# CALCULUS & STATISTICAL METHODS - 2013

**Note :** All questions are compulsory. Attempt any two parts from each questions carry equal marks.

## UNIT - 1

1. (a) Find the limit of : $\underset{x\to 1}{Lt} \frac{x^2-1}{|x-1|}$ if it exists.

   (b) Show that the function :

$$f(x) = \begin{cases} x & , \text{ when } 0 \le x < \frac{1}{2} \\ 1 & , \text{ when } x = \frac{1}{2} \\ 1-x & , \text{ when } \frac{1}{2} < x < 1 \end{cases}$$

   is discontinuous at $x = \frac{1}{2}$.

   (c) Show that the function :

$$f(x) = \begin{cases} x^2 - 1, & \text{when } x \ge 1; \\ 1 - x, & \text{when } x < 1; \end{cases}$$

   is not differentiable at x = 1.

## UNIT - 2

2. (a) If $y = x^{\sin x}$, find $\frac{dy}{dx}$

   (b) Find the value of $\frac{dy}{dx}$ when $\log xy = x + y^2$.

   (c) If $x = a(t + \sin t)$, $Y = a(1 - \cos t)$, find the value of $\frac{dy}{dx}$.

## UNIT - 3

3. (a) Find the tangent to the curve $y = be^{-x/a}$ where the curve crosses the axis of y.

   (b) In the curve $x^{m+n} = a^{m-n} y^{2n}$, prove that the mth power of the subtangent varies as the nth power of the subnormal.

   (c) Examine whether $x^{1/x}$ possesses a maximum or a minimum and determine the same.

## UNIT - 4

4. (a) A bag contains 3 red, 6 white and 7 blue balls. What is the probability that two balls drawn are white and blue ?

   (b) What is the chance that two numbers, chosen at random, will be prime to each other ?

   (c) State and prove Bayes theorem.

## UNIT - 5

5. (a) Find the simple and weighted arithmetic mean of the first n natural numbers, the weights being the corresponding numbers.

   (b) Fit a parabola of second degree to the following data :

| X | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Y | 1 | 1.8 | 1.3 | 2.5 | 6.3 |

   (c) The variables X and Y are connected by the equation aX + bY + c = 0. show that the correlation between them is –1 if the signs of a and b are alike and +1 if they are different.