



B.Sc. Part - I Semester - I

# 1 S : Bioinformatics : Elementary Mathematics & Statistics

P. Pages : 7

Time : Three Hours

Max. Marks : 80.

- Notes :
1. Attempt all questions.
  2. Question No. 1 is compulsory.

1. a) Fill in the blanks :

2

i) Order of the DE

$$\frac{d^2y}{dx^2} + x^2 \frac{dy}{dx} - y \sin x = 0 \text{ is } \text{-----}$$

ii) Tossing of a coin is a trial and getting head or tail is -----

iii) If  $k$  is some constant and  $u$  is a derivable function of  $x$  and  $y = ku$  then  $\frac{dy}{dx}$  is equal to -----

iv) If  $f(x)$  and  $g(x)$  are continuous functions at  $x = a$ , then  $f(x) + g(x)$  is continuous at ---

b) Choose the correct alternative

- i) The value of  $\lim_{x \rightarrow 0} \frac{\sin x}{x}$  is 1/2  
 a) 0 b) 1  
 c) -1 d) none of these

- ii) The order of the differential equation 1/2  
 $x^2 \left( \frac{dy}{dx} \right)^2 + xy \frac{dy}{dx} - 6y^2 = 0$  is  
 a) 1 b) 2  
 c) 4 d) none of these

- iii) If  $n$  coins are tossed once, then the number 1/2  
 of sample points is  
 a)  $2n$  b)  $n^2$   
 c)  $2^n$  d) none of these

- iv) The value of  $\int_0^2 (3x + 5) dx$  is 1/2  
 a) 3 b) 5  
 c) 8 d) none of these

c) Answer the following questions in brief.

- i) Classify the following DE as to order and 1  
 degree  $\frac{d^2y}{dx^2} = 4 \sqrt{y + \left( \frac{dy}{dx} \right)^2}$
- ii) Explain the method of integration by parts 1

- iii) What do you mean by linear regression? **1**
- iv) Explain what is meant by random variable. **1**
2. a) If  $\lim_{x \rightarrow x_0} f(x)$  exists then prove that it is unique. **4**
- b) Find  $\frac{dy}{dx}$  if  $y = \sin^{-1}(2x\sqrt{1-x^2})$  **4**
- c) Find the local maximum and local minimum values of the function **4**  
 $f(x) = 2x^3 - 3x^2 - 12x + 12$

**OR**

- d) If  $f$  is continuous at  $x = x_0$  then show that  $|f|$  is continuous at  $x = x_0$ . **4**
- e) A wire of length 12 cm is to form a rectangle. Find the dimensions of rectangle so that it has maximum area. **4**
- f) Evaluate  $\lim_{x \rightarrow 2} \frac{(x+1)(3x-4)}{(x-1)(2x-3)}$  **4**
3. a) Prove that **4**  

$$\int_0^{2a} f(x) dx = 0 \text{ if } f(2a-x) = -f(x)$$

$$= 2 \int_0^a f(x) dx \text{ if } f(2a-x) = f(x)$$

b) Evaluate  $\int \frac{x dx}{(x-1)^2(x+2)}$  4

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

**OR**

d) Using definition of a definite integral as a limit of sum, evaluate  $\int_a^b x^2 dx$  4

e) Evaluate  $\int_0^1 \frac{\sin^{-1} x}{x} dx$  4

f) Find the area bounded by parabola  $y^2 = 2x$  and the line  $y = x - 4$ . 4

4. a) Solve the DE :  $\frac{dy}{dx} = \frac{x(2\log x + 1)}{\sin y + y \cos y}$  4

b) Solve the DE :  $(x+2)\sin y dx + x \cos y dy = 0$  4

c) Deduce the DE from  $y = A e^{mx} + B e^{nx} + C$ , by eliminating constants  $A$ ,  $B$  and  $C$ . 4

**OR**

d) Solve the DE : 4

$$(1 - x^2) \frac{dy}{dx} + 2xy = x(1 - x^2)^{1/2}$$

e) Solve the DE :  $\sec x \frac{dy}{dx} = y + \sin x$  4

f) Solve the DE :  $x^2 dy + y(x + y) dx = 0$  4

5. a) Explain what are regression lines. Why are there two such lines? 6

b) Calculate the mean and standard deviation for the following table giving the age distribution of 542 members. 6

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

**OR**

c) Explain the method of constructing histogram and frequency polygon. 6

d) What are quartiles? How they are used to measure of skewness? 6

6. a) Give the classical and statistical definitions of probability. 6
- b) Define independent events. If A and B are independent events then prove that  $\bar{A}$  and  $\bar{B}$  are also independent events. 6

**OR**

- c) Show that the probability of the union of any two events A and B is given by 6  
$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$
- d) If two dice are thrown then what is the probability that the sum is 6  
i) greater than 8  
ii) neither 7 nor 11.
7. a) Define uniform distribution. State it's probability mass function. 6
- b) The diameter of an electric cable, say X, is assumed to be a continuous random variable with probability distribution function 6  
$$f(x) = 6x(1-x), 0 \leq x \leq 1$$
  
Determine a number 'b' such that  
$$P(X < b) = P(X > b).$$

**OR**

- c) Define distribution function (or cumulative distribution function) of a random variable and state it's essential properties. **6**
- d) If the cumulative distribution function of X is  $F(x)$ , then find the cumulative distribution function of
- i)  $Y = X + a$
  - ii)  $Y = X - b$
  - iii)  $Y = ax$

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