Exam. Code : 206601
Subject Code : 4756

M.Sc. Bio-Informatics 1st Semester (Batch 2021-23)

BASIC BIOSTATISTICS & MATHEMATICS

Paper—BI-513

Time Allowed—3 Hours] [Maximum Marks—75

Note :— Attempt **FIVE** questions in all, selecting at least **ONE** question from each Section. The **FIFTH** question may be attempted from any Section. All questions carry equal marks.

SECTION—A

I. (a) Compare mean, median and mode as measure of location of a distribution.

(b) Explain briefly the methods of measuring skewness and kurtosis of a frequency distribution.

(c) The means of two samples of size 50 and 100 respectively are 54.1 and 50.3 and the standard deviations are 8 and 7. Obtain the mean and standard deviation of sample of size 150 obtained by combining the two samples.

II. (a) State and prove Baye's theorem.

(b) What do you mean by independent events ? For any two events A and B show that :—

$P(A \cap B) < P(A) \leq P(A \cup B) < P(A) + P(B)$.

(c) From 6 positive and 8 negative numbers, 4 numbers are choosen at random and multiplied. What is the probability that the product is a positive number ?

SECTION—D

VII. (a) Let f be a function defined by

$$f(x)=\begin{cases}\dfrac{x}{|x|+2x^2}, & x \neq 0\\ 0, & x=0\end{cases}$$

Does $\lim_{x\to 0} f(x)$ exist ?

(b) Find the derivative of function $f(x) = (2x + 3)(5x^2 - 7x + 1)$.

(c) Determine the value of x for which the function $2x^3 - 24x + 5$ is increasing or decreasing.

VIII. (a) Find two numbers whose sum is 15 and the square of one multipled by the cube of other is maximum.

(b) Evaluate $\int \left(x - \frac{1}{x}\right)^3 dx$.

(c) Solve the equation :

$(1 + x)(1 + y^2)\,dx + (1 + y)(1 + x^2)\,dy = 0$.

SECTION—B

III. (a) Define random sampling. Differentiate between simple random sampling with and without replacement.

(b) Define random variable and its distribution function. If random variable X has poisson distribution with $P(X=2) = P(X=4)$, find the mean and variance of the distribution.

(c) The number of shoots on a branch is a random variable which takes values :

$P(X = x) = kx$; for $x = 1, 2, 3, 4, 5$

What should be the value of the constant 'k' so that it is a proper probability distribution ? Find the mean and variance of number of shoots.

IV. (a) Let random variable X has the probability density

$$\text{function } f(x)=\begin{cases} x & ; \quad 0<x<1 \\ 2-x & ; \quad 1<x<2 \\ 0 & ; \quad \text{otherwise} \end{cases}$$

Find cumulative distribution function F(x). Also find $P\left(\frac{1}{3}<x<\frac{4}{3}\right)$.

(b) Define normal distribution. Show that for normal distribution mean, median and mode coincide.

SECTION—C

V. (a) (i) Prove the following identity :

$$(x^2+a^2)^4 = (x^4 - 6x^2a^2 + a^4)^2 + (4x^3a - 4xa^3)^2.$$

(ii) Find the real values of x and y for which of the following equation is satisfied :—

$$\frac{(1+i)x-2i}{3+i}+\frac{(2-3i)y+i}{3-i}=i$$

(b) If $z=-5+2\sqrt{-4}$, find the value of

$z^4 + 9z^3 + 35z^2 - z + 4$

VI. (a) If $A=\begin{bmatrix} 1 & -4 \\ 3 & 1 \\ 2 & 0 \end{bmatrix}$ and $B=\begin{bmatrix} 2 & 1 & 2 \\ 1 & 3 & 4 \end{bmatrix}$ verify that

$(AB)^t = B^tA^t$.

(b) Prove that :

$$\begin{vmatrix} x-y-z & 2x & 2x \\ 2y & y-z-x & 2y \\ 2z & 2z & z-x-y \end{vmatrix} = (x+y+z)^3.$$

(c) Find $\bar{a}\bullet\bar{b}$ when $\bar{a}=\hat{i}-2\hat{j}-2\hat{k}$, $\bar{b}=2\hat{i}+3\hat{j}-6\hat{k}$.