



Booklet No. :

BT - 16

Bio Technology

Duration of Test : 2 Hours

Max. Marks : 120

Hall Ticket No.

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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.

BT-16-A



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BIOTECHNOLOGY (BT)

- 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.
- 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
- The function $f(x, y) = xy + a\left(\frac{1}{x} + \frac{1}{y}\right)$ is minimum at the point
 (A) $(0, a)$ (B) (a, a) (C) $(a, 0)$ (D) $(0, 0)$
- If $x = u(1-v)$ and $y = uv$ then $\frac{\partial(x, y)}{\partial(u, v)} =$
 (A) 1 (B) $u+v$ (C) u (D) $1-u$
- 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
- 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) $\frac{5^x e^{-5}}{x!}$
- The degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^2 + x\left(\frac{dy}{dx}\right)^2 + e^2y = 0$ is
 (A) 0 (B) 2 (C) 3 (D) 5

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8. The solution of the equation $xe^{-x} dx + \sin y dy = 0$ is
- (A) $e^{-x} + \sin y = C$ (B) $\frac{e^{-x^2}}{2} + \cos y = C$
 (C) $xe^{-x} + \sin y = C$ (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) $|f(x)f'(x)| \leq |f(x)|^2$
 (C) $|f(x)f'(x)| \leq |f'(x)|^2$ (D) $|f'(x)| > 0$
10. If $y' = y + y^2$ 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) Phosphoglucose mutase (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

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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 inflammation

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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

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35. The term *molecular biology* was coined in 1937 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) dsDNA
 (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

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45. In an operon it 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) ^mGATC (B) G^mATC (C) GAT^mC (D) G^mAT^mC

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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

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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

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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

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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) Northern 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.

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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 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 amplification 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 flavor saver 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) Monosaccharides
 - (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

Set - A

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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) Northern 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



Set - A

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BT



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