structure is formed in :
  - (A) the transcript
  - (B) the template DNA
  - (C) coding strand
  - (D) Both (A) and (B)
7. Xeroderma pigmentosum is an autosomal recessive genetic disease that causes a variety of phenotypic changes in skin cells exposed to sunlight. This disease involves a defect in which of the following DNA repair mechanisms ?
  - (A) base excision repair
  - (B) double-strand break repair
  - (C) mismatch repair
  - (D) nucleotide excision repair

8. Telomerase is ribonucleoprotein complex that synthesizes :
  - (A) DNA in the absence of DNA or RNA template
  - (B) DNA using a DNA template that is part of the ribonucleoprotein complex
  - (C) DNA using an RNA template that is part of the ribonucleoprotein complex
  - (D) DNA using ribosomal RNA as template
9. In E. coli, attenuation and antitermination utilize which structure ?
  - (A) Stem loop structures in RNA
  - (B) Stem loop structures in DNA
  - (C) RNA/DNA hybrids
  - (D) Differential protein folding
10. Choose the false statement :
  - (A) Peptidyl/RNA binds in the P-site
  - (B) Shine-Dalgarno is polypurine sequence that helps in ribosome binding
  - (C) Eukaryotic mRNAs are mostly monocistronic
  - (D) Translocation of ribosome requires ATP hydrolysis
11. How is the lariat structure formed during splicing of a GU-AG intron ?
  - (A) After cleavage of the 5' splice site, a new phosphodiester bond is formed between the 5' nucleotide and the 2' carbon of the nucleotide at the 3' splice site.
  - (B) After cleavage of the 5' splice site, a new phosphodiester bond is formed between the 5' nucleotide and the 2' carbon of an internal adenosine.
  - (C) After cleavage of the 3' splice site, a new phosphodiester bond is formed between the 5' nucleotide and the 2' carbon of the nucleotide at the 5' splice site.
  - (D) After cleavage of the 3' splice site, a new phosphodiester bond is formed between the 5' nucleotide and the 2' carbon of an internal adenosine.
12. Puffs in polytene chromosome is associated mainly with :
  - (A) DNA synthesis
  - (B) RNA synthesis
  - (C) Protein synthesis
  - (D) None of the above

13. An enhancer element shows all of the following properties except :
- (A) acts as a binding site for transcription factors
  - (B) acts as a binding site for RNA polymerase
  - (C) is functional when located upstream or downstream of the transcription initiation site
  - (D) is functional when located in an intron
14. Which among the following is true about the origin of replication in eukaryotes ? It has :
- (A) one origin of replication
  - (B) two origin of replication
  - (C) many origin of replication
  - (D) origin is absent
15. siRNA(s) interfere at :
- (A) transcriptional level
  - (B) post-transcriptional level
  - (C) DNA replication level
  - (D) translational level
16. The Shine-Dalgarno sequence is responsible for :
- (A) binding of RNA polymerase to gene during transcription
  - (B) binding of DNA polymerase to origin of replication during DNA replication
  - (C) binding of ribosomes to mRNA during initiation of translation
  - (D) binding of snurps during splicing
17. Among the following which statement is correct regarding the promoter of the gene ?
- (A) It is always located upstream of transcription start site
  - (B) It is always located downstream of translation start site
  - (C) Different promoter elements are recognized by different RNA polymerase
  - (D) Promoters are recognized due to their different secondary structures

18. During mismatch repair in *E. coli*, the parental strand is recognized by :
- (A) single-stranded breaks
  - (B) glycosylated adenines
  - (C) methylated adenines
  - (D) methylation of the 6th position of guanine residues
19. Khorana *et al.* synthesized RNA with copolymer of UGUGUGUGUG..... . It produced a peptide with alternative cysteine and valine. The codons for the two are :
- (A) UGU and GUG
  - (B) UUG and GGU
  - (C) GUG and UGU
  - (D) UGG and GUU
20. What is incorrect about RNA ?
- (A) It binds with an amino acid at its 3' end
  - (B) It has five double-stranded regions
  - (C) It has an anticodon at oonen end which recognizes codon of mRNA
  - (D) It looks like clover leaf in 3-dimensional structure
21. A specific aminoacyl-/RNA always carries the same amino acid that is attached by a specific aminoacyl-/RNA synthetase. Regions on RNA that are required for the specificity of the enzyme is/are the :
- (A) anticodon and acceptor region
  - (B) D loop and acceptor rgion
  - (C) anticodon alone
  - (D) The  $\psi$  C loop and anticodon
22. Which of the following is not part of the pathway for nuclear pre-mRNA splicing ?
- (A) Transesterification where the 5' OH of the downstream exon attacks the donor junction
  - (B) Transesterification where the 2' OH of the branch point attacks the donor junction
  - (C) Recognition of the donor junction by the U1 snRNP
  - (D) Dissociation of U4 from U6
23. If a mutation occurred in the phosphorylation site in domain of RNA polymerase II, which of the following outcomes would be observed ?
- (A) Transcription of /RNA would occur normally
  - (B) Transcription of mRNA would not occur
  - (C) Transcription of precursor rRNA would not occur
  - (D) All of the above

24. A leader sequence in mRNA of eukaryotes can be found :
- (A) after the 'stop' codon
  - (B) between transcriptional start site and translational start site
  - (C) within the first exon
  - (D) in the exon-intron boundaries
25. In bacterial RNA synthesis, which of the following is the function of factor rho ?
- (A) Allow promoter initiation of transcription
  - (B) Eliminate the binding of RNA polymerase to the promoter
  - (C) Participate in the proper termination of transcription
  - (D) Increase the rate of RNA synthesis
26. Which step of translation does not consume high-energy phosphate bond ?
- (A) Translocation
  - (B) Peptidyl transferase reaction
  - (C) Amino acid activation
  - (D) Aminoacyl tRNA binding to A-site
27. Protein-binding regions of DNA are identified by one of the following techniques ?
- (A) Fingerprinting
  - (B) Footprinting
  - (C) Southern blotting
  - (D) Western blotting
28. Antibiotic inhibiting interaction between tRNA and mRNA during protein synthesis in bacteria is :
- (A) Tetracycline
  - (B) Neomycin
  - (C) Erythromycin
  - (D) Streptomycin
29. Which of the following is a characteristic of eukaryotic transcription but not prokaryotic transcription ?
- (A) Transcription and translation are coupled
  - (B) There is one form of RNA polymerase
  - (C) RNA polymerase II is responsible for synthesis of mRNA
  - (D) RNAs can be polycistronic
30. Enhancer elements are known to increase the rate of transcription when present at the upstream side of the promoter sequences. If the same enhancer element is placed in reverse orientation :
- (A) the rate of transcription increases as compared to upstream side
  - (B) the rate of transcription decreases as compared to upstream side
  - (C) the rate of transcription remains same as compared to upstream side
  - (D) no transcription is observed.

31. Which of the following processes does not take place in the 5'-3' direction ?
- (A) DNA replication
  - (B) Transcription
  - (C) Nick translation
  - (D) RNA editing
32. A deletion of three consecutive bases in the coding region of a gene cannot result in :
- (A) deletion of a single amino acid without any other change in the protein
  - (B) replacement of two adjacent amino acids by a single amino acid
  - (C) replacement of a single amino acid by another without any other change in sequence of proteins
  - (D) production of a truncated protein
33. Meselson and Stahl showed that DNA replication is semiconservative making use of :
- (A) radioactivity
  - (B) centrifugation
  - (C) chromatography
  - (D) dialysis
34. Which of the following contains thymine ?
- (A) mRNA
  - (B) rRNA
  - (C) RNA
  - (D) DNA
35. One of the following correctly represents DNA organization from least organized to most organized :
- (A) DNA-nucleosomes-chromosome-looped domain
  - (B) DNA-looped domain-nucleosome-chromosome
  - (C) DNA-nucleosomes-looped domain-chromosome
  - (D) Nucleosomes-DNA-looped-looped domain-chromosome
36. Which sequence represents a usable pathway in the production of a secretory protein ?
- (A) RER-secretory vesicles-ribosomes
  - (B) ribosomes-RER-Golgi apparatus-secretory vesicle
  - (C) secreting vesicle-Golgi apparatus-RER-secretory vesicle
  - (D) SER-RER-secretory vesicle-ribosomes

37. DNA synthesis requires a primer, which consists of :
- (A) primase
  - (B) DNA
  - (C) RNA
  - (D) an okazaki fragment
38. Which of the following is found only in eukaryotic cells ?
- (A) mRNA
  - (B) sn RNA
  - (C) rRNA
  - (D) tRNA
39. Viruses contain :
- (A) DNA or RNA, ribosomes, mitochondria
  - (B) DNA polymerase, ribosomes, mitochondria
  - (C) DNA polymerase, ribosomes, protein coat
  - (D) DNA or RNA, protein coat
40. DNA-protein interactions are mainly because of :
- (A) DNA bases and some amino acids of DNA-binding proteins
  - (B) Negative charge of DNA and positive charge on protein
  - (C) DNA are target molecules of protein
  - (D) DNA topology
41. A protein domain is essentially :
- (A) 3-D tertiary structure
  - (B) super-secondary structure
  - (C) organizational unit of 2nd level
  - (D) a quaternary structure with a function
42. Gene expression control at transcription level is achieved by :
- (A) recombination
  - (B) histone modification
  - (C) DNA modification
  - (D) all epigenetic modification



43. A DNA binding protein, associates with DNA by :
- (A) H-bonding between amino acids and bases in DNA helix
  - (B) hydrophobic interaction
  - (C) covalent bonding
  - (D) electrostatic attraction
44. 2D-Gel analyses is a method to separate a mixture of large number of :
- (A) proteins
  - (B) DNA
  - (C) RNA
  - (D) mRNA
45. A naturally occurring coding strand composed of alternately C and U residue would result in the formation of :
- (A) A polypeptide containing alternating Leu and Ser residues
  - (B) A polypeptide containing either Leu or Ser
  - (C) A polypeptide containing only Leu
  - (D) A polypeptide containing only Ser
46. The relation between the fraction of repetitive DNA and the time required for reassociation of its denatured strands in a specific genome is :
- (A) direct
  - (B) inverse
  - (C) hyperbolic
  - (D) None of the above
47. Microarray is a technique for :
- (A) comparative study of gene expression at mRNA level
  - (B) comparative study of gene expression at protein level
  - (C) comparative study of gene expression at polypeptide level
  - (D) None of the above
48. What feature of protein can be used to predict its function ?
- (A) number of amino acids
  - (B) overall charge of molecule
  - (C) molecular weight
  - (D) structure

49. An investigator would be able to distinguish a solution containing RNA from one containing DNA by :
- (A) heating the solution to 82.5°C and measuring the absorption of light at 260 nm
  - (B) comparing the  $T_m$  of each solution
  - (C) monitoring the change in absorption of light at 260 nm while elevating the temperature
  - (D) measuring the absorption of light at 260 nm
50. Which among the following activates eukaryotic RNA polymerase II by the modification ?
- (A) phosphorylation
  - (B) acetylation
  - (C) methylation
  - (D) None of the above
51. What is the arrangement of gene in an operon ?
- (A) ZYX
  - (B) ZYA
  - (C) AZY
  - (D) YAZ
52. Telomerase has :
- (A) RNA-DNA helicase activity
  - (B) RNA dependent DNA synthesis
  - (C) Sequence 3AATCCCAAT in its RNA components in humans
  - (D) All of the above
53. Telomerase :
- (P) is a ribonucleoprotein
  - (Q) participates in replication of linear dsDNA
  - (R) is species specific
  - (S) is absent in somatic cells
- Codes :**
- (A) P, Q and R
  - (B) P, R and S
  - (C) P, Q, R and S
  - (D) Only P
54. Choose the mismatch :
- (A) Pol I-primer removal and DNA repair
  - (B) Pol III-DNA replication
  - (C) Pol V-translation replication
  - (D) Pol  $\lambda$ -nuclear DNA replication

55. TATA box is important because :
- (A) it has low  $T_m$
  - (B) it has high  $T_m$
  - (C) it is found in RNA
  - (D) it has low  $T_m$  hence, its dissociation between the two DNA strands is easy
56. Thymine is found in the :
- (A) DNA
  - (B) DNA and RNA
  - (C) DNA and some RNA
  - (D) Protein
57. Reverse transcriptase has :
- (A) RNA dependent DNA polymerase function
  - (B) DNA dependent RNA polymerase function
  - (C) Both (A) and (B)
  - (D) been found in bacteria
58. Which of the following types of DNA replication or repair systems is dysfunctional in individuals with xeroderma pigmentosum ?
- (A) mismatch repair
  - (B) base excision repair
  - (C) nucleotide excision repair
  - (D) DNA helicase
59. Transfer RNA is important in :
- (A) synthesizing RNA codons
  - (B) assembling ribosomes
  - (C) transporting messenger RNA
  - (D) adding amino acids to a polypeptide
60. Proteins that bind to DNA regulate gene expression in :
- (A) eukaryotes but not in prokaryotes
  - (B) prokaryotes but not in eukaryotes
  - (C) neither eukaryotes nor prokaryotes
  - (D) both eukaryotes and prokaryotes

4. Four alternative answers are mentioned for each question as—A, B, C & D in the booklet. The candidate has to choose the most correct/appropriate answer and mark the same in the OMR Answer-Sheet as per the direction :

**Example :**

**Question :**

Q. 1 (A) ☒ (B) (C) (D)

Q. 2 (A) (B) ☒ (C) (D)

Q. 3 (A) ☒ (B) (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 सबसे सही अथवा सबसे उपयुक्त उत्तर छोटना है। उत्तर को OMR आन्सर-शीट में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ☒ (B) (C) (D)

प्रश्न 2 (A) (B) ☒ (C) (D)

प्रश्न 3 (A) ☒ (B) (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।