

**ENTRANCE EXAMINATION, 2017**  
**Ph.D. Biotechnology**

**Time: 2 hours**

**Maximum Marks: 80**

**HALL TICKET  
NUMBER:**

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**INSTRUCTIONS:**

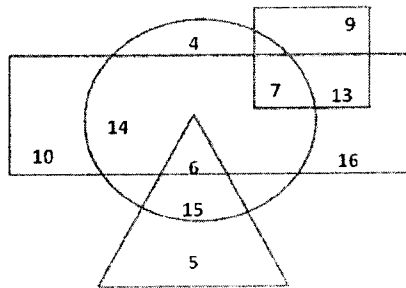
1. Answers are to be marked on the OMR answer sheet following the instructions provided there upon
2. Handover the OMR answer sheet at the end of the examination to the invigilator
3. The question paper contains 80 questions of multiple choice type printed in 15 pages including this page. OMR answer sheet provided separately.
4. All questions carry one mark each.
5. Non-programmable scientific calculators are permitted.
6. Cell/Mobile Phones are strictly prohibited in the examination hall.

## PART-A

1. What is the final pH of a solution made by mixing 100 ml of 0.05 M acetic acid and 100 ml of 0.1 M sodium acetate? Assume the  $pK_a$  for acetic acid is 4.76.
  - A) 5.06
  - B) 5.60
  - C) 5.43
  - D) 5.50
  
2. You have a liquid culture of yeast *Saccharomyces cerevisiae*. You have diluted it by  $10^5$  folds and have plated 0.1 ml of the diluted culture on a solid agar plate to obtain 63 colonies. What was the  $OD_{600}$  of the initial culture? [Given that  $1OD_{600} = 3 \times 10^7$  cells/ml]
  - A) 0.21
  - B) 0.33
  - C) 2.1
  - D) 3.3
  
3. Three persons A, B and C wore shirts of black, blue and orange colors (not necessarily in that order) and pants of green, yellow and orange colors (not necessarily in that order). No persons were shirt and pants of the same color. Further it is given that;
  - a) A did not wear shirt of black color
  - b) B did not wear shirt of blue color
  - c) C did not wear shirt of orange color
  - d) A did not wear pant of green color
  - e) B wore pants of orange colorWhat were the colors of the pants and shirt of C respectively?
  - A) Orange and Black
  - B) Green and Blue
  - C) Yellow and Blue
  - D) Yellow and Black
  
4. Which of the following statistical test could be used to calculate and the compare the difference between the mean values of two samples?
  - A) t-test
  - B)  $\chi^2$ -test
  - C) F-test
  - D) ANOVA

5. In a certain code language '253' means books are old; '546' means man is old and '378' means buy good books. What stands for 'are' in that code?
- A) 2
  - B) 4
  - C) 5
  - D) 6
6. P+Q means 'P is the brother of Q';  
P-Q means 'P is the mother of Q';  
PxQ means 'P is the sister of Q';  
Which of the following means P is the maternal uncle of Q?
- A) P+Q+R
  - B) P-Q+R
  - C) P+R-Q
  - D) P+RXQ
7. Radha is the niece of Alok. Alok's mother is Priya. Seema is Priya's mother. Seema's husband is Hari. Rita is the mother-in-law of Hari. How is Alok related to Hari.
- A) Son
  - B) Daughter's son
  - C) Grand nephew;
  - D) Great grandson's son
8. If GO=32 and SHE=49, then SOME will be equal to
- A) 56
  - B) 58
  - C) 62
  - D) 64
9. Raju travels 10 km towards north, turns left and travels 4 km, and then turns right and covers 5 km more, and then turns right, and proceeds another 4 km. What is the displacement of Raju from the starting point?
- A) 5 km
  - B) 10 km
  - C) 15 km
  - D) 20 km

10.



In the above diagram, i) Rectangle represents females; ii) Triangle represents uneducated persons; iii) Circle represents urban; iv) Square represents Government employees. In different regions in the diagram some numbers are indicated which corresponds to the persons.

How many persons are urban females but not uneducated and Government employees?

- A) 14
- B) 4
- C) 7
- D) 6

11. 50% of a number 'x' is equal to the three-fourth of another number y. What is the ratio of x and y?

- A) 2:3
- B) 3:2
- C) 3:4
- D) 4:3

12. The total sum of ages of 5 children born at the intervals of 3 years each is 50 years. What is the age of the youngest child?

- A) 10 years
- B) 8 years
- C) 6 years
- D) 4 years

13. There are 200 questions in a 3 hr examination. Among these questions 50 are mathematical problems. It is suggested that twice as much time be spent on each math problem as for each other question. How many minutes should be spent on mathematical problems?

- A) 36
- B) 72
- C) 60
- D) 100

14.  $a^m / a^n = ?$

- A)  $a^{m+n}$
- B)  $a^{m-n}$
- C)  $a^{m \times n}$
- D)  $a^{m \div n}$

15. A coin was tossed 1000 times of which the head appeared 455 times, find the probability of the tail.

- A) 0.455
- B) 0.545
- C) 4.55
- D) 5.45

16. Ramesh solved  $2/7$  part of an exercise while Seema solved  $4/5$  of it. Which of the following statements are true?

- A) Ramesh took lesser time
- B) Seema took lesser time
- C) Both took the same time
- D) None of the statements are true

17. Complete the sequence: 1, 8, 4, 27, 9, ?

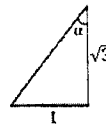
- A) 8
- B) 9
- C) 64
- D) 16

18. 20, 20, 19, 16, 17, 13, 14, 11, ?, ?

- A) 10, 10
- B) 11, 13
- C) 13, 14
- D) 13, 16

19. For the given right angle triangle, find the value of  $\alpha$ .

- A)  $\pi/6$
- B)  $\pi/4$
- C)  $\pi/3$
- D)  $\pi/2$



20. Guess the element in the sequence: DKY, FJW, HIU, JHS, ?

- A) KFR
- B) KGR
- C) LGQ
- D) LFQ

21. A PCR reaction that continues for 30 cycles will produce how many PCR products from a single template DNA molecule?
- A) 60
  - B) 128,000
  - C) Approximately 1 million
  - D) Approximately 1 billion
22. RNA interference (RNAi) of a gene regulatory protein was conducted. Following RNAi, the transcriptome of the treated cells was compared to the transcriptome of the untreated cells, using microarray analysis. Surprisingly, no difference in transcriptome activity was observed between treated and untreated cells. Why might this be the case?
- A) The protein is not a gene regulatory protein.
  - B) The protein requires co-regulatory proteins that are not present in the cell type tested.
  - C) The protein was unable to enter the nucleus on account of the absence of a signal that allows transit to the nucleus.
  - D) A, B and C could account for the observation.
23. When conducting an electrophoretic mobility shift assay using nuclear extracts from muscle cells, you find that you have three shifted bands. Why might this be the case?
- A) Three different DNA-binding proteins have bound to the DNA probe.
  - B) One DNA-binding protein binds to the DNA probe, but it can bind as a monomer, a dimer, or a trimeric complex.
  - C) One DNA-binding protein binds to the DNA probe, but it exists as three different post-translationally modified forms in the nuclear extract.
  - D) A), B) and C) could explain the observation.
24. In the laboratory, you combined wheat germ DNA sample with water and loading dye. What is the function of loading dye in electrophoresis?
- A) It is used as a way of estimating how far your DNA sample has migrated in the gel
  - B) It is used to visualize your DNA sample
  - C) It increases the density of your DNA sample causing it to sink to the bottom of the well in the gel
  - D) a and c
25. You prepared a Master Mix solution for PCR. Which of the ingredients listed below was NOT included in the Master Mix?
- A) Taq polymerase
  - B) EDTA
  - C) dNTPs
  - D)  $MgCl_2$

26. Which of the following is TRUE about the restriction enzyme *Bam*H1 (5'-G↑GATCC-3)?  
The arrow indicates where the enzyme cuts the DNA.
- A) When it cuts DNA, it creates a 5' overhang
  - B) When it cuts DNA, it creates a 3' overhang
  - C) It is classed as an exonuclease
  - D) It can cut both single- and double- stranded DNA
27. Isoelectric focusing of proteins is associated with the technique
- A) Chromatography
  - B) Electrophoresis
  - C) Crystallography
  - D) Spectroscopy
28. Hybridization of single stranded RNA or DNA is facilitated by
- i) high temperature
  - ii) low temperature
  - iii) high salt
  - iv) low salt
  - v) the presence of an unrelated DNA
- A) Only ii) and iii) are true
  - B) Only i) and iii) are true
  - C) Only ii) and iv) are true
  - D) Only ii) and v) are true
29. In two dimensional polyacrylamide gel electrophoresis second electrophoresis is done at \_\_\_\_\_ degree angle relative to the first one.
- A) 30°
  - B) 60°
  - C) 90°
  - D) 180°
30. Which of the following method is used for the improvement of microbes in industry?
- A) Protoplast fusion
  - B) Recombinant DNA technique
  - C) Mutation
  - D) All of the above

31. In size exclusion chromatography the molecules bigger than a particular size don't get into the matrix
- A) This results in the small molecules entering in matrix and thus they come out first in the process
  - B) This results in the small molecules entering in matrix and thus they are retained in the matrix permanently
  - C) This results in the big molecules to be excluded from entering into the matrix and they come out last in the process
  - D) This results in the big molecules to be excluded from entering into the matrix and they come out first in the process
32. Which of the following act is not considered as an act of Plagiarism?
- A) Representing someone else's work as your own without citing
  - B) Changing words but copying the sentence structure of a source without citing
  - C) Reusing the identical or nearly identical portions of one's own work without acknowledging that one
  - D) Taking passages from other's work using quotations and citing
33. Flow Cytometry is used for the measurement of
- A) DNA content in a cell
  - B) Size of cells
  - C) Type of cells
  - D) All of the above
34. Which of the following is correct in case of microarray technology?
- A) Hybridization of RNA: RNA
  - B) Hybridization of labeled and unlabeled cDNAs
  - C) Hybridization of RNA: protein
  - D) All of the above
35. Number of chromosomes in primary cell culture will
- A) Remain the same
  - B) Be doubled
  - C) Be tripled
  - D) Be increased by several times
36. Repeated centrifugation steps with progressively high speed refers to
- A) High speed centrifugation
  - B) Density gradient centrifugation
  - C) Differential centrifugation
  - D) Equilibrium centrifugation



37. A viruses' plaque forming units indicates
- A) Potential to transmit
  - B) Potential to initiate a productive infection
  - C) Potential to elicit immunity
  - D) Potential to show symptoms
38. Infectious dose 50 (ID<sub>50</sub>) means the dose required to
- A) Transmit to 50% of the animals
  - B) Kill the 50% of the animals
  - C) Show the symptoms in 50% of the animals
  - D) Infect 50% of the inoculated animals
39. If, circular and open circular DNAs were analyzed in a single agarose gel electrophoresis
- A) Both DNAs migrates at same speed
  - B) Circular DNA migrates faster
  - C) Open circular migrates faster
  - D) No relevance
40. The amino acid that used in SDS-PAGE technique is
- A) Glycine
  - B) Proline
  - C) Arginine
  - D) Serine

**PART-B**

41. Which of the following residue/modification combinations is false?
- A) Cysteine and disulphide bridges
  - B) Proline and phosphorylation
  - C) Asparagine and glycosylation
  - D) N-terminus and lipidation
42. Which of the following is the host of a virus?
- A) Fish
  - B) Bacteria
  - C) Prawns
  - D) All
43. In the normal human being the concentration(s) of various antibodies in the serum is in the order:
- A) IgM>IgA>IgG>IgE
  - B) IgG>IgA>IgM>IgE
  - C) IgE>IgG>IgM>IgA
  - D) IgA>IgM>IgE>IgG

44. When comparing ultraviolet light and X-ray,
- A) X-rays have longer wavelengths and are thus less mutagenic
  - B) X-rays have longer wavelengths and are thus more mutagenic
  - C) X-rays have a shorter wavelength than does UV light
  - D) X-rays and UV lights are of the same wavelength and are equally mutagenic
45. An example of innate immunity is
- A) T-lymphocytes
  - B) B-lymphocytes
  - C) Neutrophils
  - D) Thyroid cells
46. The precursor(s) for the synthesis of isopentylpyrophosphate in plastids
- A) RuBP and Acetyl CoA
  - B) Acetyl CoA
  - C) Mevalonyl CoA
  - D) Pyruvate and D-glyceraldehyde- 3-phosphate
47. Cowpox virus was used as vaccine for smallpox which works on the basis of
- A) Cross reactivity
  - B) Same family of viruses
  - C) Heterogeneity
  - D) None
48. The light activation of ribulose phosphate kinase is facilitated by
- A) Thioredoxin
  - B) Flavodoxin
  - C) Malate Dehydrogenase
  - D) Pyruvate Dehydrogenase
49. Kinase activity is inhibited by which of the following co-factor?
- A) ATP
  - B) GTP
  - C) ATPyP-32
  - D) ATPyS
50. Following is not a retroviral replication intermediate
- A) ssRNA
  - B) RNA: DNA hybrid
  - C) DNA
  - D) Duplex RNA
51. Peroxide mediated DNA damage can be detected by the presence of
- A) Double stranded breaks
  - B) Single stranded breaks
  - C) Oxidized bases
  - D) All the above

52. Four different types of clear mutations are found in lambda (the clear phenotype indicates that no lambda lysogens form): three of these (lambda\_cl, lambda\_cII, and lambda\_cIII) are defective in the cl, cII, and cIII genes, respectively; the fourth (lambda\_cy) is defective in P<sub>RE</sub> so that it no longer binds the cII product. Indicate which of these would allow a mutant phage to bypass λ immunity and grow on a lambda lysogen?
- A) lambda\_cl
  - B) lambda\_cII
  - C) lambda\_cy
  - D) None of the above
53. Which of the following is not a chaperone?
- A) Hsp70
  - B) Bip
  - C) HSF1
  - D) Hsp40
54. *Xeroderma pigmentosum* in human is associated with a mutation in
- A) Photoreactivation
  - B) Nucleotide Excision Repair
  - C) Base Excision Repair
  - D) Mismatch Repair
55. Advantage of NMR spectroscopy over X-ray crystallography is
- A) It can be done on macromolecules in solution
  - B) It can give dynamics of the atoms in the molecule
  - C) You don't need to crystallize the protein
  - D) All of the above
56. The intensity of color is used to quantify the differential expression of genes in
- A) Microarray
  - B) RNA Seq
  - C) SAGE
  - D) None of the above
57. Phycobiliproteins are present in
- A) *Rhodobacter*
  - B) *Pseudomonas*
  - C) *Xanthomonas*
  - D) *Nostoc*

58. The two principal backbone torsion angles for a polypeptide chain are \_\_\_\_ and \_\_\_\_
- A)  $\psi$  and  $\chi$
  - B)  $\psi$  and  $\omega$
  - C)  $\phi$  and  $\psi$
  - D)  $\tau$  and  $\phi$
59. The whole three dimensional structure of myoglobin is an example for \_\_\_\_\_
- A) Protein quaternary structure
  - B) Protein primary structure
  - C) Protein secondary structure
  - D) Protein tertiary structure
60. Antigen-antibody agglutinations occurring during blood transfusions are due to
- A) Cross reactivity
  - B) Heterogeneity
  - C) Homogeneity
  - D) All
61. In mitochondria, the enzyme Succinate Dehydrogenase is associated with
- A) Complex I
  - B) Plastoquinone
  - C) Complex II
  - D) Complex III
62. Which of the following are cytosolic TLRs?
- A) TLR9
  - B) TLR3
  - C) TLR8
  - D) All of the above
63. Microorganism that is being used in Acetone production is
- A) *Saccharomyces cerevisiae*
  - B) *Lactobacillus bulgaricus*
  - C) *Clostridium acetobutylicum*
  - D) *Bacillus subtilis*
64. Which of the following biomolecules can't be synthesized by our body and hence it is required to be supplied or supplemented through our diet?
- A) Omega-6 fatty acids (PUFAs)
  - B) Omega-3 fatty acids (PUFAs)
  - C) Cholesterol
  - D) Triacyl glycerol

65. Which of the following set of amino acids consists of only polar side chains?  
A) Ala, Gly, Pro, Phe  
B) Ser, Gly, Pro, Leu  
C) Gly, Lys, Asn, Arg  
D) Ser, Glu, Asp, Thr
66. Protein core (interior/ buried portion) is predominantly comprises of ..... amino acid residues  
A) Polar  
B) Apolar/hydrophobic  
C) Neutral  
D) Charged
67. Which of the following statements regarding collagens is true?  
A) A protein containing a short stretch of Gly-X-Y repeats is technically considered as collagen  
B) Of all the possible combinations only heterotrimers are found in the human extracellular matrix  
C) The propeptides of collagen are cleaved off in the exiting vesicle in order to start creating collagen fibre  
D) The X and Y residues (of the Gly-X-Y repeats) are typically acidic
68. Role of a 'sparger' in a bioreactor is  
A) To supply water  
B) To supply Media  
C) To control pH  
D) To supply air
69. 'Facultative anaerobe' will grow  
A) At the surface of the culture medium  
B) At the bottom of the culture medium  
C) At the middle of the culture medium  
D) Throughout the culture medium
70. Which of the following statements is false?  
A) B cell receptor binds to soluble antigens while T cell receptor binds to antigen presented by MHC  
B) Glycosylation site is present in the Fc region of antibody  
C) D-amino acid polymers are more immunogenic  
D) L-amino acid polymers can be easily degraded within APCs
71. The output of the phylogenetic analysis will be in the form of  
A) Histogram  
B) 3D models  
C) Graph models  
D) Dendrograms

72. Which of the following types of RNA contains regions that acts as a switch to turn protein synthesis on and off for the protein it codes for?
- A) microRNA
  - B) riboswitches
  - C) tRNA
  - D) antisense RNA
73. Which one of the following is true for clustered regularly interspaced short palindromic repeats (CRISPR) systems in bacterial cell?
- A) It protects bacteria from virus attack
  - B) Codes for cas proteins that can degrade viral mRNA
  - C) Can be used to infer a viral infection history
  - D) All of the above
74. Which of the following statements concerning hemoglobin are TRUE?
- (1) The disease sickle cell anemia results from a mutated hemoglobin gene.
  - (2) Hemoglobin is composed of 4 identical subunits.
  - (3) Each subunit of hemoglobin contains a heme group in the site that binds O<sub>2</sub>.
  - (4) The same mutation causing sickle cell anemia is thought to be advantageous (in heterozygotes) against malaria infection.
- A) 1, 2
  - B) 1, 2, 3
  - C) 1, 3, 4
  - D) 1, 2, 3, 4
75. The formation of a phosphodiester bond between two nucleotides:
- A) It is a hydrolysis reaction and requires a hydroxyl group attached to the 5' carbon of the sugar, a phosphate attached to the 3' carbon of the sugar on another nucleotide and an ester bond.
  - B) It is a condensation reaction and requires a hydroxyl group attached to the 5' carbon of the sugar, a phosphate attached to the 3' carbon of the sugar on another nucleotide, and an ester bond.
  - C) It is a hydrolysis reaction and requires a hydroxyl group attached to the 3' carbon of the sugar, a phosphate attached to the 5' carbon of the sugar on another nucleotide, and an ester bond.
  - D) It is a condensation reaction and requires a hydroxyl group attached to the 3' carbon of the sugar, a phosphate attached to the 5' carbon of the sugar on another nucleotide, and an ester bond.

76. In mRNA, 'ORF' refers to
- A) One Recognition Fragment
  - B) Open Reading Frame
  - C) One gene Recognized Function
  - D) One time Riding Factor
77. Swiss prot is a
- A) Swiss developed genetic engineering technology
  - B) Swiss developed plant breeding technology
  - C) Swiss developed protein sequence database
  - D) Swiss developed floriculture
78. The name 'Ebola virus' is due to
- A) Symptoms
  - B) Scientist discovered
  - C) Virus family
  - D) Place of discovery
79. The genome of Swine flu virus is
- A) Positive sense RNA
  - B) Negative sense RNA
  - C) Double stranded RNA
  - D) Double stranded DNA
80. A scientist has been working to characterize a novel organism from outer space. Recently, the organism's chromatin was examined. Which of the following features of its chromatin would be novel relative to that of most eukaryotes on earth? That is, which one is UNEXPECTED?
- A) 147 nucleotide pairs of DNA wrap around a nucleosome core.
  - B) The nucleosome core is an octamer comprising pairs of histones H1, H2, H3A, and H3B.
  - C) The carboxy terminal tails of some of the histones can be post-translationally modified by the addition of ubiquitin.
  - D) There is a linker histone that functions between nucleosome cores.