A
SET

Booklet No. :

BT - 16

Bio Technology

Duration of Test : 2 Hours **Max. Marks : 120**

Hall Ticket No.

Name of the Candidate : _____

Date of Examination : _____ **OMR Answer Sheet No. :** _____

_____ _____

Signature of the Candidate **Signature of the Invigilator**

INSTRUCTIONS

1. This Question Booklet consists of **120** multiple choice objective type questions to be answered in **120** minutes.
2. Every question in this booklet has 4 choices marked (A), (B), (C) and (D) for its answer.
3. Each question carries **one** mark. There are no negative marks for wrong answers.
4. This Booklet consists of **16** pages. Any discrepancy or any defect is found, the same may be informed to the Invigilator for replacement of Booklet.
5. Answer all the questions on the OMR Answer Sheet using **Blue/Black ball point pen only.**
6. Before answering the questions on the OMR Answer Sheet, please read the instructions printed on the OMR sheet carefully.
7. OMR Answer Sheet should be handed over to the Invigilator before leaving the Examination Hall.
8. Calculators, Pagers, Mobile Phones, etc., are not allowed into the Examination Hall.
9. No part of the Booklet should be detached under any circumstances.
10. The seal of the Booklet should be opened only after signal/bell is given.

BIOTECHNOLOGY (BT)

1. If the system of equations $AX = 0$ has a unique solution if the square matrix A is

   (A) singular (B) non-singular

   (C) unit matrix (D) such that the det(A) is 1.

2. The product of the eigen values of the square matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ is equal to

   (A) –36 (B) –18 (C) 36 (D) 18

3. The function $f(x, y) = xy + a^3(\frac{1}{x} + \frac{1}{y})$ is minimum at the point

   (A) $(0, a)$ (B) (a, a) (C) $(a, 0)$ (D) $(0, 0)$

4. If $x = u(1 - v)$ and $y = uv$ then $\frac{\partial(x, y)}{\partial(u, v)} =$

   (A) 1 (B) $u + v$ (C) u (D) $1 - u$

5. Three persons A, B and C supply 40%, 30% and 30% of the total output. Out of them 2% from A, 1% from B and 2% from C are defective. If an item is selected at random, then the probability of defective is

   (A) 0.08 (B) 0.008 (C) 0.01 (D) 0.017

6. For a Poisson distribution $2P(X = 0) = P(X = 1)$, then the probability density is

   (A) $\frac{2^x e^{-2}}{x!}$ (B) $\frac{3^x e^{-3}}{x!}$ (C) e^{-2x} (D) $\frac{5^x e^{-5x}}{x!}$

7. The degree of the differential equation $(\frac{d^2y}{dx^2})^3 + x(\frac{dy}{dx})^3 x^2 y = 0$ is

   (A) 0 (B) 2 (C) 3 (D) 5

8. The solution of the equation $xe^{-x^2}dx + \sin y dy = 0$ is

(A) $e^{-x} + \sin x = C$ (B) $\frac{e^{-x^2}}{2} + \cos y = C$

(C) $xe^{-x} + \sin x = C$ (D) $\int e^{-x^2}dx + \sin y = C$

9. The condition for convergence of Newton-Raphson method to find a real root of $f(x) = 0$ is

(A) $|f'(x)| \leq 1$ (B) $|f(x)f''(x)| \leq |f'(x)|$

(C) $|f(x)f''(x)| \leq |f'(x)|^2$ (D) $|f'(x)| > 0$

10. If $y' = x + y^2$ and $y(0) = 1$ then $y(1.1)$ by Euler's method is

(A) 1.1 (B) 0.1 (C) 1.11 (D) 1.011

11. Endogenous antigens are presented on to the cell surface along with

(A) MHC-II (B) MHC-I (C) Fc receptor (D) complement receptor

12. The rate-limiting enzyme in glycolysis is

(A) Phosphoglumutase (B) Phospho hexose isomerase

(C) Hexokinase (D) Phospho glycerate mutase

13. The number of nucleotide pairs in the genome of *E.coli* is

(A) 5,639,221 (B) 4,639,221 (C) 2,639,221 (D) 1,639,221

14. Which of the following organelle is present only in animal cells and not in plant cells ?

(A) Chloroplasts (B) Vacuoles (C) Microtubules (D) Plasmalemma

15. Antibody dependent cell mediated immunity occurs by binding of cell surface receptors to

(A) Complement (B) TCR (C) Fc region (D) MHC-II

16. Which of the following is not a genetic transformation technique ?

(A) Electroporation (B) Biolistic gene gun

(C) Laser microbeams (D) PAGE

17. Interleukins are a set of proteins secreted by immune cells which are classed under
(A) Antigens (B) Antibodies (C) Complement (D) Cytokines

18. Stability of DNA is achieved by DNA bases being held together by
(A) Van der Waals forces
(B) Hydrogen bonds
(C) Covalent bonds
(D) Disulphide bonds

19. The term originally applied to cells of a single type, isolated and allowed to reproduce to create a population of identical cells is called
(A) Clone (B) Population (C) Colony (D) Family

20. Generating and propagating a recombinant DNA molecule requires which of the following set of enzymes ?
(A) Polymerases and transferases
(B) Restriction endonucleases and DNA ligases
(C) Transcriptase and Exonuclease
(D) Kinases and Phosphatases

21. The nucleotide analogue used in DNA sequencing by chain termination method is
(A) 1', 3'-dideoxy nucleoside triphosphate
(B) 2', 3'-dideoxy nucleoside triphosphate
(C) 2', 4'-dideoxy nucleoside triphosphate
(D) 2', 5'-dideoxy nucleoside triphosphate

22. Human genome sequencing project involved the construction of genomic library in
(A) Bacterial artificial chromosome (B) pBR322
(C) bacteriophage (D) pcDNA3.1

23. EcoRI recognition sequence is
(A) G G A T C C (B) G A T A T C
(C) G G C C (D) G A A T T C

24. Adjuvants are used to
(A) prolong the persistence of antigen (B) cross link the antigen
(C) increase the size of antigen (D) avoid inflamnation

25. An RNA primer is synthesized during the replication process in bacteria by
(A) RNaseH (B) primase
(C) DNA polymerase-I (D) DNA polymerase-II

26. Which one of the following modifications is common to both protein and DNA ?
(A) Phosphorylation (B) Nitrosylation
(C) Methylation (D) Ubiquitination

27. Bovine growth hormone produced artificially using recombinant DNA technology is
(A) rBST (B) cDNA (C) pGEM (D) pBR

28. Multidrug Resistance Protein (MDR) belongs to which of the following class of transporters ?
(A) V-Type ATPases (B) P-type ATPases
(C) ABC transporters (D) Ionic channels

29. In 1982 the first synthetic insulin, came on the market and it was genetically engineered by Genentech and marketed by Eli Lilly. It was named as
(A) Rh-Insulin (B) Humulin (C) Basalog (D) Insugen

30. Repeating units of glucuronic acid α(1. 4) glucosamine are found in
(A) Chondroitin sulphate (B) Hyaluronic acid
(C) Heparin (D) Keratin

31. Gap junctions between animal cell types are also called
(A) Nexus (B) Ephapse (C) Plasmodesmata (D) Connexons

32. A retrovirus is a type of virus that contains
(A) DNA (B) RNA (C) Protein (D) rDNA

33. Golden Rice-2 was created by introducing phytoene synthase from
(A) Daffodils (B) Maize (C) Carrot (D) Amaranthus

34. Recombinant human antithrombin (ATryn) is a protein with anticoagulant and anti-inflammatory properties that has been manufactured from milk of transgenic :
(A) Cow (B) Goat (C) Buffalo (D) Donkey

35. The term *biotechnology* was coined in 1917 by a Hungarian inventor named
(A) Karl Ereky (B) Phoebus Levene
(C) Harry H. Laughlin (D) Jonas Salk

36. Electroporation is a technique used with
(A) Calli (B) Ovules (C) Pollen (D) Cell suspensions

37. If thermally denatured DNA is allowed to re-associate and then passed through a hydroxyl apatite column the fraction that will be eluted last with salt is
(A) ssDNA (B) ds DNA
(C) Single copy DNA (D) Free nucleotides

38. In the present day dye terminator systems of DNA sequencing the fluorescent dyes are attached to
(A) The primers (B) ddNTPs (C) dNTPs (D) The templates

39. Large scale production of monoclonal antibodies is the result of mass culture technique involving
(A) Hybridoma Cells (B) Animal and Plant Cell Hybrids
(C) Recombinant *E. coli* (D) Animal and Bacterial Cell Hybrids

40. The least conserved histone is
(A) H4 (B) H2a (C) H3 (D) H1

41. The packaging ratio obtained in the second level of nucleosome organization is
(A) 7 (B) 3 (C) 40 (D) 100

42. The enzyme that is located in the nucleolus :
(A) RNA Pol I (B) RNA Pol II (C) RNA Pol III (D) DNA polymerase

43. The subunit of *E. coli* RNA polymerase that is involved in promoter recognition is
(A) Alpha subunit (B) Sigma subunit (C) Beta subunit (D) Delta subunit

44. The only RNA having a polyA tail is
(A) Hn RNA (B) rRNA (C) mRNA (D) tRNA

45. In lac operon IPTG is

(A) Repressor (B) Corepressor (C) Inducer (D) Aporepressor

46. *Alu* family of sequences belongs to

(A) LINES (B) MITES (C) SINES (D) LTRs

47. In the Sanger method of DNA sequencing the radioactive labeling is done to

(A) 3'-end of the primer (B) 5'-end of the primer

(C) Internal labeling of the primer (D) The templates

48. The enzyme that contains Molybdenum in its active site is

(A) Ascorbate oxidase (B) Nitrate reductase

(C) Glutamate dehydrogenase (D) Nitrogenase

49. Retroelements transpose through the following intermediate :

(A) RNA (B) Protein (C) DNA (D) Retroviruses

50. The smallest unit of DNA capable of coding for the synthesis of a polypeptide is

(A) Operon (B) Amplicon (C) Cistron (D) Replicon

51. The plasmid present in *Agrobacterium rhizogenes* is

(A) Ti (B) Ri (C) pBR322 (D) pUC

52. Glycosylation of newly synthesized proteins largely takes place in

(A) Nucleus (B) Endoplasmic reticulum

(C) Golgi bodies (D) Cytosol

53. The anticodon in tRNA that corresponds to the codon UCA in mRNA is

(A) UGA (B) TGA (C) GCU (D) AGU

54. The action of Dam methylase in GATC sequence results in

(A) ^{m}GATC (B) G^{m}ATC (C) GAT^{m}C (D) G^{m}AT^{m}C

55. The inactive form of G protein gets activated by binding to
(A) GTP (B) GDP (C) ATP (D) cAMP

56. Most common cause for PTGS involves methylation of
(A) CG islands (B) Coding sequences
(C) Promoter sequences (D) Terminator

57. The mutation that occurs during the deamination of Cytosine to Uracil is
(A) Transition (B) Transversion (C) Deletion (D) Frame-shift

58. The sulfur containing amino acid that is **NOT** found in proteins :
(A) Methionine (B) Homocysteine (C) Cysteine (D) Cystine

59. The first evidence of ds RNA leading to gene silencing was from the work on
(A) *C. elegans* (B) Petunia (C) *Arabidopsis* (D) Mouse

60. In Type II restriction enzymes, Restriction and Methylation are
(A) Simultaneous (B) Mutually exclusive
(C) Separate reactions (D) Stepwise

61. The site of binding of RNA polymerase on DNA can be characterized by the method of
(A) Fingerprinting (B) Foot printing
(C) Differential staining (D) FISH

62. The co-enzyme that forms a Schiff base linkage with lysine present in the active site of a transaminase during transamination reactions is
(A) TPP (B) Pyridoxal phosphate
(C) Biotin (D) NAD

63. Hypersensitivity reactions are mediated by
(A) IgG (B) IgD (C) IgE (D) IgM

64. J chain is present in
(A) IgA and IgM (B) IgG and IgD (C) IgA and IgG (D) IgM and IgD

65. Who among the following elucidated the basic structure of the antibody molecule and shared the nobel prize in 1972 ?

(A) Thomas and Murray (B) Porter and Edelman
(C) Richet and Border (D) Lansteiner and Theiler

66. Dihybrid test cross ratio is

(A) 9 : 3 : 3 : 1 (B) 1 : 1 : 1 : 1 (C) 1 : 6 : 6 : 1 (D) 1 : 1

67. Signal Transduction is usually initiated by modification of cytoplasmic portion of transmembrane receptors in which way ?

(A) Lysine phosphorylation (B) Tyrosine phosphorylation
(C) Alanine phosphorylation (D) Isoleucine phosphorylation

68. Antibody class switching is mediated by

(A) GM-CSF (B) RANTES (C) Interleukins (D) G-CSF

69. The F_2 ratio in additive factors in gene interaction is

(A) 12 : 3 : 1 (B) 9 : 6 : 1 (C) 15 : 1 (D) 13 : 3

70. The One-Gene-One-Enzyme hypothesis was developed based on genetic studies in

(A) *E. coli* (B) Neurospora (C) Drosophila (D) Pisum

71. Somatic hypermutation of heavy and light chain variable region genes results in

(A) Antigen diversity (B) Complement diversity
(C) Antibody diversity (D) Macrophage diversity

72. One group of effector cells that have direct cytotoxic activity against foreign cells by lysis of the target are

(A) Natural killer cells (B) Antibodies
(C) Cytokines (D) Complement proteins

73. Respiratory cycle that results in CO_2 release is

(A) Glycolysis (B) HMP shunt
(C) TCA cycle (D) Electron Transport Chain

74. ATP synthase complex is present in which pathway ?
(A) Glycolysis (B) HMP shunt
(C) TCA cycle (D) Electron Transport Chain

75. Formation of C-C, C-S, C-O and C-N bonds is catalyzed by
(A) Hydrolases (B) Oxidases (C) Ligases (D) Isomerases

76. Activation energy in a biochemical reaction can be lowered most efficiently by
(A) Enzyme catalysis (B) higher temperature
(C) Increasing substrate (D) Optimum pH

77. K_m is equal to
(A) Highest substrate conc. (B) Lowest substrate conc.
(C) Zero substrate conc. (D) Substrate conc. at half of V_{max}.

78. Glucose transport across intestinal epithelial cells occurs through which of the following types of transport ?
(A) Uniporters (B) Symporters
(C) Ion gated channels (D) Antiporters

79. DNA replication takes place only at which specific phase of the cell cycle ?
(A) M (B) G_1 (C) S (D) G_2

80. Which of the following signaling molecules can be classed as a secondary messenger ?
(A) Neurotransmitter (B) Hormone
(C) Cyclic-AMP (D) Growth factor

81. When any substrate can bind first to the enzyme and any product can leave the reaction first, the reaction is called
(A) Ordered sequential (B) Random sequential
(C) Double displacement (D) Steady state

82. Conformation of a hemoglobin molecule is an example of a
(A) Primary structure (B) Secondary structure
(C) Tertiary structure (D) Quarternary structure

83. Human genome contains about how many base pairs ?

(A) 2 billion bp (B) 3 billion bp (C) 4 billion bp (D) 5 billion bp

84. Entering a set of IUPAC codes into BLAST, helps to

(A) find out whether a certain protein has any role in human disease.

(B) search for the genes that are located on the same chromosome as a gene whose sequence you have.

(C) find which section of a piece of DNA is transcribed into mRNA.

(D) determine the identity of a protein

85. The species of bacteria that possesses 250 genes for lipid biosynthesis is

(A) *M. genitalium* (B) *M. tuberculosis*

(C) *E. coli* (D) *H. influenzae*

86. Small solid supports onto which are spotted thousands of tiny drops of DNA used to screen gene expression are

(A) Southern Blot (B) Cloning Library

(C) DNA microarrays (D) Nothern Blot

87. Which of the following is a tool for motif identification ?

(A) COPIA (B) pattern hunter

(C) PROSPECT (D) BLAST

88. Which of the following tools are used for assessing homology and similarity ?

(A) PROSPECT (B) EMBOSS (C) RASMOL (D) BLAST

89. Multiple sequence alignment can be done using

(A) BLAST (B) CLUSTAL W (C) RASMOL (D) PROSPECT

90. NCBI Human Genome page gives information on

(A) Determine what genes are around the gene of interest on its chromosome.

(B) Identify a DNA sequence and see if it came from a human.

(C) Look up papers about diseases caused by abnormalities in a certain protein.

(D) Look at colorful, rotating, 3-D pictures of the tertiary structure of a protein.

91. Which of the following bacteria can grow in acidic medium ?
(A) *Vibrio cholerae* (B) *Lactobacilli*
(C) *Shigella* (D) *Salmonella*

92. Which of the following is a nucleotide sequence data base ?
(A) EMBL (B) SWISS PROT (C) PROSITE (D) TREMBL

93. Pheophytin-quinone type of system containing roughly equal amounts of chlorophylls *a* and *b* is called
(A) Photosystem I (B) Photosystem II
(C) Z scheme (D) Calvin cycle

94. A recombinant DNA molecule is also called a
(A) Chimera (B) Clone (C) Vector (D) Phage

95. Which of the following restriction enzymes produces 'sticky' ends ?
(A) EcoRI (B) SmaI (C) PvuII (D) HaeIII

96. Before freeze drying, a dense cell suspension is placed in small vials and frozen at
(A) –60°C to –78°C (B) –20°C to –38°C
(C) –30°C to –48°C (D) –40°C to –58°C

97. All of the following enzymes are involved in DNA replication, except
(A) Helicase (B) Primase
(C) DNA polymerase (D) RNA polymerase

98. The solidifying agent normally used for media preparation is
(A) Silica gel (B) Gelatin (C) Acrylamide (D) Agar

99. Why are heat-killed bacteria be useful as a vaccine ?
(A) They can cause a lethal infection.
(B) Heat degradation of proteins changes their shape.
(C) Molecules from the cell surface are still intact and can provoke an immune response.
(D) DNA molecules can transform other strains of bacteria.

100. When a mixture of DNA fragments undergo gel electrophoresis,

(A) smaller fragments move slower and further on the gel relative to larger fragments.

(B) larger fragments move slower and further on the gel relative to smaller fragments.

(C) smaller fragments move faster, but not as far on the gel relative to larger fragments.

(D) larger fragments move slower and not as far on the gel relative to smaller fragments.

101. The number of nitrogenous bases that are codes for 9 amino acids would be

(A) 27 (B) 9 (C) 3 (D) 18

102. Which of the following enzymes would be considered a exonuclease, an enzyme with the ability to remove incorrectly matched nucleotides ?

(A) DNA helicase (B) RNA polymerase

(C) Peptidyl transferase (D) DNA polymerase

103. The principle behind PCR is

(A) the cloning of one's entire DNA sequence to create genetically similar organisms

(B) the combination of two different organism's DNA

(C) the amplication of a specific region of the DNA for further study

(D) the extraction of DNA from a cell

104. ATATATATAT is an example of

(A) SNP (B) SSR (C) RAPD (D) None of these

105. The gene that was induced in flavr savr tomato for delayed ripening by suppressing production of ACC, a precursor to Ethylene is

(A) Polygalacturonase (B) Geraniol synthase

(C) ACC deaminase (D) ACC synthase

106. Yield coefficient represents

(A) total biomass or product produced

(B) conversion efficiency of a substrate into product

(C) conversion rate of a substrate into biomass or product

(D) production time of biomass or product

107. The lowest biomass yield in a culture of *Escherichia coli* will be in

(A) an aerated batch culture containing a initial high concentration of glucose

(B) an aerated batch reactor containing an initial low concentration of glucose

(C) an aerated fed-batch reactor having a low glucose concentration

(D) an aerated continuous reactor having a low glucose concentration

108. The lowest yield of ATP is in

(A) fermentation (B) aerobic respiration

(C) anaerobic respiration (D) All of the above

109. The continuous cultures are not widely used in industry because

(A) they are not suited for the production of secondary metabolites

(B) contamination or mutation can have a disastrous effect on the operation

(C) the government will not approve the licensing of pharmaceuticals produced in continuous cultures

(D) all of the above

110. If biomass yields are constant, then the biomass productivity of a culture grown in continuous reactor will

(A) always decrease with dilution rate

(B) increase with dilution rate until washout

(C) remain constant irrespective of the dilution rate

(D) decrease with dilution rate until washout

111. Acetyl CoA Carboxylase (ACC) is the first enzyme of the biosynthetic pathway of which of the following biomolecules ?

(A) Amino Acids (B) Monosaccarides

(C) Fatty Acids (D) Purines

112. The most popular and commonly used, studied and characterized cells for expression of human recombinant glycoproteins whose glycosylation enzymes resemble of human cell lines are

(A) Chinese Hamster Ovary (CHO) (B) Human Fibroblast cells

(C) XPV cells (D) Embryonic stem cells

113. While choosing a gene to be transferred for genetic modification, the target gene should have

(A) Promoter (B) Selectable marker

(C) Exon (D) All of the above

114. To create a homozygous pattern necessary for stable inheritance, first generation offspring should be _____ and need to be inbred.

(A) Homozygous (B) Heterozygous

(C) Both (A) and (B) (D) None of the above

115. Which of the following Genetically modified crop is commercially cultivated in India ?

(A) Rice (B) Cotton (C) Soyabean (D) Maize

116. To confirm the presence of the gene of interest, which of the following methods is used ?

(A) Nothern Blotting (B) Western Blotting

(C) Southern Blotting (D) None of the above

117. Regeneration of a modified organism in plants requires which of the following technique ?

(A) Tissue culture (B) Embryonic stem cells

(C) Bacterial cultures (D) All of the above

118. SV40 is a virus isolated from

(A) Hamster (B) Monkey (C) Goat (D) Bacteria

119. The purpose of the nanocomputer, which consists of DNA and DNA processing enzymes whose input, output and software are all in the form of DNA molecules, is to

(A) Analyze DNA (B) Detect abnormalities in the human body

(C) Formulate remedies (D) All of the above

120. Reproductive cloning in animals is achieved through

(A) Tissue culture (B) Micropropagation

(C) Somatic nuclear transfer (D) None of the above

SPACE FOR ROUGH WORK

BIO TECHNOLOGY (BT)
SET-A

Question No	Answer	Question No	Answer
1	B	61	B
2	A	62	B
3	B	63	C
4	C	64	A
5	D	65	B
6	A	66	B
7	B	67	B
8	B	68	C
9	C	69	B
10	A	70	B
11	B	71	C
12	C	72	A
13	B	73	C
14	C	74	D
15	C	75	C
16	D	76	A
17	D	77	D
18	B	78	D
19	A	79	C
20	B	80	C
21	B	81	B
22	A	82	D
23	D	83	B
24	A	84	D
25	B	85	B
26	C	86	C
27	A	87	A
28	C	88	D
29	B	89	B
30	C	90	A
31	A	91	B
32	B	92	A
33	B	93	B
34	B	94	A
35	A	95	A
36	D	96	A
37	B	97	D
38	B	98	D
39	A	99	C
40	D	100	D
41	C	101	A

42	A	102	D
43	B	103	C
44	C	104	B
45	C	105	A
46	C	106	B
47	B	107	A
48	D	108	A
49	A	109	D
50	C	110	B
51	B	111	C
52	C	112	A
53	D	113	D
54	B	114	B
55	A	115	B
56	B	116	C
57	A	117	A
58	B	118	B
59	A	119	D
60	A	120	C