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PHD-EE-2013

SUBJECT : Biotechnology Engineering

D

Sr. No. 10012

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. Most predominant antibody in serum is :
(1) Ig G (2) Ig D
(3) Ig E (4) Ig A
2. 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
3. CD-19 is a marker for :
(1) NK cells (2) Macrophages (3) B-cells (4) T-cells
4. HAT selection is based on :
(1) TK and HPRT genes (2) APRT and ATK genes
(3) HK and AP genes (4) HAT gene
5. 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
6. Graft rejection is induced by :
(1) Antibody response (2) T-helper cell response
(3) NK-T cell response (4) Cytotoxic T-cell response
7. 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
8. 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
9. Patient suffering from tetanus are given antiserum therapy. This process of immunization is defined as :
(1) Active immunization (2) Passive immunization
(3) Booster immunization (4) Prophylaxis
10. Which of the following blood cell count decreases rapidly in dengue ?
(1) Basophils (2) Eosinophils (3) Platelets (4) Monocytes

11. Which of the following is a molecular chaperone ?
(1) Dna G (2) Dna A (3) Lysozyme (4) Dna K
12. Ultraviolet radiation causes DNA damage by formation of :
(1) Cytidine dimer (2) Thymidine dimer
(3) Adenine dimer (4) Guanine dimer
13. Which of the following is an ABC transporter ?
(1) Acetylcholine receptor (2) Multidrug resistance protein
(3) Bacteriorhodopsin (4) ATP synthase
14. 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
15. Restriction enzymes which do not require ATP belong to :
(1) Type I (2) Type II
(3) Type III (4) Type IV
16. 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
17. 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
18. 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

19. 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
20. 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
21. Gene therapy through stem cells may be done using :
- (1) Plasmid vector
 - (2) Lentiviral vector
 - (3) Episomal vector
 - (4) Baculovirus vector
22. Embryonic stem cells are derived from :
- (1) Fertilized embryo
 - (2) Unfertilized embryo
 - (3) Sperm
 - (4) Brain
23. 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
24. 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
25. 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

26. Mean deviation for ungrouped data is calculated as :

$$(1) \sqrt{\frac{\sum x^2}{N}} \quad (2) \frac{\sum |f \cdot x|}{\sum f} \quad (3) \frac{\sum |x|}{N} \quad (4) \sqrt{\frac{\sum x^2}{N-1}}$$

Statement for Q. Nos. 27 & 28 : The abdomen length (in millimeters) was measured in 15 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

27. Variance (V_x) for this population of fruit flies as calculated from the above data shall be :

$$(1) 0.85 \quad (2) 0.25 \quad (3) 0.061 \quad (4) 0.08$$

28. The value of Standard Deviation (S.D.) will be :

$$(1) 0.061 \quad (2) 0.25 \quad (3) 0.61 \quad (4) 0.85$$

29. Which type of biostatistical analysis would be done for drugs tested on different types of animal species with sampling variations ?

$$(1) \text{ T-test} \quad (2) \text{ Z-test} \\ (3) \text{ ANOVA-one way} \quad (4) \text{ ANOVA-two way}$$

30. Which of the following is a non-parametric test ?

$$(1) \text{ Chi-square test} \quad (2) \text{ T-test} \\ (3) \text{ F-test} \quad (4) \text{ Z-test}$$

31. You can patent a product/process only if it is :

$$(1) \text{ a major discovery reported in high impact journals} \\ (2) \text{ novel, non-obvious and usable} \\ (3) \text{ new and extension of earlier principles} \\ (4) \text{ new applications of a patented product}$$

32. Crop varieties cannot be subjected to intellectual property rights in the form of :

$$(1) \text{ PBR} \quad (2) \text{ FRA} \quad (3) \text{ PPV} \quad (4) \text{ TRIP}$$

33. An agreement about regulating both tariff rates and quantitative restrictions on global imports and exports is :

$$(1) \text{ GATT} \quad (2) \text{ TRIP} \\ (3) \text{ WIPO} \quad (4) \text{ PBR}$$

34. 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 transplastic lines
 - (4) Elimination of markers using Cre/lox system
35. Which of the following is *not* relevant to recombinant DNA safety guidelines in India ?
- (1) IBSC
 - (2) RCGM
 - (3) GEAC
 - (4) NBPGR
36. Which of the following bacterial species cannot be used as biopesticide ?
- (1) Pseudomonas
 - (2) Enterobacter
 - (3) Bacillus
 - (4) Haemophilus
37. 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
38. Phenomenon *not* associated with phytoremediation is :
- (1) Phytoextraction
 - (2) Rhizofiltration
 - (3) Bioleaching
 - (4) Phytotransformation
39. Gold extraction from mine waste is carried out by which of the following microbes ?
- (1) Pseudomonas
 - (2) Nitrifying bacteria
 - (3) Pseudoxanthomonas
 - (4) Acidithiobacillus
40. 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.
41. C_pG 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

42. Nice Prot is :
- (1) Protein sequence database
 - (2) Derived protein database
 - (3) Protein sequence view
 - (4) Nucleotide sequence view
43. 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
44. 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
45. 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
46. 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
47. First commercial biosensor – the blood glucose biosensor is :
- (1) Fluorescence biosensor
 - (2) SPR biosensor
 - (3) DNA microarray biosensor
 - (4) Electrochemical biosensor
48. Which of the following is *not* a sensing technique for biosensors ?
- (1) SERS
 - (2) QCM
 - (3) SPM
 - (4) MS
49. Which of the following is *not* a characteristic of a biosensor ?
- (1) Sensitivity
 - (2) Linearity
 - (3) Response time
 - (4) Versatility
50. DNA biosensors are based on :
- (1) Replication
 - (2) Translation
 - (3) Hybridization
 - (4) Restriction

51. 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
52. 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
53. 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
54. 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
55. 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
56. Which of the following is the best annotated database ?
- (1) Genbank (2) PDB
(3) Prodom (4) Swissprot
57. PROSITE is :
- (1) a database of protein structures (2) a database of interacting proteins
(3) a database of protein motifs (4) a search tool
58. One PAM means one accepted point mutation per :
- (1) 10^2 residues (2) 10 residues
(3) 10^3 residues (4) 10^4 residues

59. 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
60. Which of the following databases is derived from mRNA information ?
- (1) OMIM
 - (2) PDB
 - (3) HTGS
 - (4) dbEST
61. DNA vaccination induces :
- (1) Cytotoxic T-cell response
 - (2) NK cell response
 - (3) Antibody response
 - (4) Immediate hypersensitivity response
62. Quantitative Structure Activity Relationship (Q SAR) is used for :
- (1) Molecular dynamics simulation
 - (2) Protein modelling
 - (3) Aligning two sequences
 - (4) Drug design
63. First successful vaccine against cancer has been prepared for :
- (1) Oral cancer
 - (2) Breast cancer
 - (3) Cervical cancer
 - (4) Colon cancer
64. 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
65. 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
66. Hela cell line is derived from which type of carcinoma ?
- (1) Lung
 - (2) Colon
 - (3) Brain
 - (4) Cervical
67. 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

68. The product commercially produced by animal cell culture is :
- (1) Hepatitis B vaccine
 - (2) Tissue plasminogen activator
 - (3) Insulin
 - (4) Interferon
69. 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
70. 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
71. 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
72. Which one of the following is an unprotected fermentation ?
- (1) Enzyme production
 - (2) Antibiotic production
 - (3) Citric acid production
 - (4) Ethanol production
73. 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
74. 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
75. 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

76. Commercial microbial source of citric acid is :
- (1) *Aspergillus niger* (2) *Alcaligenes eutrophus*
(3) *Klebsiella oxytoca* (4) *Corynebacterium lilium*
77. 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
78. 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
79. 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
80. 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
81. Scientist who received Nobel prize for Golden Rice Technology is :
- (1) M. S. Swaminathan (2) I. Potrykus
(3) G. S. Khush (4) N. Borlang
82. Sodium alginate is used in :
- (1) Protoplast fusion (2) Cryopreservation
(3) Media as gelling agent (4) Artificial seed production
83. 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
84. 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
85. RNAi can be applied to plants for providing resistance against :
- (1) Insects (2) Fungus
(3) Virus (4) All of these

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86. ABA is a :
- (1) Stress hormone
 - (2) Growth promoter
 - (3) Protein
 - (4) Polyamine
87. SSR markers are :
- (1) Dominant
 - (2) Co-dominant
 - (3) Epistatic
 - (4) Recessive
88. Application of molecular biological techniques for commercial production of recombinant products in plants is referred as :
- (1) Transgenic technology
 - (2) Biotech crops technology
 - (3) Molecular forming
 - (4) Recombinant DNA technology
89. 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
90. 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
91. Which one of the following microscopic techniques is best suited to visualize the 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
92. 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
93. 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

94. ESTs are obtained through :
- (1) Genomic DNA library
 - (2) cDNA library
 - (3) RT-PCR
 - (4) Chromosome walking
95. X-ray crystallography can be used to determine :
- (1) Primary structure
 - (2) Secondary structure
 - (3) Tertiary structure
 - (4) All of the above
96. Polymorphism in alpha-amylase gene can be studied by :
- (1) Southern blot
 - (2) Slot blot
 - (3) Dot blot
 - (4) Northern blot
97. 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
98. Protein-protein interactions can be studied by :
- (1) DNA foot printing
 - (2) Ligase chain reaction
 - (3) Co-immunoprecipitation
 - (4) Chromatin immunoprecipitation
99. 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
100. 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