

B.Sc. Part—I (Semester—I) Examination
IS : BIOINFORMATICS
(Elementary Mathematics and Statistics)

Time—Three Hours] [Maximum Marks—80

Note :—(1) Attempt **ALL** questions.

(2) Question No. 1 is compulsory.

1. (a) Fill in the blanks :— 2

(i) If a coin is tossed n times, then the Sample Space contains _____ elements.

(ii) If K is some constant and u is a derivable function of x and $y = Ku$ then $\frac{dy}{dx}$ is equal to _____.

(iii) The function $F(x)$ is even iff $F(-x) = \underline{\hspace{2cm}}$.

(iv) Quartile 2 is also known as _____.

(b) Choose the correct alternative and rewrite the complete sentence :— 2

(i) The order of the differential equation

$$\frac{d^3y}{dx^3} = \sqrt[4]{y + \left(\frac{dy}{dx}\right)^5} \text{ is } \underline{\hspace{2cm}}.$$

(a) Three

- (b) Four
(c) Five
(d) None of these
- (ii) If $f(x)$ and $g(x)$ are continuous function $x = a$ then $f(x) + g(x)$ is continuous at ____.
- (a) $x = a$
(b) $x = -a$
(c) $x = 0$
(d) None of these
- (iii) If definite integral of a given function is not :
- (a) Absolute
(b) Unique
(c) Constant
(d) None of these
- (iv) Degree of the DE

$$x^2 \left(\frac{dy}{dx} \right)^2 + xy \frac{dy}{dx} - 6y^2 = 0 \text{ is } \underline{\hspace{2cm}}.$$

- (a) 0
(b) 1

7. (a) Distinguish between discrete and continuous variables. 6

- (b) A continuous random variable X has a probability distribution function :

$$f(x) = 3x^2, 0 \leq x \leq 1.$$

Find a and b such that :

- (i) $P\{x \leq a\} = P\{x > a\}$ and
(ii) $P\{x > b\} = 0.05$ 6

OR

- (p) State and prove multiplicative law of expectation for discrete random variable. 6
- (q) If x and y are random variables then prove that $E(x + y) = E(x) + E(y)$ provided that all the expectations exist. 6

5. (a) Name the different kinds of averages and discuss their merits and demerits. 6
- (b) State the different measures of skewness that are commonly used. 6

OR

- (p) Explain the difference between histogram and frequency polygon. 6
- (q) In what respect the weighted mean is superior to the simple average ? 6
6. (a) Define independent events. If A and B are independent events, then prove that $\bar{A}$ and $\bar{B}$ are also independent events. 6
- (b) State and prove law of addition of probabilities. 6

OR

- (p) If two dice are thrown then what is the probability of the sum is :
- (a) Greater than 8
- (b) Neither 7 nor 11. 6
- (q) For any three events A, B and C prove that
- $$P(A \cup B/C) = P(A/C) + P(B/C) - P(A \cap B/C).$$
- 6

(c) 2

(d) None of these

- (c) Answer the following questions in brief :— 4
- (i) Write any two properties of a definite integral.
- (ii) What is meant by mutually exclusive events ?
- (iii) What are quartiles ?
- (iv) What is linear regression ?

2. (a) Discuss the continuity of $f(x)$ in the interval (0, 5) if

$$f(x) = \frac{x^2 - a}{x - 3} \text{ for } x \neq 3$$

$$= 6 \quad \text{for } x = 3 \quad 4$$

- (b) For the probability density function

$$f(x) = \frac{2(b+x)}{b(a+b)}, \quad -b \leq x < 0$$

$$= \frac{2(a-x)}{a(a+b)}, \quad 0 \leq x \leq a$$

find means, median, and variance. 4

- (c) Using (ϵ, δ) definition, show that

$$\lim_{x \rightarrow 1} (5x - 3) = 2. \quad 4$$

OR

- (p) A wire of length 12 cm is to form a rectangle.
Find the dimensions of a rectangle. 4
- (q) Find $\frac{dy}{dx}$ if $y = \sin^{-1}(\sqrt{1-x^2})$. 4
- (r) Define continuity of a function at a point. 4
3. (a) If $x = \phi(f)$ be a derivable function then prove that

$$\int f(x) dx = \int f \phi(f)'(f) dt. \quad 4$$

- (b) Show that

$$\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} dx = \frac{\pi}{4}. \quad 4$$

- (c) Evaluate $\int_0^{\pi/2} \sin x dx$, using the definition of a definite integral as the limit of a sum. 4

OR

- (p) Evaluate

$$\int \frac{dx}{\sqrt{x^2 - a^2}}. \quad 4$$

- (q) Find the area bounded by the x-axis, the curve $y = c \cosh(x/c)$ and the ordinates $x = 0$, $x = a$. 4

- (r) Find the volume of a right circular cone of height h with base radius r . 4

4. (a) If two regression equation between x and y are $10x - 20y - 14 = 0$, $5x - 6y = 47$, the standard deviation of x is 9 then find the mean values of x and y . 6
- (b) Describe briefly the construction of histogram and frequency polygon of a frequency distribution. 6

OR

- (p) Calculate the mean and standard deviation for the following table giving the age distribution of 542 members :

Age in Years	No. of Members
20—30	3
30—40	61
40—50	132
50—60	153
60—70	140
70—80	51
80—90	2

- (q) What are quartiles ? How are they used to measure skewness ? 6