Roll No. .....

Question Booklet Number

O. M. R. Serial No.

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

(New Syllabus Effective from 2023)

RECOMBINANT DNA TECHNOLOGY

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 *cos* packaging sites are feature of :

(A) Plasmids

(B) Fosmids

(C) Cosmids

(D) Ti vector

2. What is the function of the TRP1 gene located on the yeast replicating plasmid, YRp7 ?

(A) Termination

(B) Tetracycline biosynthesis

(C) Tryptophan biosynthesis

(D) Tyrosine biosynthesis

3. T-DNA integration into plant genome is usually :

(A) Site-specific

(B) Directional

(C) Random

(D) Replication dependent

4. Identify the physical transfection strategy that are used for gene transfer to animal cells :

(A) PEG-mediated

(B) DEAE-mediated

(C) Microinjection

(D) All of the above

5. A transgenic plant 'Golden Rice' contains foreign genes that produce :

(A) Niacin

(B) Biotin

(C) Beta-carotene (β- carotene)

(D) Yellow fluorescent protein

6. The 2μm plasmid was discovered from :

(A) *Staphylococcus aureus*

(B) *Saccharomyces cerevisiae*

(C) *Escherichia coli*

(D) *Bacillus subtilis*

7. The most commonly used animal for producing transgenic models is :

(A) Rabbit

(B) Mouse

(C) Sheep

(D) Goat

8. What does "I" in YIp vectors stand for ?

(A) Infected

(B) Integrative

(C) Insertional

(D) Initiation

9. Disarming of Ti vectors involves :

(A) Removal of Oncogenes located in the T-DNA region

(B) Removal of Opine catabolic genes

(C) Removal of *vir* genes

(D) Removal of left and right border sequences

10. What is the CEN4 region in the YAC vector ?

(A) DNA from centromere

(B) DNA from telomere

(C) DNA from origin

(D) Bacterial DNA

11. What do the sequences TEL signify in a YAC vector ?

(A) Gene center

(B) Origins

(C) Telomeres

(D) Centromere

12. Transformation carried out using a particle gun is known as biolistic transformation. It falls under which category of transformation ?

(A) Physical

(B) Chemical

(C) Electroporation

(D) Natural

13. Knockout mice are primarily used to study :

(A) Protein purification

(B) Enzyme kinetics

(C) Cell culture

(D) Gene function

14. Which of the following statements is correct with respect to Yeast centromere plasmid (YCp) ?

(A) YCp contains only a yeast centromere.

(B) YCP contains both an ARS and a yeast centromere.

(C) YCP contains only an ARS.

(D) YCp contains an ARS, a telomere and a yeast centromere.

15. Pronuclear microinjection method is used to create :

(A) Transgenic plant

(B) Novel fungal strains

(C) Recombinant microbes

(D) Transgenic mice

16. Elution of MBP (Maltose binding protein) -tagged protein from amylose resin is performed by :

(A) Amylose

(B) Maltose

(C) Lactose

(D) Glucose

17. The gene which was used to produce insect resistant transgenic cotton plant was taken from :

(A) *Bacillus clausii*

(B) *Agrobacterium tumefaciens*

(C) *Bacillus subtilis*

(D) *Bacillus thuringiensis*

18. Which cells are commonly used for generating knockout mice ?

(A) Stem cells

(B) Embryonic stem cells

(C) Somatic cells

(D) Blood cells

19. Which of the following is a major application of transgenic animals ?

(A) Vaccine production

(B) Studying disease mechanisms

(C) Production of therapeutic proteins

(D) All of the above

20. Which problem does SV40 as a cloning vector face which is similar to that faced by lambda and caulimovirus ?

(A) Narrow host range

(B) Packaging constraint

(C) Digestion limitation

(D) Post translational modifications

21. Embryonic stem cells are :

(A) Totipotent stem cells

(B) Pluripotent stem cells

(C) Multipotent stem cells

(D) Omnipotent stem cells

22. Antibiotics are used in recombinant DNA technology. They are used :

(A) To keep culture free of microbial infections

(B) To promote the ligation between foreign DNA and vector

(C) To initiate the replication of vectors

(D) As selectable markers

23. In blue-white screening, what do white colonies represent ?

(A) Cells containing self-ligated vectors

(B) Cells with recombinant plasmids containing a new insert

(C) Cells containing empty plasmid vectors

(D) Cells with a functional *lac*Z gene

24. Glyphosate is used in the plant biotechnology as :

(A) Antiviral resistance marker

(B) Antibiotic resistance marker

(C) Herbicide resistance marker

(D) Antifungal resistance marker

25. DNA fingerprinting was developed by :

(A) Francis Crick

(B) Alec Jeffrey

(C) James Watson

(D) Nathan, Arber and Smith

26. Which of the following method used for the generation of uniformly labeled radioactive hybridization probes ?

(A) Nick translation

(B) Inverse PCR

(C) Cryptic transcription

(D) Alkaline lLysis

27. M13mp vectors contain a multiple cloning site within :

(A) *lac*Z gene

(B) *amp*R gene

(C) *tet*R gene

(D) *ori* region

28. Alkaline lysis method is used to isolate :

(A) RNA

(B) Lipids

(C) Proteins

(D) Plasmids

29. Inner cell mass of the blastocyst is the source of :

(A) Totipotent cells

(B) Somatic cells

(C) Multipotent stem cells

(D) Embryonic stem cells

30. The dideoxy method of sequencing is also known as :

(A) Maxam and Gilbert method

(B) Pyrosequencing

(C) Sanger sequencing

(D) Autosequencing

31. IPTG acts as :

(A) Antibiotic

(B) Repressor

(C) Herbicide

(D) Inducer

32. BAC vectors have less cloning capacity than :

(A) Plasmids

(B) Phasmids

(C) Cosmids

(D) YAC

33. Which size of the insert is generally accepted by the plasmids ?

(A) 0.1-10 kb

(B) 100-150 kb

(C) 250-350 kb

(D) 100-120 kb

34. Which one of the following is the filamentous coliphages ?

(A) P1

(B) SV40

(C) M13

(D) λ-phage

35. T7 promoter drives the expression of cloned gene in :

(A) pUC19 vector

(B) pBR322 vector

(C) pET vector

(D) pBSKS vector

36. M13mp vectors are commonly used for :

(A) Protein purification

(B) DNA sequencing

(C) RNA transcription

(D) Gene knockout

37. Random priming is performed for the synthesis of :

(A) tRNA

(B) cDNA

(C) Radioactive DNA Probe

(D) Recombinant proteins

38. Pairs of restriction enzymes that have slightly different recognition sequences, but upon cleavage of DNA, generate identical overhanging termini sequences, are called :

(A) Isoschizomers

(B) Neoschizomers

(C) Isocaudomers

(D) None of the above

39. Lowering the induction temperature during protein expression helps to :

(A) Increase protein degradation

(B) Improve protein folding

(C) Stop transcription

(D) Reduce plasmid copy number

40. Exonucleases :

(A) Only act on single stranded DNA molecules

(B) Only act on double stranded DNA molecules

(C) Remove a single nucleotide base at a time from the end of a polynucleotide chain

(D) Remove nucleotide bases from the middle of a polynucleotide chain

41. Which one of the following secretion system is responsible for the transfer of T-DNA into the host plant ?

(A) Type I secretion system

(B) Type II secretion system

(C) Type III secretion system

(D) Type IV secretion system

42. Identify the DNA virus that have been developed as vector for the gene transfer to the plant cell :

(A) Tobacco mosaic virus

(B) Cauliflower mosaic virus

(C) Brome mosaic virus

(D) Potato virus X

43. Which host strain is commonly used with pET vectors ?

(A) DH5α

(B) BL21(DE3)

(C) JM109

(D) XL1-Blue

44. The complete set of proteins expressed by an organism is called :

(A) Gene

(B) Genome

(C) Genomics

(D) Proteome

45. Phage display technique is used to study :

(A) Protein-DNA interactions

(B) Protein-protein interactions

(C) Lipid metabolism

(D) RNA transcription

46. The ability of cells to uptake DNA fragments from the surroundings is known as :

(A) HFR

(B) Competence

(C) Fecundity

(D) Fitness

47. Which of the following enzymes in bacteria are responsible for restricting the growth of viruses ?

(A) Protease

(B) Gyrase

(C) Topoisomerase

(D) Restriction endonuclease

48. Recombinant plasmids are added to a bacterial culture that has been pretreated with ……. ions.

(A) Magnesium

(B) Iodine

(C) Calcium

(D) Ferric

49. Which type of dye is commonly used in real-time PCR ?

(A) Ethidium bromide

(B) X-gal

(C) Coomassie blue

(D) SYBR Green

50. Phage display commonly uses which bacteriophage ?

(A) T4

(B) λ phage

(C) M13

(D) P1

51. Southern blotting is used for :

(A) Detection of the RNA

(B) Sequencing of DNA

(C) Quantification of RNA

(D) Detection of the DNA

52. *Thermus aquaticus* is the well-known source of :

(A) T7 RNA polymerase

(B) Terminal transferase

(C) Aquaporin

(D) Thermostable DNA polymerase

53. The inheritance pattern of RFLP markers are :

(A) Dominant

(B) Recessive

(C) Co-dominant

(D) Random

54. Sanger method is used in :

(A) Primer designing

(B) DNA sequencing

(C) In-vitro transcription

(D) DNA fingerprinting

55. Nick translation is performed for the synthesis of :

(A) mRNA

(B) Recombinant proteins

(C) DNA Probes

(D) Endogenous proteins

56. A molecular technique in which DNA sequences between two oligonucleotide primers can be amplified is known as :

(A) Southern blotting

(B) Northern blotting

(C) Polymerase chain reaction

(D) DNA replication

57. The Northern blotting technique depends on :

(A) Similarities between the sequences of probe DNA and experimental DNA

(B) Similarities between the sequences of probe RNA and experimental RNA

(C) Similarities between the sequences of probe protein and experimental protein

(D) The molecular mass of proteins

58. A vector that can be propagated between two different organisms is called :

(A) Binary vector

(B) Shuttle vector

(C) Relaxed vector

(D) Stringent vector

59. Identify the label used for the generation of non-radioactive hybridization probes :

(A) Fluorescein

(B) Rhodamine

(C) Biotin

(D) All of the above

60. Which of the following enzyme is required for the 3′- end labeling of DNA with radioactive phosphorous ?

(A) Terminal Deoxynucleotidyl Transferase

(B) Alkaline Phosphatase

(C) Polynucleotide Kinase

(D) DNA Polymerase

61. Which of the following is the basic requirement of PCR reaction ?

(A) Two oligonucleotide primers

(B) DNA segment to be amplified

(C) A heat-stable DNA polymerase

(D) All of the above

62. If any protein-encoding gene is expressed in a heterologous host, it is called a :

(A) Pure protein

(B) Mixed protein

(C) Recombinant protein

(D) Similar protein

63. Recombinant proteins that have Glutathione S-transferase (GST) tags are purified using :

(A) Amylose columns

(B) Immobilized metal ion affinity chromatography

(C) Ni-NTA affinity resin.

(D) Glutathione sepharose resins

64. His-tagged fusion proteins can easily be purified by :

(A) Amylose columns

(B) Glycogen beads

(C) Ni-NTA affinity resin

(D) Glutathione sepharose resins

65. Which one of the following can generate all cell types including placenta ?

(A) Multipotent stem cells

(B) Totipotent stem cells

(C) Pluripotent stem cells

(D) Omnipotent stem cells

66. The process of DNA cutting and joining is usually performed in the :

(A) DNA synthesis

(B) DNA degradation

(C) DNA manipulation

(D) DNA replication

67. The research on host controlled restriction modification system is responsible for the discovery of :

(A) DNA Polymerase III

(B) DNA Polymerase I

(C) Restriction Enzymes

(D) RNA Polymerase

68. Restriction enzymes are enzymes :

(A) Capable of restricting protein synthesis

(B) Capable of cutting DNA molecules

(C) Capable of adding nucleotides to the 3′ end of DNA

(D) Capable of joining DNA molecules

69. *Eco*RI, *Hind*III and *Bam*HI restriction enzymes belongs to class of :

(A) Type I restriction endonucleases

(B) Type II restriction endonucleases

(C) Type III restriction endonucleases

(D) Type IV restriction endonucleases

70. T-DNA refers to :

(A) Tumor DNA

(B) Transfer DNA

(C) Transgenic DNA

(D) Template DNA

71. The restriction endonuclease which cleave within recognition site belongs to :

(A) Type I restriction endonuclease

(B) Type II restriction endonuclease

(C) Type III restriction endonuclease

(D) Type IV restriction endonuclease

72. The T4 DNA ligase requires ..... cofactor for its function.

(A) FAD

(B) ATP

(C) NADH

(D) GTP

73. Find the microorganism that can be the source of the restriction endonuclease *Xho*I ?

(A) *Xanthomonas oryzae*

(B) *Xanthomonas campestris*

(C) *Xanthomonas holicicola*

(D) *Xanthomonas badrii*

74. Which is the enzyme used to add phosphate group to the 5′ end of the DNA ?

(A) Polynucleotide Kinase

(B) Terminal Deoxynucleotidyl Transferase

(C) Alkaline Phosphatase

(D) Restriction Endonuclease

75. Which enzyme is used in homopolymer tailing procedure ?

(A) Terminal Deoxynucleotidyl Transferase

(B) Alkaline Phosphatase

(C) Polynucleotide Kinase

(D) DNA Polymerase

76. Alkaline Phosphatase enzyme :

(A) Removes phosphate group from the 5′ end of the DNA

(B) Add the phosphate group to the 5′ end of the DNA

(C) Add phosphate group to the 3′ end of the DNA

(D) Removes phosphate group from the 3′ end of the DNA

77. Which enzyme is used to join together two different types of DNA molecules ?

(A) Ligase

(B) Reverse transcriptase

(C) Transferase

(D) DNase

78. Which enzyme is used to generate complementary DNA (cDNA) from an mRNA template ?

(A) RNA polymerase

(B) Reverse Transcriptase

(C) DNA Ligase

(D) RNA Methyltransferase

79. A cDNA library does not contain :

(A) Coding DNA

(B) Noncoding DNA

(C) Both (A) and (B)

(D) None of the above

80. Blue-white screening is employed to detect :

(A) Recombinant cells

(B) Non-transformed cells

(C) Auxotrophic cells

(D) Cancer cells

81. A library encompassing an entire genome is called :

(A) cDNA library

(B) tRNA library

(C) Genomic library

(D) mRNA library

82. The T-DNA region of Ti plasmid is transferred into :

(A) Bacterial cell

(B) Plant mitochondrial genome

(C) Plant nuclear genome

(D) Chloroplast genome

83. Which of the following is true regarding restriction enzymes ?

(A) Restriction enzymes are used to cut DNA molecule

(B) Restriction enzymes are used to construct restriction map

(C) Restriction enzymes are used in RFLP

(D) All of the above

84. Single stranded unpaired extension formed by restriction enzyme upon digestion is known as :

(A) Blunt ends

(B) Sticky ends

(C) Flush ends

(D) None of the above

85. Which genes are present in the T-DNA region ?

(A) Antibiotic resistance genes

(B) Tumor-inducing and opine synthesis genes

(C) Ribosomal genes

(D) Replication genes

86. The RNA strand in the RNA-DNA hybrid is removed by :

(A) RNaseH

(B) RNaseA

(C) DNase I

(D) RNA Polymerase

87. The extra chromosomal, naturally occurring, self-replicating, double stranded circular DNA molecules are called :

(A) PPLO

(B) Plasmids

(C) MLO

(D) Phages

88. What does pBR stand for, in the pBR322 cloning vector ?

(A) Plasmid Boliver and Rodriguez

(B) Plasmid Baltimore and Rodriguez

(C) Plasmid Bacterial Recombination

(D) Plasmid Bacterial Replication

89. In binary vector system, T-DNA and vir genes are located on :

(A) Same plasmid

(B) Different plasmids

(C) Plant genome

(D) Bacterial genome

90. Which antibiotic resistance is present in pUC vectors ?

(A) Ampicillin

(B) Kanamycin

(C) Tetracycline

(D) Both ampicillin and tetracycline

91. The correct order of the three steps involved in PCR is :

(A) Annealing, extension, and denaturation

(B) Extension, denaturation, and annealing

(C) Denaturation, annealing, and extension

(D) Denaturation, extension, and annealing

92. Some plasmids are maintained as multiple copies per cell. These plasmids are called :
(A) Stringent Plasmids
(B) Relaxed Plasmids
(C) Repetitive Plasmids
(D) Restricted Plasmids

93. Which of the statement is true for pUC19 vector ?
(A) It contains both ampicillin resistant and tetracycline resistant gene.
(B) It contains only an ampicillin resistance gene.
(C) Blue-White screening cannot be performed with this vector.
(D) The size of this vector is 10 KB.

94. Identify the desirable properties of plasmid cloning vehicles :
(A) Multiple cloning sites
(B) Selectable marker
(C) Low molecular weight
(D) All of the above

95. The process of introducing DNA molecules into the recipient host organism is known as :
(A) Translation
(B) Transformation
(C) Transduction
(D) Transcription

96. Insertional and replacement vector are type of :
(A) Plasmids of bacterial origins
(B) Phage Lambda (λ) Vectors
(C) Cosmids
(D) YAC

97. Single stranded DNA vectors are useful :
(A) For sequencing of cloned DNA
(B) For oligonucleotide directed mutagenesis
(C) For probe preparation
(D) All of the above

98. Choose the correct statement for the infectious particle of lambda phage :
(A) It has single stranded RNA genome.
(B) It has circular double stranded genome.
(C) Its genome size is approximately 48.5 KB.
(D) None of the above

99. Identify the correct order for the following cloning vectors in terms of cloning capacity :
(A) Cosmid > BAC > YAC
(B) BAC > YAC > Cosmid
(C) YAC > BAC > Cosmid
(D) BAC > YAC > Cosmid

100. If a plasmid is having two antibiotic resistant genes, say ampicillin resistant and kanamycin resistant. If insertional inactivation of the ampicillin gene takes place during cloning process, then the recombinant clones will grow on medium containing :
(A) Ampicillin
(B) Kanamycin
(C) Both kanamycin and ampicillin
(D) None of the above

(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।