

Roll No.

Question Booklet Number

O. M. R. Serial No.

| | | | | | | | |
|--|--|--|--|--|--|--|--|
| | | | | | | | |
|--|--|--|--|--|--|--|--|

**M. Sc. (Second Semester)
(NEP) EXAMINATION, 2025-26**

BOTANY

(Cytogenetics & Basic Molecular Biology)

| Paper Code | | | | | | | |
|------------|---|---|---|---|---|---|---|
| B | 0 | 4 | 0 | 8 | 0 | 3 | T |

Questions Booklet
Series

D

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. Gene interaction often modifies the classical Mendelian ratio due to :
 - (A) Mutation
 - (B) Interaction between different genes affecting phenotype
 - (C) DNA repair
 - (D) Protein synthesis
2. Mitochondrial DNA inheritance is important because it :
 - (A) Controls ribosomes
 - (B) Encodes proteins for respiration
 - (C) Produces histones
 - (D) Forms chromosomes
3. A cross between two heterozygous individuals produces a phenotypic ratio of :
 - (A) 1 : 1
 - (B) 3 : 1
 - (C) 9 : 3 : 3 : 1
 - (D) 1 : 2 : 1
4. Multiple alleles occur because :
 - (A) A gene has more than two alternative forms in a population
 - (B) Many chromosomes exist
 - (C) DNA is duplicated
 - (D) Genes mutate simultaneously
5. Recombination frequency is used to :
 - (A) Identify proteins
 - (B) Map gene distances on chromosomes
 - (C) Measure RNA synthesis
 - (D) Determine mutation rate
6. Linkage reduces genetic recombination because :
 - (A) Genes mutate
 - (B) RNA interferes
 - (C) DNA replicates faster
 - (D) Genes are located close together on the same chromosome
7. Cytoplasmic inheritance differs from nuclear inheritance because it is :
 - (A) Biparental
 - (B) Usually maternally inherited
 - (C) Random
 - (D) Dominant
8. A test cross is useful in determining :
 - (A) Mutation rate
 - (B) Gene sequence
 - (C) Chromosome number
 - (D) Genotype of a dominant phenotype organism

9. Epistasis occurs when :
- (A) Alleles segregate independently
 - (B) One gene masks the expression of another gene
 - (C) Chromosomes mutate
 - (D) DNA replicates
10. Mendel's law of independent assortment applies to genes that are :
- (A) On the same chromosome
 - (B) On different chromosomes or far apart on the same chromosome
 - (C) Dominant only
 - (D) Recessive only
11. Exons are :
- (A) Coding regions of genes
 - (B) Non-coding DNA
 - (C) Satellite DNA
 - (D) Regulatory DNA
12. Introns are :
- (A) Coding sequences
 - (B) Protein sequences
 - (C) Non-coding sequences
 - (D) Ribosomal genes
13. Repetitive DNA may function in :
- (A) Chromosome structure
 - (B) Protein synthesis
 - (C) Lipid formation
 - (D) Respiration
14. Satellite DNA is usually found in :
- (A) Telomeres
 - (B) Ribosomes
 - (C) Centromeric regions
 - (D) Cytoplasm
15. Genome size is usually measured in :
- (A) Nanometers
 - (B) Base pairs
 - (C) Kilograms
 - (D) Microns
16. Overlapping genes share :
- (A) Different chromosomes
 - (B) Common DNA sequences
 - (C) Same proteins
 - (D) Same RNA
17. Genes containing introns and exons are called :
- (A) Structural genes
 - (B) Overlapping genes
 - (C) Split genes
 - (D) Silent genes

18. Non-functional copies of genes are known as :
- (A) Introns
 - (B) Pseudogenes
 - (C) Operons
 - (D) Exons
19. Highly repetitive DNA sequences are called :
- (A) Coding DNA
 - (B) Introns
 - (C) Gene clusters
 - (D) Satellite DNA
20. The paradox that genome size does not correlate with organism complexity is called :
- (A) Genome paradox
 - (B) DNA paradox
 - (C) C-value paradox
 - (D) Gene paradox
21. Fluorescent banding techniques are used in :
- (A) PCR
 - (B) Karyotyping
 - (C) Translation
 - (D) Replication
22. Chromosome banding techniques were developed mainly for :
- (A) Cytogenetic analysis
 - (B) Gene cloning
 - (C) Protein synthesis
 - (D) DNA sequencing
23. Dark G-bands represent :
- (A) GC rich regions
 - (B) AT rich regions
 - (C) RNA rich regions
 - (D) Protein rich regions
24. Banding patterns help in detecting :
- (A) Enzymes
 - (B) Lipids
 - (C) Proteins
 - (D) Chromosomal abnormalities
25. R-banding produces bands that are :
- (A) Same as G bands
 - (B) Reverse of G bands
 - (C) Random
 - (D) Non-specific
26. Chromosome banding is mainly used for :
- (A) Protein synthesis
 - (B) Chromosome identification
 - (C) DNA replication
 - (D) Mutation repair

27. Q-banding uses :
- (A) Quinacrine dye
 - (B) Giemsa dye
 - (C) Ethidium bromide
 - (D) Acridine orange
28. C-banding specifically stains :
- (A) Constitutive heterochromatin
 - (B) Euchromatin
 - (C) Centromeres only
 - (D) Telomeres
29. G banding uses :
- (A) Acridine orange
 - (B) Giemsa stain
 - (C) Crystal violet
 - (D) Safranin
30. The most common chromosome banding technique is :
- (A) C banding
 - (B) Q banding
 - (C) G banding
 - (D) R banding
31. The “beads-on-a-string” model describes :
- (A) Ribosome structure
 - (B) Gene mutation
 - (C) Nucleosome arrangement on-DNA
 - (D) RNA folding
32. The interaction between histone tails and DNA contributes to :
- (A) DNA replication
 - (B) Chromatin compaction
 - (C) Protein synthesis
 - (D) Mutation
33. Constitutive heterochromatin is typically found at :
- (A) Promoters
 - (B) Ribosomes
 - (C) Introns
 - (D) Centromeres and telomeres
34. Chromatin remodeling complexes primarily function to :
- (A) Destroy histones
 - (B) Reposition nucleosomes to regulate transcription
 - (C) Replicate DNA
 - (D) Repair RNA

35. Histone acetylation generally leads to :
- (A) Increased gene expression
 - (B) DNA condensation
 - (C) DNA degradation
 - (D) Chromosome breakage
36. The 30 nm chromatin fiber results from :
- (A) DNA replication
 - (B) Coiling of nucleosome chains
 - (C) RNA synthesis
 - (D) Chromosome mutation
37. Heterochromatin is usually associated with :
- (A) Active genes
 - (B) Ribosome synthesis
 - (C) Gene silencing
 - (D) RNA processing
38. Euchromatin is transcriptionally active mainly because it is :
- (A) Highly methylated
 - (B) Less condensed and accessible to RNA polymerase
 - (C) Lacking histones
 - (D) Located outside nucleus
39. Histones bind DNA primarily through :
- (A) Hydrogen bonding with bases
 - (B) Hydrophobic interactions
 - (C) Covalent bonding
 - (D) Electrostatic interaction with negatively charged DNA
40. The nucleosome core particle contains :
- (A) Six histones
 - (B) Eight histone proteins (octamer)
 - (C) Ten histones
 - (D) Four histones
41. The spindle apparatus is made of :
- (A) Actin
 - (B) Myosin
 - (C) Microtubules
 - (D) Chromatin
42. Programmed cell death is called :
- (A) Necrosis
 - (B) Apoptosis
 - (C) Senescence
 - (D) Autolysis

43. The longest phase of the cell cycle is :
- (A) Interphase
 - (B) Prophase
 - (C) Metaphase
 - (D) Anaphase
44. Separation of sister chromatids occurs during :
- (A) Metaphase
 - (B) Prophase
 - (C) Anaphase
 - (D) Telophase
45. Chromosomes align at the equatorial plate during :
- (A) Metaphase
 - (B) Prophase
 - (C) Anaphase
 - (D) Telophase
46. Cytokinesis in plant cells occurs by formation of :
- (A) Cleavage furrow
 - (B) Cell plate
 - (C) Chromosome plate
 - (D) Spindle fibers
47. The protein responsible for regulating the cell cycle is :
- (A) Histone
 - (B) Cyclin
 - (C) Actin
 - (D) Tubulin
48. The checkpoint that ensures DNA replication is complete before mitosis begins is :
- (A) G₁ checkpoint
 - (B) S checkpoint
 - (C) M checkpoint
 - (D) G₂ checkpoint
49. The process by which a cell divides into two identical daughter cells is called :
- (A) Meiosis
 - (B) Cytokinesis
 - (C) Mitosis
 - (D) Replication
50. The phase of the cell cycle in which DNA replication occurs is :
- (A) G₁ phase
 - (B) S phase
 - (C) G₂ phase
 - (D) M phase

51. Molecular chaperones assist proteins by :
- (A) Helping correct folding of newly synthesized proteins
 - (B) Destroying them
 - (C) Replicating DNA
 - (D) Transcribing RNA
52. Protein folding into its functional conformation is essential because :
- (A) It replicates DNA
 - (B) Structure determines protein function
 - (C) RNA forms ribosomes
 - (D) DNA mutates
53. Post-translational modification may include :
- (A) DNA replication
 - (B) Phosphorylation, glycosylation, or cleavage
 - (C) RNA splicing
 - (D) Gene mutation
54. Termination of translation occurs when :
- (A) Ribosome reaches promoter
 - (B) RNA degrades
 - (C) DNA mutates
 - (D) Stop codon is recognized by release factors
55. The P site of the ribosome holds :
- (A) Incoming tRNA
 - (B) Empty tRNA
 - (C) tRNA carrying the growing polypeptide chain
 - (D) DNA
56. The A site of the ribosome binds :
- (A) Growing peptide chain
 - (B) Incoming aminoacyl-tRNA
 - (C) Released tRNA
 - (D) mRNA
57. Peptide bond formation during translation is catalyzed by :
- (A) DNA polymerase
 - (B) Peptidyl transferase activity of rRNA
 - (C) tRNA enzyme
 - (D) Helicase
58. The ribosome contains how many functional sites for tRNA binding?
- (A) One
 - (B) Two
 - (C) Three (A, P, E sites)
 - (D) Four

59. During translation initiation in eukaryotes, the ribosome recognizes :
- (A) Stop codon
 - (B) Start codon (AUG)
 - (C) Anticodon
 - (D) DNA sequence
60. The genetic code is described as degenerate because :
- (A) Codons overlap
 - (B) Proteins repeat
 - (C) Codons mutate
 - (D) More than one codon codes for the same amino acid
61. Telomerase maintains chromosome stability by :
- (A) Destroying telomeres
 - (B) Extending telomeric DNA sequences
 - (C) Replicating RNA
 - (D) Producing histones
62. Proofreading activity during replication is performed by :
- (A) RNA polymerase
 - (B) DNA polymerase
 - (C) DNA ligase
 - (D) Helicase
63. DNA repair mechanisms are important because they :
- (A) Destroy damaged DNA
 - (B) Increase mutation rate
 - (C) Maintain genetic stability
 - (D) Stop transcription
64. Ribosomal RNA primarily functions in :
- (A) DNA replication
 - (B) Formation and catalytic activity of ribosomes
 - (C) Gene mutation
 - (D) Chromosome segregation
65. The anticodon of tRNA pairs with :
- (A) mRNA codon
 - (B) DNA codon
 - (C) rRNA
 - (D) Protein
66. Transcription involves synthesis of :
- (A) DNA from RNA
 - (B) RNA from DNA template
 - (C) Protein from RNA
 - (D) DNA from protein

67. DNA ligase functions to :
- (A) Break DNA
 - (B) Join DNA fragments together
 - (C) Replicate DNA
 - (D) Synthesize RNA
68. Okazaki fragments are produced during replication of :
- (A) Leading strand
 - (B) RNA strand
 - (C) Lagging strand
 - (D) Template strand
69. DNA polymerase requires which molecule to initiate synthesis?
- (A) DNA ligase
 - (B) Helicase
 - (C) RNA primer
 - (D) Histone
70. DNA replication is called semi-conservative because :
- (A) DNA is partially destroyed
 - (B) Each daughter molecule contains one parental strand
 - (C) Both strands are new
 - (D) Replication occurs once
71. Enhancers are :
- (A) Protein molecules
 - (B) Lipid molecules
 - (C) RNA sequences
 - (D) DNA sequences increasing transcription
72. Gene regulation in prokaryotes is mainly at :
- (A) Transcription
 - (B) Translation
 - (C) Replication
 - (D) Mutation
73. Repressor protein binds to :
- (A) Promoter
 - (B) Terminator
 - (C) Enhancer
 - (D) Operator
74. Structural genes code for :
- (A) RNA only
 - (B) Proteins
 - (C) Lipids
 - (D) Carbohydrates

75. Operator site is part of :
- (A) Ribosome
 - (B) Chromosome
 - (C) Operon
 - (D) Histone
76. Regulatory genes control :
- (A) Protein structure
 - (B) Gene expression
 - (C) DNA replication
 - (D) Mutation
77. The lac operon is found in :
- (A) Yeast
 - (B) Plants
 - (C) Bacteria
 - (D) Humans
78. Prokaryotic genes are often organized into :
- (A) Introns
 - (B) Operons
 - (C) Exons
 - (D) Chromatids
79. The fine structure of gene was explained by :
- (A) Watson
 - (B) Mendel
 - (C) Darwin
 - (D) Benzer
80. A gene is defined as :
- (A) Protein unit
 - (B) DNA segment coding for functional product
 - (C) RNA unit
 - (D) Chromosome
81. Mutation can result in :
- (A) Genetic variation
 - (B) Cell death only
 - (C) No effect
 - (D) Protein loss only
82. Site directed mutagenesis is used to :
- (A) Destroy DNA
 - (B) Introduce specific mutations
 - (C) Repair DNA
 - (D) Stop replication
83. EMS is a :
- (A) Chemical mutagen
 - (B) Physical mutagen
 - (C) Biological mutagen
 - (D) Radiation
84. Mutations useful in crop improvement are called :
- (A) Induced mutations
 - (B) Natural mutations
 - (C) Harmful mutations
 - (D) Silent mutations

85. Addition or deletion of bases causing reading shift is :
- (A) Substitution
 - (B) Neutral mutation
 - (C) Silent mutation
 - (D) Frameshift mutation
86. A mutation that changes one base pair is :
- (A) Frameshift
 - (B) Deletion
 - (C) Chromosomal mutation
 - (D) Point mutation
87. Mutagens are agents that :
- (A) Repair DNA
 - (B) Induce mutations
 - (C) Destroy RNA
 - (D) Form proteins
88. UV radiation causes :
- (A) Thymine dimers
 - (B) Adenine dimers
 - (C) Guanine dimers
 - (D) Cytosine dimers
89. Mutation caused by chemicals is :
- (A) Physical mutation
 - (B) Chemical mutation
 - (C) Genetic mutation
 - (D) Natural mutation
90. A sudden heritable change in DNA is called :
- (A) Replication
 - (B) Translation
 - (C) Mutation
 - (D) Transcription
91. Polyploidy has been widely used in plant breeding because it :
- (A) Reduces variation
 - (B) Stops mutation
 - (C) Increases genetic diversity and vigor
 - (D) Prevents meiosis
92. Structural chromosomal mutations primarily affect :
- (A) RNA structure
 - (B) Arrangement of genes on chromosomes
 - (C) Ribosome activity
 - (D) Protein folding

93. Translocation heterozygotes may produce reduced fertility due to :
- (A) DNA mutation
 - (B) RNA processing errors
 - (C) Protein synthesis errors
 - (D) Abnormal segregation of chromosomes during meiosis
94. A condition in which one chromosome of a pair is missing is called :
- (A) Trisomy
 - (B) Polyploidy
 - (C) Monosomy
 - (D) Tetrasomy
95. Polyploid plants often show increased size due to :
- (A) Increased RNA synthesis
 - (B) Increased cell size (gigantism)
 - (C) Faster DNA repair
 - (D) Higher mutation rate
96. Allopolyploidy is commonly formed through :
- (A) Mutation within a species
 - (B) Hybridization between two different species followed by chromosome doubling
 - (C) DNA replication failure
 - (D) Deletion of chromosomes
97. Autopolyploidy arises from :
- (A) Hybridization of different species
 - (B) Multiplication of chromosome sets from the same species
 - (C) Loss of chromosomes
 - (D) Gene duplication only
98. Aneuploid organisms arise mainly due to :
- (A) DNA replication errors
 - (B) RNA transcription errors
 - (C) Non-disjunction of chromosomes during meiosis
 - (D) Mutation in genes
99. A paracentric inversion differs from a pericentric inversion because it :
- (A) Includes the centromere.
 - (B) Occurs only in plants
 - (C) Does not include the centromere
 - (D) Occurs only during mitosis
100. A chromosomal aberration that results from unequal crossing over during meiosis is most likely to produce :
- (A) Duplication
 - (B) Inversion
 - (C) Translocation
 - (D) Aneuploidy

(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 छँटना 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।