

Roll. No.

Question Booklet Number

O.M.R. Serial No.

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M.Sc. (SEM.-III) (NEP) (SUPPLE.) EXAMINATION, 2024-25

MICROBIOLOGY
(Microbial Genetics)

Paper Code

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Question Booklet
Series

A

Time : 1 : 30 Hours

Max. 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.
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 :

(Remaining instructions on 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 हों या उसमें किसी अन्य प्रकार की कमी हो, उसे तुरन्त बदल लें।
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 छानना है। उत्तर को OMR उत्तर-पत्रक में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

(शेष निर्देश अन्तिम पृष्ठ पर)

1. A mutation is best defined as:
 - (A) Any heritable change in the genome
 - (B) A temporary alteration in phenotype
 - (C) A permanent change in protein structure
 - (D) All of the above
2. A spontaneous mutation in bacteria usually arises due to:
 - (A) Radiation exposure
 - (B) Replication errors
 - (C) Low salt conditions
 - (D) Carbon rich sources
3. Which type of mutation involves substitution of one base for another without altering the amino acid?
 - (A) Missense mutation
 - (B) Silent mutation
 - (C) Nonsense mutation
 - (D) Frameshift mutation
4. Which mutation type converts a codon to a stop codon?
 - (A) Missense mutation
 - (B) Back mutation
 - (C) Frameshift mutation
 - (D) Nonsense mutation
5. An auxotrophic mutant differs from wild type in that it:
 - (A) Cannot utilize oxygen
 - (B) Grows faster than wild type
 - (C) Requires additional nutritional supplement
 - (D) Resists antibiotics
6. A mutant that grows at 30°C but not at 42°C is a:
 - (A) Nutritional mutant
 - (B) Revertant mutant
 - (C) Auxotrophic mutant
 - (D) Temperature-sensitive mutant
7. Which of the following is not a conditional lethal mutant?
 - (A) Cold-sensitive mutant
 - (B) Temperature-sensitive mutant
 - (C) Nutritional auxotroph
 - (D) Antibiotic-resistant mutant
8. In bacterial genetics, a prototroph is defined as:
 - (A) A mutant requiring supplements
 - (B) The wild-type strain capable of synthesizing all growth factors
 - (C) A temperature-sensitive mutant
 - (D) A revertant strain

9. UV light primarily induces mutations in DNA by forming:
 - (A) Double-strand breaks
 - (B) Thymine dimers
 - (C) Guanine oxidation products
 - (D) Insertion sequences
10. The chemical mutagen 5-bromouracil acts as a:
 - (A) Alkylating agent
 - (B) Intercalating agent
 - (C) Base analog
 - (D) Crosslinking agent
11. Nitrous acid induces mutations by:
 - (A) Deaminating bases
 - (B) Alkylating guanine
 - (C) Breaking sugar-phosphate bonds
 - (D) Forming bulky adducts
12. Which mutagen alkylates guanine leading to mispairing?
 - (A) EMS (ethyl methanesulfonate)
 - (B) UV light
 - (C) X-rays
 - (D) 5-bromouracil
13. A reversion mutation is best described as:
 - (A) A mutation that suppresses another mutation at a different site
 - (B) A mutation induced by mutagens
 - (C) A mutation causing frameshifts
 - (D) A mutation that restores the original DNA sequence or phenotype
14. A mutation in a different gene that compensates for the effect of the first mutation is called:
 - (A) True reversion
 - (B) Silent mutation
 - (C) Suppressor mutation
 - (D) Nonsense mutation
15. Intragenic suppression occurs when:
 - (A) The suppressor mutation is in a different gene
 - (B) The mutation restores DNA sequence
 - (C) The original mutation is eliminated by repair
 - (D) Both mutations are in the same gene
16. Which enzyme directly reverses UV-induced thymine dimers in bacteria?
 - (A) DNA glycosylase
 - (B) Photolyase
 - (C) DNA ligase
 - (D) RecA

17. Direct reversal of DNA damage is considered unique because:
- (A) It requires nucleotide excision
 - (B) It does not involve DNA polymerase
 - (C) It removes damage without cutting the DNA backbone
 - (D) It only occurs in eukaryotes
18. Which enzyme initiates base excision repair by removing damaged bases?
- (A) Photolyase
 - (B) DNA glycosylase
 - (C) DNA polymerase
 - (D) DNA ligase
19. In nucleotide excision repair, which enzyme makes the first incision in Prokaryotes?
- (A) UvrC
 - (B) UvrB
 - (C) UvrA
 - (D) UvrD
20. Base excision repair primarily fixes:
- (A) Bulky adducts
 - (B) Thymine dimers
 - (C) Single modified bases
 - (D) Double-strand breaks
21. Which enzyme fills the gap after excision repair?
- (A) DNA ligase
 - (B) DNA glycosylase
 - (C) UvrC
 - (D) DNA polymerase
22. Mismatch repair primarily corrects errors made during:
- (A) Transcription
 - (B) Translation
 - (C) Recombination
 - (D) DNA replication
23. Which protein unwinds the mismatched DNA region during mismatch repair in *E. coli*?
- (A) MutS
 - (B) MutL
 - (C) UvrD helicase
 - (D) RecA
24. Which protein is essential for homologous recombination repair in bacteria?
- (A) RecA
 - (B) UvrC
 - (C) MutS
 - (D) Ligase

25. Double-strand breaks are repaired by:
- (A) Photoreactivation
 - (B) Homologous recombination or non-homologous end joining
 - (C) Base excision repair
 - (D) SOS repair only
26. SOS repair in bacteria is induced under:
- (A) Low temperature
 - (B) Normal DNA replication
 - (C) Excess nutrients
 - (D) UV-induced DNA damage
27. Which protein is the main inducer of SOS response in *E. coli*?
- (A) SecA
 - (B) RecA
 - (C) UvrD
 - (D) MutS
28. Complementation analysis is primarily used to determine:
- (A) Mutation rate
 - (B) The replication origin
 - (C) The ploidy of an organism
 - (D) Whether two mutations are in the same gene or different genes
29. When two mutations complement each other, it means:
- (A) They occur in the same gene
 - (B) They produce identical phenotypes
 - (C) They restore wild-type function when combined in the same cell
 - (D) They cannot be studied further
30. If two auxotrophic yeast mutants (mutant A and mutant B) grow on minimal medium after mating, the result suggests:
- (A) They are allelic
 - (B) They are lethal mutations
 - (C) They cannot be mapped
 - (D) They complement each other (mutations in different genes)
31. The F plasmid in *E. coli* is primarily responsible for:
- (A) Antibiotic resistance
 - (B) Colicin production
 - (C) Conjugation
 - (D) Restriction-modification
32. Cells containing an integrated F plasmid into the chromosome are called:
- (A) F^- cells
 - (B) F' cells
 - (C) Hfr cells
 - (D) R cells

33. Which form of F plasmid carries chromosomal genes along with plasmid genes?
- (A) F^-
 - (B) F'
 - (C) F^+
 - (D) Col plasmid
34. Col plasmids encode:
- (A) Fertility factors
 - (B) Antibiotic resistance
 - (C) Colicins (bacteriocins)
 - (D) Virulence toxins
35. R plasmids are important because they:
- (A) Confer resistance to antibiotics
 - (B) Produce toxins
 - (C) Enhance motility
 - (D) Carry metabolic genes
36. Col plasmids benefit the host by:
- (A) Providing antibiotic resistance
 - (B) Allowing conjugation
 - (C) Killing competing bacteria
 - (D) Producing virulence factors
37. Plasmid incompatibility means:
- (A) Two plasmids cannot stably coexist in one host
 - (B) Plasmid cannot replicate
 - (C) Plasmid causes host death
 - (D) Plasmid prevents transformation
38. The IncP plasmid is known for:
- (A) Narrow host range
 - (B) Wide host range
 - (C) Antibiotic production
 - (D) Colicin production
39. Incompatibility of plasmids is mainly due to:
- (A) Competition for replication machinery
 - (B) Conjugation interference
 - (C) Restriction enzymes
 - (D) Transposon insertion
40. A plasmid able to replicate in both Gram-negative and Gram-positive bacteria is:
- (A) Narrow host range plasmid
 - (B) Broad host range plasmid
 - (C) Cryptic plasmid
 - (D) Conditional plasmid

41. A shuttle vector has:
- (A) two selectable markers only
 - (B) no replication system
 - (C) a single oriC
 - (D) two origins of replication for different hosts
42. Plasmid copy number refers to:
- (A) number of plasmids per host cell
 - (B) number of genes per plasmid
 - (C) number of proteins expressed
 - (D) number of oriT sites
43. High copy number plasmids usually:
- (A) Have strict replication control
 - (B) Have relaxed replication control
 - (C) Require host factors strictly
 - (D) Cannot be used in cloning
44. pUC19 is an example of:
- (A) Low copy number plasmid
 - (B) High copy number plasmid
 - (C) Cryptic plasmid
 - (D) Broad host range plasmid
45. Curing of plasmid means:
- (A) Integration into host chromosome
 - (B) Increase in copy number
 - (C) Loss of plasmid from host cells
 - (D) Expression of plasmid genes
46. An ideal plasmid cloning vector should have:
- (A) Multiple cloning sites, selectable marker, ori
 - (B) Only antibiotic resistance
 - (C) Only Conjugation genes
 - (D) Colicin operon
47. The uptake of free, naked DNA fragments from the environment by a bacterial cell is called:
- (A) Conjugation
 - (B) Transformation
 - (C) Transduction
 - (D) Transposition
48. Griffith's experiment with *Streptococcus pneumoniae* demonstrated:
- (A) DNA replication
 - (B) Transduction
 - (C) Conjugation
 - (D) Principle of transformation
49. Natural competence in bacteria is regulated by:
- (A) Plasmids
 - (B) Ribosomes
 - (C) Bacteriophages
 - (D) Competence factors

50. Conjugation in bacteria was first demonstrated in *E. coli* by :
- (A) Griffith
 - (B) Lederberg and Tatum
 - (C) Watson and Crick
 - (D) Avery and MacLeod
51. The transfer of DNA during conjugation requires:
- (A) Pilus
 - (B) Ribosome
 - (C) Cell wall porins
 - (D) DNA polymerase III
52. Hfr strains differ from F^+ strains in that:
- (A) they lack plasmids
 - (B) F-plasmid is integrated into the chromosome
 - (C) they cannot form pili
 - (D) they only undergo transduction
53. Interrupted mating experiments are useful for:
- (A) Measuring transformation frequency
 - (B) Mapping bacterial genes
 - (C) Studying protein synthesis
 - (D) Detecting transposons
54. Transfer of bacterial DNA from one cell to another by bacteriophage is called:
- (A) Conjugation
 - (B) Transformation
 - (C) Transduction
 - (D) Recombination
55. Generalized transduction can transfer:
- (A) only specific bacterial genes
 - (B) only transposons
 - (C) only plasmids
 - (D) any part of the bacterial genome
56. Which bacteriophage is a model for studying generalized transduction?
- (A) λ phage
 - (B) T4
 - (C) P22
 - (D) All of the above
57. Co-transduction frequency is used for:
- (A) Mapping gene order
 - (B) Studying plasmid transfer
 - (C) Detecting mutations
 - (D) Inhibiting recombination
58. Homologous recombination in bacteria is mediated by:
- (A) RecA protein
 - (B) Pilin protein
 - (C) DNA ligase
 - (D) Transposase

59. Branch migration in recombination requires:
- (A) F pilus
 - (B) Only DNA ligase
 - (C) RNA polymerase
 - (D) RecBCD enzyme complex
60. Resolution of Holliday junction produces:
- (A) Only parental molecules
 - (B) Either crossover or non-crossover products
 - (C) Only recombinant DNA
 - (D) Only plasmids
61. Transposons are also called:
- (A) Jumping genes
 - (B) Silent genes
 - (C) Mobile plasmids
 - (D) Integrins
62. The enzyme essential for transposition is:
- (A) DNA ligase
 - (B) DNA helicase
 - (C) Transposase
 - (D) DNA primase
63. Non-replicative transposition is also known as:
- (A) Copy-and-paste mechanism
 - (B) Cut-and-paste mechanism
 - (C) Rolling-circle mechanism
 - (D) Site-specific recombination
64. Retrotransposons transpose via an:
- (A) RNA intermediate
 - (B) Only DNA intermediate
 - (C) Protein intermediate
 - (D) Ribosome intermediate
65. The movement of transposons contributes to:
- (A) Genetic variation
 - (B) Genome rearrangements
 - (C) Antibiotic resistance spread
 - (D) All of the above
66. T4 phage genome is composed of:
- (A) Linear double-stranded DNA with terminal repeats
 - (B) Linear single-stranded RNA
 - (C) Circular double-stranded DNA
 - (D) Circular single-stranded DNA
67. Which enzyme is carried by bacteriophage T7 to initiate transcription?
- (A) Host RNA polymerase
 - (B) T7 RNA polymerase
 - (C) DNA polymerase III
 - (D) Reverse transcriptase
68. Phage T4 uses which special DNA base instead of cytosine?
- (A) 5-methylcytosine
 - (B) Hydroxymethylcytosine
 - (C) Uracil
 - (D) Pseudouridine

69. Which of the following is TRUE about T7 phage replication?
- (A) Replication begins at multiple origins
 - (B) It does not require DNA polymerase
 - (C) Only It uses host primase
 - (D) Replication begins at a single defined origin
70. Tail fibers of T4 phage are responsible for:
- (A) DNA replication
 - (B) Transcription regulation
 - (C) Host cell recognition and adsorption
 - (D) Assembly of viral proteins
71. The decision between lysis and lysogeny in λ phage is mainly regulated by:
- (A) Cro and CI proteins
 - (B) RecA protein
 - (C) cAMP-CAP complex
 - (D) LexA protein
72. Which protein maintains lysogeny in λ phage?
- (A) Cro
 - (B) CI repressor
 - (C) N protein
 - (D) O protein
73. Site of integration of λ prophage in E. coli genome is:
- (A) *lac operon*
 - (B) *oriC*
 - (C) *trp operon*
 - (D) *attB site near gal/bio region*
74. Induction of λ prophage is triggered by:
- (A) Low temperature
 - (B) Host DNA damage and SOS response
 - (C) Nutrient abundance
 - (D) Absence of Cro protein
75. P1 phage maintains itself in E. coli as:
- (A) Integrated prophage
 - (B) Plasmid prophage with partitioning system
 - (C) RNA replicon
 - (D) Episome without partitioning
76. Phage P1 is used in molecular biology as:
- (A) A generalized transducing phage
 - (B) A specific cloning vector for eukaryotes
 - (C) RNA phage system
 - (D) Reverse transcriptase source

77. Prions are infectious agents made of:
- (A) DNA
 - (B) RNA
 - (C) Only Proteins
 - (D) Protein and lipid
78. Creutzfeldt–Jakob disease is caused by:
- (A) Virus infection
 - (B) Prions
 - (C) Bacteria
 - (D) Protozoa
79. The adaptive immunity in bacteria is primarily mediated by:
- (A) Restriction-modification system
 - (B) CRISPR-Cas system
 - (C) Toxin-antitoxin system
 - (D) Abortive infection system
80. Which of the following is an example of innate bacterial immunity?
- (A) CRISPR-Cas
 - (B) Restriction-modification system
 - (C) Memory spacer acquisition
 - (D) Protospacer adjacent motif recognition
81. Restriction-modification systems distinguish host DNA from phage DNA by:
- (A) PAM recognition
 - (B) Cas protein cleavage
 - (C) CRISPR spacer complementarity
 - (D) DNA methylation patterns
82. Toxin-antitoxin systems help in antiphage defense mainly by:
- (A) Restricting DNA methylation
 - (B) Blocking phage adsorption
 - (C) Inducing dormancy or programmed cell death
 - (D) Producing CRISPR spacers
83. The CRISPR locus in bacteria consists of:
- (A) Only Cas genes
 - (B) Repeats and spacers
 - (C) Only repeats
 - (D) Only spacers
84. Protospacer Adjacent Motif (PAM) is essential for:
- (A) CRISPR repeat transcription
 - (B) Host DNA protection
 - (C) Spacer integration
 - (D) Cas protein recognition of foreign DNA
85. A point mutation that replaces a purine with another purine, or a pyrimidine with another pyrimidine is called:
- (A) Nonsense mutation
 - (B) Silent mutation
 - (C) Transition mutation
 - (D) Transversion

86. The term “relaxed plasmid” usually refers to plasmids that:
- (A) have very low copy numbers
 - (B) have high copy numbers without strict control
 - (C) integrate frequently into host genome
 - (D) do not replicate at all
87. Name the repair system which involves the removal of the damaged segment of DNA:
- (A) Recombinational repair
 - (B) Direct repair
 - (C) Excision repair
 - (D) Mismatched repair
88. The correction of changes in DNA by a set of process known as:
- (A) Replication
 - (B) DNA repair
 - (C) Translation
 - (D) Transcription
89. The term Hfr strain in *E. coli* refers to:
- (A) Cell with multiple plasmids
 - (B) High frequency recombination strain
 - (C) Bacterium resistant to transformation
 - (D) Bacterium lacking any plasmid
90. The synthesis of polynucleotide chain of mRNA is catalyzed by the enzyme :
- (A) RNA helicase
 - (B) RNA polymerase
 - (C) DNA polymerase
 - (D) DNA helicase
91. Which of the following best describes a plasmid?
- (A) Linear RNA molecule in prokaryotes
 - (B) Circular double-stranded DNA molecule independent of the chromosome
 - (C) Protein complex aiding DNA replication
 - (D) Short peptide molecule for cell signaling
92. Which of the following is a key feature of plasmid replication?
- (A) It requires the host chromosome origin of replication.
 - (B) It stops during cell division.
 - (C) It always integrates into the host genome.
 - (D) It occurs independently of the host chromosome.

93. The term “broad host range plasmid” refers to plasmids that can:
- (A) only replicate in a single species
 - (B) only integrate into host genome
 - (C) replicate in multiple bacterial species
 - (D) only transfer through transformation
94. Which mechanism ensures equal plasmid distribution to daughter cells during cell division?
- (A) Rolling circle replication
 - (B) Conjugation
 - (C) Partitioning system (par genes)
 - (D) DNA repair system
95. The phenomenon where two plasmids cannot stably coexist in the same cell is called:
- (A) Plasmid incompatibility
 - (B) Plasmid recombination
 - (C) Plasmid conjugation
 - (D) Plasmid transformation
96. Plasmids that carry genes conferring antibiotic resistance are called:
- (A) R plasmids
 - (B) F plasmids
 - (C) Col plasmids
 - (D) Virulence plasmids
97. The enzyme responsible for transposition in IS elements is:
- (A) Ligase
 - (B) Transposase
 - (C) Reverse transcriptase
 - (D) Helicase
98. Which of the following is a characteristic feature of IS elements?
- (A) Terminal inverted repeats
 - (B) Origin of replication
 - (C) Ribosomal binding site
 - (D) Antibiotic resistance gene
99. Transposition is generally categorized as:
- (A) Conservative and replicative
 - (B) Conservative and mutational
 - (C) Integrative and excisive
 - (D) Parallel and divergent
100. The discovery of transposons was first made in maize by:
- (A) Watson and Crick
 - (B) Barbara McClintock
 - (C) Joshua Lederberg
 - (D) Frederick Griffith

Rough Work

Example :

Question :

Q.1 (A) ● (C) (D)

Q.2 (A) (B) ● (D)

Q.3 (A) ● (C) (D)

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 & 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.

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ● (C) (D)

प्रश्न 2 (A) (B) ● (D)

प्रश्न 3 (A) ● (C) (D)

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।
6. सभी उत्तर केवल ओ०एम०आर० 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. ओ०एम०आर० 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 में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।
11. परीक्षा-कक्ष में लॉग-बुक, कैल्कुलेटर, 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 प्रश्नपुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरिज की दूसरी प्रश्नपुस्तिका प्राप्त कर लें।