Entrance Examination — 2019
Ph.D. Biotechnology

Time: 2 hours   **Maximum Marks: 70**

HALL TICKET NUMBER

INSTRUCTIONS

1. Enter your Hall Ticket number in the OMR answer sheet given to you. Also write the Hall Ticket number in the space provided above.

2. Please read carefully the instructions before answering the questions.

3. Answers are to be marked on the OMR answer sheet with BLACK/BLUE ball point/sketch pen following the instructions provided there upon.

4. Hand over the OMR answer sheet at the end of the examination to the Invigilator. The candidate can take the question paper with him at the end of the examination.

5. The question paper contains 70 questions of multiple choice types printed in 14 pages including this page. OMR answer sheet is provided separately.

6. The question paper consists of Part A and Part B. All questions carry one mark each.

7. The marks obtained in part A will be taken into consideration in case of tie, when more than one student gets equal marks.

8. No additional sheets will be provided. Rough works may be done in the question paper / in the space provided at the end of the booklet.

9. Use of non-programmable scientific calculator is permitted.

10. Cell/Mobile Phones are strictly prohibited in the examination hall.

PART A

1. A, B, C, D, E, F and G are 7 friends sitting in a single row facing North. D is to the immediate right of C. E and A are neighbors of F. B is to the immediate left of C and on second place from left most end. A is at the right most end. Who is in between C and E?

A. B
B. F
C. D
D. None of these

2. In a certain code language, 'it be pee' means 'dogs are blue', 'sik hee' means 'large horses' and 'pee mit hee' means 'horses are pigs'. How is 'pig' written in this code?

A. Hee
B. Pee
C. Sik
D. Mit

3. A plastic container has 20 microfuge tubes with 1.5 and 2ml capacity, out of which 4 are 2ml capacity. Two tubes are chosen at random from the container. The probability that at least one of these is having 2 ml capacity

A. 4/19
B. 5/19
C. 6/19
D. 7/19

4. Supercoiled DNA is soluble in

A. Buffer-saturated phenol
B. Water-saturated phenol
C. Not soluble phenol
D. Phenol-chloroform mixture

5. Identify the **mismatch** from the following

A. Solubilization of the membrane lipid bilayer – SDS
B. Digestion of Prokaryotic cell wall – Lysozyme
C. Cleavage of ester bond in diacyl glycerol phosphate – Lipase
D. Digestion of RNA of DNA-RNA hybrid – RnaseA

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6. Identify **incorrect** match from the following combinations

A. Real time PCR – expression profiling of all the genes at a time in an organism
B. Affinity purification of proteins – Ni-NTA column
C. Contig – Genome sequencing project
D. SDS-PAGE – Dithiothreitol

7. *E. coli* has a cylindrical shape about 1 μm in diameter and 3 μm long. The doubling time of *E. coli* when growing on nutrient agar is about 25 minutes. After 12 hours of growth, a colony is roughly 2 mm in diameter and ½ mm high. How many cells does the colony contain?

A. 10^5 cells
B. 10^7 cells
C. 10^9 cells
D. 10^{11} cells

8. You are extracting DNA from *Saccharomyces cerevisiae*. In your final spin, you discover that you have a large, white pellet. You dissolve the pellet in TE (pH 8) and then use the spectrophotometer and get an A260 : A280 ratio of 1.4. Which of the following BEST explains your observations?

A. The pH of the TE altered the properties of the DNA sample
B. The DNA is contaminated with RNA
C. The DNA is contaminated with protein
D. The EDTA in the TE absorbs light maximally at 260 nm

9. If you draw a line joining two points X and Y in two-dimensional space having the coordinates (6,7) and (9,11) respectively, then the slope of the line drawn is
A. 5
B. 3
C. 3/4
D. 4/3

10. The binary equivalent of a decimal number 9.25 is

A. 1001.01
B. 1001.001
C. 1001.1
D. 1010.01

11. A survey of numerous bacterial species was done to identify in each case the sequence recognized by the endogenous Dam methylase. Using synthetic DNA fragments, gel mobility shift assays, and direct assays for the methylation of the DNA, four new sequences are identified from different organisms that are recognized by the Dam enzymes. In one of these bacteria, the Dam methylase is not used to mark newly-synthesized DNA for mismatch repair. Mark that sequence. These sequences are:

A.   5'TCGATCGA3'
B.   5'CATG 3'
C.   5'GTACGT3'
D.   5'GTTATAAC3'

12. You have isolated a bacterium that exhibits very poor growth in the presence of low tryptophan. You then hypothesized that a mutation occurred in the *trp* repressor causing it to bind too strongly to the operator. Which of the following experiments would BEST confirm your hypothesis?

A. Sequence the trp repressor, perform a ClustalW alignment to compare the new sequence with wild-type sequences, and then perform an EMSA (Gel Mobility shift assay).
B. Sequence the trp operator, perform a ClustalW alignment to compare the new sequence with wild-type sequences, and then perform a Western blot.
C. Generate a trp repressor-luciferase recombinant bacterium to check for expression levels in cell cultures.
D. Perform a Northern blot to assess the expression levels of the *trp* operon.

13. A typical microRNA (miRNA) is expressed in neurons so that it is abundant during the night but absent during the day. Which of the following statements would be UNEXPECTED based on this information?
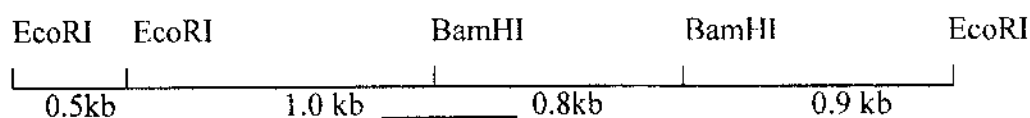
A. Target sequences identical to the miRNA would be expected to have high transcript abundance during the night and lower abundance during the day.
B. Target transcript sequences with less extensive similarity to the miRNA would.be expected to have low translation during the night and higher translation during the day.
C. Target transcript sequences with less extensive similarity to the miRNA would be expected to accumulate in P-bodies during the night.
D. Target transcript sequences with less extensive similarity to the miRNA would be expected to be associated with the RISC during the night

14. In cancer cells, a protein that is normally degraded through the ubiquitin pathway accumulates to high levels. What might explain this accumulation of the protein in cancer cells?
A. The amino acid residue that is normally poly-ubiquitinated on the target protein has been mutated so that it is no longer recognized by E2.
B. The degradation signal on the target protein has been mutated so that it is no longer recognized by E3.
C. A mutation has occurred so that the E2 and E3 pair that normally ubiquitinate the target protein no longer interact.
D. A, B and C could explain the observation.

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15. Where are the synaptic vesicles containing neurotransmitters located?
A. On the presynaptic end
B. In the soma
C. On the postsynaptic end
D. In the dendrites

16. Consider the following restriction map below:

EcoRI	EcoRI		BamHI	BamHI	EcoRI
0.5kb		1.0 kb	0.8kb		0.9 kb

The solid bar represents a portion of this DNA that was used as a probe for a Southern Blot. DNA digested with EcoRI alone is separated and subjected to a Southern blot, using the region of DNA indicated by the solid bar. The size of the bands seen on the Southern blot can be represented as:
A. 1.0 kb and 0.8 kb
B. 1.8 kb
C. 2.7 kb
D. 1.5 kb and 1.7 kb

17. Apoptosis is
   A. A form of cell death
   B. Cell division
   C. Cell multiplication
   D. None of the above

18. Memory loss is not associated with
A. Huntington disease
B. Alzheimer's disease
C. Amyotrophic Lateral Sclerosis
D. Parkinson's disease

19. Which of the interactions between T cell and APCs would lead to Anergy
   A. B7.1-CD28
   B. B7.2-CD28
   C. B7.1-CTLA4
   D. All

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20. What is the net charge of arginine at pH = 1?
A. +2
B. +1
C. +3
D. 0

21. Hydrogen ion concentration in mol/L in a solution of pH = 5.4 will be
A. 3.98×10^8
B. 3.88×10^6
C. 3.68×10^{-6}
D. 3.98×10^{-6}

22. The ratio of masses of oxygen and nitrogen in a particular gaseous mixture is 1 : 4. The ratio of number of their molecule is:
A. 1 : 8
B. 3 : 16
C. 1 : 4
D. 7 : 32

23. Which of the following hydrogen bonds is the strongest?
A. O-H.....N
B. F-H......F
C. O-H......O
D. O-H......F

24. The term anomers of glucose refers to
A. Isomers of glucose that differ in configurations at carbons one and four (C-1 and C-4)
B. A mixture of (D) glucose and (L) glucose
C. Enantiomers of glucose
D. Isomers of glucose that differ in configuration at carbon one (C-1)

25. Match the following lists:

1. Hard Ionization
2. Soft ionization
3. Mass analyzer
4. Resolution

i. Quadrapole
ii. full width at half maximum
iii. Electron impact
iv. MALDI

	1	2	3	4
A.	iii	i	iv	ii
B.	iii	iv	i	ii
C.	iv	iii	i	ii
D.	iv	iii	ii	i

26. Incorporation of which one of the following nucleotide triphosphate leads to termination of polynucleotide synthesis during Sanger's sequencing reaction?

A. 2' deoxyribonucleoside triphosphate
B. 3' deoxyribonucleotide triphosphate
C. 2',3' – dideoxyribonucleoside triphosphate
D. 2',5' – dideoxyribonucleoside triphosphate

27. In an equilibrium A ↔ B, at a particular temperature and pressure condition [A] = [B]. The equilibrium free energy at this condition will be,
A.   0
B.   1
C.   -1
D.   0.5

28. How many liters of water must be added to 1 litre of an aqueous solution of HCl with a pH of 1 to create an aqueous solution with pH of 2?
A. 0.9 L
B. 2.0 L
C. 9.0 L
D. 0.1 L

29. Which of the following technique / methods is used to determine stoichiometry of interacting proteins
A. Immuno-precipitation
B. Yeast two hybrid system
C. Isothermal calorimetric technique
D. TAP-tagging technique

30. Which one of the following radioactive-compounds is most commonly used for studying DNA synthesis in cultures of E. coli?
A. $[^{14}C]$ uridine
B. $[\gamma-^{32}P]$ dATP
C. $[\alpha-^{32}P]$ dATP
D. $[^{32}P]$ orthophosphate

31. In an effort to produce gene knockout mice, a gene targeted homologous recombination was tried with the exogenous DNA containing neo^r gene (confer G-418 resistance) and tk^{HSV} gene (confers sensitivity to the cytotoxic nucleotide analog ganciclovir). If the neo^r gene was inserted within the target gene in the exogenous DNA and considering that both homologous and non-homologous recombination (random integration) is taking place, which one of the following statement is **not correct** about the possible outcome of the experiment?
A. Cells with non-homologous insertion will be sensitive to ganciclovir
B. Non-recombinant cells will be sensitive towards G-418 and resistant to ganciclovir
C. Homologous recombinants will grow in G-418 containing media but will be sensitive towards ganciclovir
D. Homologous recombination will ensure that cells will be resistant to both ganciclovir and G-418

32. Select the correct answer on the basis of following statements:

Statement 1: Continuous Rotary vacuum filter press has a high labor cost.
Statement 2: Continuous Rotary vacuum filter press has a high clogging.

A. True, True
B. True, False
C. False, False
D. False, True

33. Which of the following approach is associated to the prediction of Protein– Protein Interactions?
A. Domain fusion (Rosetta stone)
B. Molecular modelling
C. Position-Specific Iterated BLAST
D. None of the above

34. Nanomaterial can be used for chromatography by
A. Aggregation
B. Precipitation
C. Fragmentation
D. Functionalization

35. Which of the following expression system would not be preferred for obtaining large amount of proteins for crystallization?
A. Insect Cell
B. Mammalian Cell
C. Yeast system
D. Bacterial system

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PART – B

36. Which of the following sequences contains the pattern [GM]-x(3)-G-H-[VT].?
A. VAWGHST
B. GGLKGRT
C. AGGKSTP
D. MVKRGHT

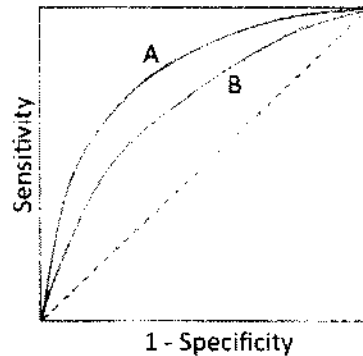37. A correlation table was obtained for 5 genes from the expression data across 15 samples.

	Gene 1	Gene 2	Gene 3	Gene 4	Gene 5
Gene 1	1.000				
Gene 2	0.894	1.000			
Gene 3	-0.162	-0.447	1.000		
Gene 4	-0.962	0.431	-0.402	1.000	
Gene 5	0.239	-0.513	0.004	0.611	1.00

Which of the following gene pair shows the strongest relationship?
A. Gene 1 – Gene 2
B. Gene 4 – Gene 1
C. Gene 5 – Gene 3
D. Gene 5 – Gene 4

38. + ve sense RNA of some viruses is used as
A. si RNA
B. mi RNA
C. mRNA
D. rRNA

39. The tuberculin skin test is an example of
A. Type IV delayed hypersensitivity
B. Allergy reaction
C. Serum sickness
D. Precipitation reaction

40. The carbon skeletons are derived from the following molecules for the synthesis of alanine
A. Ribose-5-phosphate
B. Phosphoglycolate
C. Pyruvate
D. Erythrose 4-phosphate

41. Legumes form a symbiosis with nodule-inducing bacteria. Identify the substrate provided by the host cells to the bacteroids during this process.
A. Malate
B. Asparagine
C. Sucrose
D. Glutamine

42. NADH oxidation is associated with the following reaction during photorespiration
A. Conversion of 3-phosphoglycerate to Ribulose 1,5 bisphosphate
B. Conversion of Hydroxypyruvate to Glycerate
C. Conversion of glycine to serine
D. Conversion of α-ketoglutarate to Glutamate

43. The cell wall of the following is not rigid in
A. Fungus
B. Archaea
C. Protozoa
D. Bacteria

44. The virus that uses reverse transcriptase in its life cycle is
A. HAV
B. HBV
C. HCV
D. HDV

45. The disease that can be cured with gene therapy is
A. Diabetes
B. Jaundice
C. Cystic fibrosis
D. Hypertension

46. The drug 'fusidic acid' is being used against
A. *Staphylococcus aureus*
B. *Niseria gonnarhia*
C. *Vibrio cholera*
D. *Hemophilus influenza*

47. Suppose you have been given the following ROC curve for two different machine-learning algorithms (A & B). Which of the following algorithm you would chose as final model.

1 - Specificity

A. A
B. B
C. Cannot be decided.
D. None

48. Structure of envelope on HIV-1 particle
A. Monomeric
B. Trimeric
C. Hexameric
D. Octameric

49. Activity of Topoisomerase II not exhibited in the absence of ATP
A. DNA binding
B. Double strand DNA breaks
C. Religation
D. Dimerization

50. In plants, the abundance of following molecules is noticed during abiotic stress.
i) ROS, ii) Glutathione, iii) OAA, iv) PEP
A. i and iii
B. ii and iv
C. i and ii
D. iii and iv

51. In IR spectra of proteins, the vibration frequency between 1600 and 1690 cm^{-1} corresponds to
A. C-N stretching
B. N-H Stretching
C. C=O stretching
D. N-H out-of-plane bending

52. For a FRET pair, the efficiency of the energy transfer (E_T) is related to distance between the pair (R) as,
A. $E_T \alpha R^{-1/2}$
B. $E_T \alpha R^{-2}$
C. $E_T \alpha R^{-4}$
D. $E_T \alpha R^{-6}$

53. Dysfunction of Dopaminergic neurons associated with the disease
A. Huntington disease
B. Schizophrenia
C. Parkinson's disease
D. Ataxia-telangiectasia

54. Which of the following algorithm is used by global alignment?
A. Needleman-Wunsch
B. Smith-Waterman
C. BLAST
D. FASTA

55. Which of the following are the literature databases
A. PubMed & OMIM
B. PubMed & MEDLINE
C. SRA & PDB
D. MEDLINE & SRA

56. Malignant malaria is associated with
A. *Plasmodium ovale*
B. *Plasmodium falciparum*
C. *Plasmodium vivax*
D. *Plasmodium malariae*

57. Which of the following insects belong to the order *Lepidoptera*
A. Butterflies
B. Aphids
C. Housefly
D. Mosquito

58. During metabolic stress, which of the following amino acid generally dispensable in greater amount than can readily be synthesized in the body?
A. Alanine
B. Glycine
C. Aspartate
D. Glutamate

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59. The precise arrangement of atoms of a protein can be determined by:
A. Light microscopy
B. Electron microscopy
C. Circular dichroism
D. X-ray crystallography

60. Which one of the following is NOT a naturally occurring nucleotide?
A. ATP
B. cGMP
C. cAMP
D. ddATP

61. The essential sites for recombination are known as:
A. chi sites
B. rec sites
C. gam sites
D. red sites

62. The method used for prediction of 3-D structure of a protein from known structure of related proteins is
A. Molecular Dynamics
B. Clustering
C. Homology Modeling
D. Docking

63. Which protein is involved in the separation of the two interlinked daughter chromosomes when DNA replication is terminated in *E. coli*?
A. DnaB
B. DNA polymerase
C. Topoisomerase IV
.D. Tus

64. How would you expect DNA methylation to alter gene expression?
A.   Extremely increase in expression
B.   Moderately increase in expression
C.   No change in expression
D.   Measurably decrease in expression

65. In an alpha helix, the carbonyl oxygen hydrogen bonds to the amide nitrogen to stabilize the alpha helix structure. Therefore, the shortest, stable alpha helix that can be detected by measuring circular dichroism is:
A. 6 amino acids long
B. 5 amino acids long
C. 4 amino acids long
D. 3 amino acids long

66. If 90% of a first-order reaction is completed in 10 min, the rate of reaction will be
A. 2.3 min^{-1}
B. 1.0 min^{-1}
C. 0.1 min^{-1}
D. 0.23 min^{-1}

67. In Southern blotting, nucleic acid on the nitrocellulose membrane is denatured by treatment with NaOH, however, in Northern blotting, this is not done so because the nucleic acid gets hydrolyzed. Which chemical nature of the nucleic acid in Northern is responsible for this?
A. The presence of a 3'–5' phosphodiester linkage
B. The presence of uracil
C. The presence of a 2'-hydroxyl group
D. The presence of a 3'-hydroxyl group

68. Common step for life cycles all viruses is
A. Inclusion bodies
B. mRNA synthesis
C. Necrosis
D. RNA dependent DNA synthesis

69. PD-1 and CTLA-4:
A. Positive Co-stimulatory molecules
B. They are not expressed on T cell
C. Tasuku Honjo and James P. Allison shared Nobel Prize for their work on PD-1 and CTLA-4.
D. All are correct

70. Mating type silencing in yeast is regulated by
A. Expression of mating pheromones
B. Temperature
C. Expression of histone deacetylase
D. All of the above

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University of Hyderabad

Entrance Examinations - 2019

School/Department/Centre : Department of Biotechnology & Bioinformatics

Course/Subject : Ph.D in Biotechnology

Q.No.	Answer	Q.No.	Answer	Q.No.	Answer	Q.No.	Answer
1	C	26	C	51	C	76	
2	D	27	A	52	D	77	
3	D	28	C	53	C	78	
4	B	29	C	54	A	79	
5	D	30	D	55	B	80	
6	A	31	C	56	B	81	
7	C	32	C	57	A	82	
8	C	33	A	58	B	83	
9	D	34	D	59	D	84	
10	A	35	B	60	D	85	
11	C	36	D	61	A	86	
12	A	37	B	62	C	87	
13	A	38	C	63	C	88	
14	D	39	A	64	D	89	
15	A	40	C	65	B	90	
16	C	41	A	66	D	91	
17	A	42	B	67	C	92	
18	C	43	C	68	B	93	
19	C	44	B	69	C	94	
20	A	45	C	70	D	95	
21	D	46	A	71		96	
22	D	47	A	72		97	
23	B	48	B	73		98	
24	D	49	C	74		99	
25	B	50	C	75		100	

Note/Remarks :

Signature
School/Department/Centre