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(February)

BIOTECHNOLOGY

(Honours)

(Biostatistics and Biological Techniques)

Marks : 56

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer Question No. **1** which is compulsory and *any* **four** from the rest

1. Answer the following questions : 2×6=12

   (a) What is the difference between a histogram and a line diagram?

   (b) Why is washing step important while performing ELISA?

   (c) Differentiate between a colorimeter and a spectrophotometer.

   (d) For separation of nucleus and mitochondria from a cell homogenate, which centrifugation method will you prefer? Give justification to your answer.

   (e) What are the objectives of classification of biological data?

   (f) Explain the following terms :

   Class interval and class limits

2. *(a)* What roles do buffers play in gel electrophoresis? Differentiate between continuous and discontinuous buffer system. 2+4=6

   (b) What is the role of a probe in Fluorescence In Situ Hybridization (FISH) technique? 2

   (c) What determines the annealing temperature in a polymerase chain reaction (PCR)? How does it affect the specificity of the PCR reaction? 2

   (d) What is the function of an excitation filter in fluorescence microscopy? 1

3. *(a)* Explain in brief the mobile phase and stationary phase used in column chromatography. Which of these phases will be eluted first from the column chromatography? 4+1=5

   (b) Differentiate between Northern and Southern blotting. 2

(3)

(c) A particular exogeneous protein is over-expressed in a cell culture. Which blotting technique is the best suited to confirm the presence of this protein? Explain in brief the process involved in this blotting technique. 1+3=4

4. (a) What is the relation between resolution of a microscope and a numerical aperture? 2

(b) Why is the resolving power of an electron microscope higher than that of a light microscope? 2

(c) State Beer-Lambert law and derive the mathematical expression of the law. 4

(d) What is the major difference between a native PAGE and an SDS-PAGE? Enumerate some of the applications of native PAGE. 3

5. (a) What are the different types of statistical data? Discuss in brief the purposes and importance of tabulation in the process of statistical investigation. 2+3=5

(4)

(b) Determine the missing frequencies from the following frequency table where the arithmetic mean is 35 and total frequency is 51 : 6

Class interval	Frequency
0–10	4
10–20	7
20–30	—
30–40	16
40–50	11
50–60	—
60–70	4

6. (a) Find out the median of the following distribution : 5

Class interval	Frequency
20–25	10
25–30	20
30–35	20
35–40	15
40–45	15
45–50	20

(5)

(b) Find the standard deviation of the following distribution :

Age	Number of Persons
20–25	170
25–30	110
30–35	80
35–40	45
40–45	40
45–50	35

Also calculate the coefficient of variation. 4+2=6

7. (a) Find the correlation coefficient from the following data : 4

X	Y
–3	9
–2	4
–1	1
0	0
1	1
2	4
3	9

(b) Define conditional probability. What is the probability that all 4 children in a family have birthdays falling on different dates (1 year = 365 days)? 1+3=4

(c) If A and B are two independent events and $P(A) = \frac{2}{3}$ and $P(B) = \frac{3}{5}$, find $P(A \cap B)$. 3

(6)

8. (a) Define binomial distribution. Medical records show that the probability of an individual with a rare syndrome will be cured is $p = 0 \cdot 01$. A random sample of 10 persons with this syndrome is selected; find the probability of at least 9 persons that are cured, using binomial distribution. 1+4=5

(b) A certain diet newly introduced to each of the 12 pigs resulted in the following increase in body weights :

6, 3, 8, –2, 3, 0, –1, 1, 6, 0, 5, 4

Can you conclude that the diet is effective in increasing the weight of pigs? [Given critical values of t at 5% level for 11 degree of freedom is $2 \cdot 201$ and $2 \cdot 718$ for two-tailed test and one-tailed test respectively.] 6

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