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PHD-EE-2013

SUBJECT : Biotechnology Engineering



Sr. No. 10011

Time : 1½ Hours

Max. Marks : 100

Total Questions : 100

Candidate's Name _____ Date of Birth _____

Father's Name _____ Mother's Name _____

Roll No. (in figures) _____ (in words) _____

Date of Examination _____

(Signature of the Candidate)

(Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. **All questions are compulsory and carry equal marks.**
2. All the candidates **must return** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means/misbehaviour will be registered against him/her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing **within two hours** after the test is over. No such complaint(s) will be entertained thereafter.
4. The candidate **must not** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers **Should Not** be ticked in the question booklet.
5. **Use black or blue ball point pen only in the OMR Answer-Sheet.**
6. For each correct answer, the candidate will get full credit. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer. There will be No Negative marking.
7. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained 30 minutes after starting of the examination.*

1. DNA vaccination induces :
 - (1) Cytotoxic T-cell response
 - (2) NK cell response
 - (3) Antibody response
 - (4) Immediate hypersensitivity response
2. Quantitative Structure Activity Relationship (Q SAR) is used for :
 - (1) Molecular dynamics simulation
 - (2) Protein modelling
 - (3) Aligning two sequences
 - (4) Drug design
3. First successful vaccine against cancer has been prepared for :
 - (1) Oral cancer
 - (2) Breast cancer
 - (3) Cervical cancer
 - (4) Colon cancer
4. Overall cost of production of recombinant DNA products for human use, in general increases due to complication in :
 - (1) Fermentation process
 - (2) Formulation process
 - (3) Upstream processing
 - (4) Downstream processing
5. Which of the following provides maximum information to do structure based drug design ?
 - (1) 3D- structure of a set of active compounds
 - (2) 3D-structure of the target
 - (3) Crystal structure of the target-ligand complex
 - (4) Primary structure of the target
6. Hela cell line is derived from which type of carcinoma ?
 - (1) Lung
 - (2) Colon
 - (3) Brain
 - (4) Cervical
7. Which of the following proteins was used to create first transgenic fish ?
 - (1) Antifreezing protein
 - (2) Horseshoe protein
 - (3) Myosin protein
 - (4) Green fluorescent protein
8. The product commercially produced by animal cell culture is :
 - (1) Hepatitis B vaccine
 - (2) Tissue plasminogen activator
 - (3) Insulin
 - (4) Interferon
9. Which of the following viruses has been extensively used as expression vector for a number of foreign genes ?
 - (1) Vaccinia virus
 - (2) Rotavirus
 - (3) Rabies virus
 - (4) Papilloma virus

10. Glofish is :
- (1) Commercial name of tuna fish
 - (2) Patented zebra fish genetically engineered with GFP
 - (3) An angler fish harbouring bioluminescent bacteria
 - (4) A cutter shark fish which catches its prey with the help of bioluminescent bacteria residing near the gills
11. Kinetics of microbial growth in a batch culture is represented by :
- (1) Henry's law
 - (2) Michaelis-Menton equation
 - (3) Arrhenius equation
 - (4) Monod equation
12. Which one of the following is an unprotected fermentation ?
- (1) Enzyme production
 - (2) Antibiotic production
 - (3) Citric acid production
 - (4) Ethanol production
13. Which of the following reactor systems is generally used to generate microbial mutants ?
- (1) BSTR system
 - (2) CSTR system
 - (3) PBR system
 - (4) FBR system
14. Identify the parameter among the following used for scale up of a shear sensitive cells in a fermentation process :
- (1) $K_L a$
 - (2) Power per unit volume
 - (3) Impeller tip speed
 - (4) Air flow rate in vvm
15. During batch fermentation lowest specific growth rate is achieved during :
- (1) Exponential phase
 - (2) Lag & stationary phase
 - (3) When cell division rate is highest
 - (4) All throughout the process
16. Commercial microbial source of citric acid is :
- (1) *Aspergillus niger*
 - (2) *Alcaligenes eutrophus*
 - (3) *Klebsiella oxytoca*
 - (4) *Corynebacterium lilium*
17. In which of the following fermentations, an inhibitor is added to increase the productivity ?
- (1) Citric acid fermentation
 - (2) Rifamycin B fermentation
 - (3) Glutamic acid fermentation
 - (4) Tetracyclin fermentation

18. Biological washing powders remove stains by enzymatic action. Which of the following combinations would be most effective in removing egg stain ?
- | | |
|------------------------|-----------------------|
| (1) Amylase & protease | (2) Catalase & lipase |
| (3) Lipase & protease | (4) Lipase & maltase |
19. Plug flow of both gas phase and liquid phase is a characteristic of :
- | | |
|---------------------------|---------------------------|
| (1) STR | (2) Air-lift reactor |
| (3) Bubble column reactor | (4) Fluidized bed reactor |
20. Decrease in apparent viscosity of a liquid with increasing shear rate is known as :
- | | |
|-----------------|---------------------|
| (1) Dilatant | (2) Pseudo plastic |
| (3) Casson body | (4) Bingham plastic |
21. Scientist who received Nobel prize for Golden Rice Technology is :
- | | |
|-----------------------|-----------------|
| (1) M. S. Swaminathan | (2) I. Potrykus |
| (3) G. S. Khush | (4) N. Borlang |
22. Sodium alginate is used in :
- | | |
|----------------------------|--------------------------------|
| (1) Protoplast fusion | (2) Cryopreservation |
| (3) Media as gelling agent | (4) Artificial seed production |
23. In agrobacterium mediated genetic transformation the proteins which remain attached to the T-DNA during transfer to plant cells is/are :
- | | |
|------------|----------------------|
| (1) Vir D2 | (2) Vir E2 |
| (3) Vir G | (4) Both Vir D2 & E2 |
24. Which of the following is a seed specific promoter used in plant genetic engineering ?
- | | |
|-----------------------|------------------------|
| (1) CaMV 35S promoter | (2) Ubiquitin promoter |
| (3) Glutelin promoter | (4) ABRE promoter |
25. RNAi can be applied to plants for providing resistance against :
- | | | | |
|-------------|------------|-----------|------------------|
| (1) Insects | (2) Fungus | (3) Virus | (4) All of these |
|-------------|------------|-----------|------------------|
26. ABA is a :
- | | |
|--------------------|---------------------|
| (1) Stress hormone | (2) Growth promoter |
| (3) Protein | (4) Polyamine |
27. SSR markers are :
- | | | | |
|--------------|-----------------|---------------|---------------|
| (1) Dominant | (2) Co-dominant | (3) Epistatic | (4) Recessive |
|--------------|-----------------|---------------|---------------|

28. Application of molecular biological techniques for commercial products and recombinant products in plants is referred as :
- (1) Transgenic technology
 - (2) Biotech crops technology
 - (3) Molecular forming
 - (4) Recombinant DNA technology
29. Clean gene technology means creating :
- (1) Transgenic plants with marker genes
 - (2) Transgenic plants with mechanism of removing marker gene after transformation
 - (3) Plants obtained with conventional breeding
 - (4) Transgenic plants obtained through plastid transformation
30. Transgenic for terminator seed is due to a lethal gene along with two other genes. Which of the following is the product of the lethal gene ?
- (1) Recombinase
 - (2) Repressor protein
 - (3) Protein for late embryogenesis
 - (4) Ribosomal inhibiting protein
31. Which one of the following microscopic techniques is best suited to visualize topology and distribution of transmembrane protein of a cell membrane ?
- (1) Scanning electron microscopy
 - (2) Transmission electron microscopy
 - (3) Freeze fracture electron microscopy
 - (4) Thin section electron microscopy
32. Expression of a gene can be detected using :
- (1) Southern and northern blotting
 - (2) Northern and western blotting
 - (3) Southern and western blotting
 - (4) South western blotting
33. ELISA :
- (1) Results in cell lysis
 - (2) Uses radiolabelled second antibody
 - (3) Involves addition of substrate which is converted into colored product
 - (4) Requires sensitized RBCs
34. ESTs are obtained through :
- (1) Genomic DNA library
 - (2) cDNA library
 - (3) RT-PCR
 - (4) Chromosome walking
35. X-ray crystallography can be used to determine :
- (1) Primary structure
 - (2) Secondary structure
 - (3) Tertiary structure
 - (4) All of the above

36. Polymorphism in alpha-amylase gene can be studied by :
(1) Southern blot (2) Slot blot (3) Dot blot (4) Northern blot
37. Two proteins have the same molecular mass as well as isoelectric point. The best way to separate them would be to use :
(1) Gel filtration chromatography
(2) Reverse-phase chromatography
(3) Ion exchange chromatography
(4) Chromatofocussing
38. Protein-protein interactions can be studied by :
(1) DNA foot printing (2) Ligase chain reaction
(3) Co-immunoprecipitation (4) Chromatin immunoprecipitation
39. Immunoprecipitation occurs when :
(1) Antigen is in excess
(2) Antibody is in excess
(3) Both antigen and antibody are equivalent
(4) Antigen is attached to adjuvant
40. Electrophoresis of a purified protein in SDS-PAGE in the presence of 2-mercaptoethanol yields two bands of 35 kDa and 45 kDa. However, in a gel filtration chromatography, the same protein elutes as 80 kDa. What conclusion can be drawn from above observation ?
(1) Protein is not purified to homogeneity
(2) Two bands generated in SDS-PAGE due to degradation
(3) Protein is a multimer
(4) Protein is a heterodimer
41. Most predominant antibody in serum is :
(1) Ig G (2) Ig D (3) Ig E (4) Ig A
42. Idiotypic determinants of a given immunoglobulin molecule are located within :
(1) The hinge region
(2) Constant regions of light chains
(3) Constant regions of heavy chains
(4) Hyper variable regions of heavy & light chains
43. CD-19 is a marker for :
(1) NK cells (2) Macrophages (3) B-cells (4) T-cells

44. HAT selection is based on :
(1) TK and HPRT genes (2) APRT and ATK genes
(3) HK and AP genes (4) HAT gene
45. Which of the following cytokines is secreted by both Th 1 and Th 2 cells ?
(1) IL - 2 (2) IL - 3 (3) IL - 4 (4) IFN - γ
46. Graft rejection is induced by :
(1) Antibody response (2) T-helper cell response
(3) NK-T cell response (4) Cytotoxic T-cell response
47. Which of the following cell types will be involved in an immediate hypersensitivity reaction due to an insect sting ?
(1) Neutrophils (2) Eosinophils
(3) Basophils (4) Mast cells
48. Cytotoxic T-cells generally recognise antigen in association with :
(1) HLA-DR determinants (2) Class I MHC determinants
(3) Class II MHC determinants (4) Class III MHC determinants
49. Patient suffering from tetanus are given antiserum therapy. This process immunization is defined as :
(1) Active immunization (2) Passive immunization
(3) Booster immunization (4) Prophylaxis
50. Which of the following blood cell count decreases rapidly in dengue ?
(1) Basophils (2) Eosinophils (3) Platelets (4) Monocytes
51. Which of the following is a molecular chaperone ?
(1) Dna G (2) Dna A (3) Lysozyme (4) Dna K
52. Ultraviolet radiation causes DNA damage by formation of :
(1) Cytidine dimer (2) Thymidine dimer
(3) Adenine dimer (4) Guanine dimer
53. Which of the following is an ABC transporter ?
(1) Acetylcholine receptor (2) Multidrug resistance protein
(3) Bacteriorhodopsin (4) ATP synthase

54. Calf thymus terminal nucleotidyl transferase :
- (1) Adds nucleotides to the 3'OH terminus of a DNA molecule
 - (2) Adds nucleotides to the 5'P terminus of a DNA molecule
 - (3) Removes nucleotides from 3'OH terminus of a DNA molecule
 - (4) Removes nucleotides from 5'P terminus of a DNA molecule
55. Restriction enzymes which do not require ATP belong to :
- (1) Type I
 - (2) Type II
 - (3) Type III
 - (4) Type IV
56. If you were to use *E. coli* DNA polymerase instead of taq polymerase in a PCR reaction, you will have to :
- (1) Use different primers
 - (2) Carry out denaturation step at 50°C instead of 95°C
 - (3) Use water bath instead of thermal block
 - (4) Add fresh enzyme after each denaturation step
57. Which of the following RNA sequences could form a hairpin fold ?
- (1) AGG UUU CCU
 - (2) AAA AAA AAA
 - (3) AGG UUU GGA
 - (4) AGG UUU AGG
58. RT-PCR reaction sequentially uses :
- (1) RNA dependent DNA polymerase & DNA dependent DNA polymerase I
 - (2) RNA dependent DNA polymerase & DNA dependent DNA polymerase
 - (3) RNA polymerase & DNA dependent DNA polymerase
 - (4) RNA polymerase & DNA polymerase I
59. The stability of recombinant protein can be enhanced by :
- (1) Altering the C-terminal region of protein
 - (2) Exclusion of PEST sequences from the protein
 - (3) Production of compound similar to detergents to prevent formation of inclusion bodies
 - (4) Altering N-terminus by adding Leucine or phenylalanine by genetic manipulation
60. RNAi technology is often used to :
- (1) Increase the rate of production of an enzyme of pharmacological significance
 - (2) Decrease the production from a harmful gain-of-function of mutated gene
 - (3) To mutate an unwanted allele in a homozygous individual
 - (4) To form a knockout organism that will not pass the deleted sequence to its progeny

61. Gene therapy through stem cells may be done using :
- (1) Plasmid vector
 - (2) Lentiviral vector
 - (3) Episomal vector
 - (4) Baculovirus vector
62. Embryonic stem cells are derived from :
- (1) Fertilized embryo
 - (2) Unfertilized embryo
 - (3) Sperm
 - (4) Brain
63. Xenotransplantation is :
- (1) Transfer of an organ or tissue between genetically different individuals of same species
 - (2) Transfer of an organ or tissue between genetically identical individuals
 - (3) Transfer of an organ or tissue from an animal to human being
 - (4) Transfer of an organ or tissue from xenopus to human being
64. Fertilized single cell cattle egg is what type of stem cell ?
- (1) Totipotent stem cell
 - (2) Pluripotent stem cell
 - (3) Multipotent stem cell
 - (4) None of these
65. Which of the following cells *cannot* be used in regenerative medicine ?
- (1) Bone marrow cells
 - (2) Embryonic stem cells
 - (3) Skeletal muscle cells
 - (4) CNS cells
66. Mean deviation for ungrouped data is calculated as :
- (1) $\sqrt{\frac{\sum x^2}{N}}$
 - (2) $\frac{\sum |f.x|}{\sum f}$
 - (3) $\frac{\sum |x|}{N}$
 - (4) $\sqrt{\frac{\sum x^2}{N-1}}$

Statement for Q. Nos. 67 & 68 : The abdomen length (in millimeters) was measured in male fruit flies and the following data were obtained :

2.2, 2.3, 1.6, 2.1, 2.3, 2.0, 2.0, 1.8, 1.7, 2.4, 2.2, 2.0, 2.1, 2.4 and 1.9

67. Variance (V_x) for this population of fruit flies as calculated from the above data shall be :
- (1) 0.85
 - (2) 0.25
 - (3) 0.061
 - (4) 0.08
68. The value of Standard Deviation (S.D.) will be :
- (1) 0.061
 - (2) 0.25
 - (3) 0.61
 - (4) 0.85

69. Which type of biostatistical analysis would be done for drugs tested on different types of animal species with sampling variations ?
 (1) T-test (2) Z-test
 (3) ANOVA-one way (4) ANOVA-two way
70. Which of the following is a non-parametric test ?
 (1) Chi-square test (2) T-test (3) F-test (4) Z-test
71. You can patent a product/process only if it is :
 (1) a major discovery reported in high impact journals
 (2) novel, non-obvious and usable
 (3) new and extension of earlier principles
 (4) new applications of a patented product
72. Crop varieties cannot be subjected to intellectual property rights in the form of :
 (1) PBR (2) FRA (3) PPV (4) TRIP
73. An agreement about regulating both tariff rates and quantitative restrictions on global imports and exports is :
 (1) GATT (2) TRIP
 (3) WIPO (4) PBR
74. The biosafety problem due to spread of transgenes from transgenic plants to its wild relatives can be avoided by :
 (1) Developing transgenic plants with herbicide markers
 (2) Posi-tech selection using non-antibiotic markers like pmi
 (3) Developing transplastonic lines
 (4) Elimination of markers using Cre/Lox system
75. Which of the following is *not* relevant to recombinant DNA safety guidelines in India ?
 (1) IBSC (2) RCGM (3) GEAC (4) NBPGR
76. Which of the following bacterial species cannot be used as biopesticide ?
 (1) Pseudomonas (2) Enterobacter (3) Bacillus (4) Haemophilus
77. Which of the following gases has the most powerful greenhouse effect, based on per molecule ?
 (1) CO_2 (2) CFC's (3) CH_4 (4) N_2O

78. Phenomenon *not* associated with phytoremediation is :
(1) Phytoextraction (2) Rhizofiltration
(3) Bioleaching (4) Phytotransformation
79. Gold extraction from mine waste is carried out by which of the following microbes ?
(1) *Pseudomonas* (2) Nitrifying bacteria
(3) *Pseudoxanthomonas* (4) *Acidithiobacillus*
80. The model marine organism that is widely used in assay system for the detection of antifouling substance is :
(1) *Mytilus edulis* (2) *Peneaus monodon*
(3) *Sardinella longiceps* (4) *Crassostrea* sp.
81. CpG islands and codon bias tools are used in eukaryotic genomics to :
(1) Look for DNA binding domains
(2) Identify open reading frames
(3) Determining STS
(4) Differentiate between prokaryotic and eukaryotic DNA sequences
82. Nice Prot is :
(1) Protein sequence database (2) Derived protein database
(3) Protein sequence view (4) Nucleotide sequence view
83. Molecular dynamics simulation is carried out for :
(1) Obtaining ensemble of structures at physiological condition
(2) Obtaining the structure at global energy minimum
(3) Fitting prospective drug candidate molecules to a receptor
(4) Modelling a protein structure from sequence alone
84. Ab initio approaches for prediction of protein structure utilize :
(1) Sequence similarity
(2) Structural similarity
(3) Both sequence and structural similarity
(4) Basic physicochemical principles
85. The sequence alignment tool for immunoglobulins, T-cell receptors and HLA molecules available at Immunogenetics information system (IMGT) is :
(1) IMGT/colliers-de-perles (2) IMGT/V-quest
(3) IMGT/Allele-Align (4) IMGT/Junction Analysis

86. Flow diagram of a biosensor is :

- (1) analyte → transducer → bioreceptor → electric signal
- (2) analyte → bioreceptor → electric signal → transducer
- (3) analyte → bioreceptor → transducer → electric signal
- (4) analyte → electric signal → bioreceptor → transducer

87. First commercial biosensor – the blood glucose biosensor is :

- (1) Fluorescence biosensor
- (2) SPR biosensor
- (3) DNA microarray biosensor
- (4) Electrochemical biosensor

88. Which of the following is **not** a sensing technique for biosensors ?

- (1) SERS
- (2) QCM
- (3) SPM
- (4) MS

89. Which of the following is **not** a characteristic of a biosensor ?

- (1) Sensitivity
- (2) Linearity
- (3) Response time
- (4) Versatility

90. DNA biosensors are based on :

- (1) Replication
- (2) Translation
- (3) Hybridization
- (4) Restriction

91. In a mass transfer system, the unit of diffusivity is :

- (1) m^2/h
- (2) m/h
- (3) $m.k/h$
- (4) h/m^2

92. Product yield coefficient is defined as :

- (1) Cell mass formed : substrate utilized
- (2) Substrate utilized : cell mass formed
- (3) Product formed : substrate utilized
- (4) Substrate utilized : product formed

93. Which of the following extraction methods will be most suitable in a solvent extraction system with a solute of low partition coefficient ?

- (1) Multistage batch extraction
- (2) Single batch extraction
- (3) Counter-current extraction
- (4) Co-current extraction

94. Rate of adsorption of a sparingly soluble gas in a liquid can be increased by :

- (1) Increasing the gas side mass transfer coefficient
- (2) Decreasing the gas side mass transfer coefficient
- (3) Increasing the liquid side mass transfer coefficient
- (4) Decreasing the liquid side mass transfer coefficient

95. Separation factor in solvent extraction process increases if :
- (1) Volume of organic solvent increases
 - (2) Volume of organic solvent decreases
 - (3) Volume of aqueous phase increases
 - (4) Partition coefficient of solute decreases
96. Which of the following is the best annotated database ?
- (1) Genbank
 - (2) PDB
 - (3) Prodom
 - (4) Swissprot
97. PROSITE is :
- (1) a database of protein structures
 - (2) a database of interacting proteins
 - (3) a database of protein motifs
 - (4) a search tool
98. One PAM means one accepted point mutation per :
- (1) 10^2 residues
 - (2) 10 residues
 - (3) 10^3 residues
 - (4) 10^4 residues
99. Blast X is used to :
- (1) Search a nucleotide database using a nucleotide query
 - (2) Search a protein database using a protein query
 - (3) Search a protein database using a translated nucleotide query
 - (4) Search a translated nucleotide database using a protein query
100. Which of the following databases is derived from mRNA information ?
- (1) OMIM
 - (2) PDB
 - (3) HTGS
 - (4) dbEST