<u>**Duration: 2hours**</u>   **Max.Marks : 80**

Instructions: 1) All question are compulsory (choice is internal)
              2) Start each new question on a fresh page
              3) Figures to the right indicate full marks
              4) Use of calculators allowed

Q.1 Attempt the following: **(5 x 4=20)**

a) Show that the points $(4,1),(2,-3)$ and $(1,-5)$ are collinear.

b) Find the derivative of the following $w.r.t.x$ if

$$i)\ y = \frac{3x^3 + x}{logx} \qquad ii)y = \log(3x^2 + e^x - 5) + \sqrt{logx - 5^x}$$

c) Find x if $f(x + 1) = f(x + 2)$ for $f(x) = 1 + 2x - 3x^2$

d) Evaluate the following integrals:

    i. $\int e^x - 4^x + x^3 - logx + \frac{2}{x}dx$

    ii. $\int \frac{(2x-1)^3+5}{2x-1}dx.$

<div align="center">OR</div>

Q.I Attempt the following: **(5 x 4=20)**

w) If $A\ (2, -4)$ and $B\ (-1, -7)$ are 2 points, find the equation of the line passing through origin and parallel to AB.

x) Find $\frac{dy}{dx}$ if $i)y = 7^x(4x^2 + 2\sqrt{x} - 5x)$ $ii)y = \frac{2x^2 - e^x - 4}{x^2 - 3}$

y) Find $f(g(x))$ and $g(f(x))$ if $f(x) = 3x^2 - 1$ and $g(x) = x + 1$

z) Evaluate the following integrals:

$$\int_{1}^{3} \frac{x^2 + 4x + 3}{2(x + 3)}\ dx$$

Q.2 Attempt the following: **(5 x 4=20)**

a) Evaluate the following if they exist

$$i)\lim_{x \to 2}\left[\frac{1}{x^2 + x - 6} + \frac{1}{x^2 - 9x + 14}\right] \qquad ii)\lim_{x \to 5}\frac{x^3 - 125}{x^2 - 25}$$

b) The demand function p in terms of quantity demanded (D) is given by $p = 30 + 12D - 4D^3$. Find total revenue, average revenue and marginal revenue when the demand is 3 units.

c) A factory uses three different resources for the manufacture of two different products, 20 units of the resource A, 12 units of B and 16 units of C being available. 1 unit of the first product requires2, 2 and 4units of the respective resources and 1 unit of the second product requires 4, 2 and 0 units of the respective resources. It is known that the first product gives a profit of 2 monetary units per unit and the second 3. Formulate the linear programming problem to maximize the profit.

d) Find the partial derivatives of first order of the functions $f(x, y) = x^2y + 2x^3y^2 + xy^2$ at the point (1, 2)

<center>OR</center>

Q.II Attempt the following: (5 x 4=20)

w) Discuss the continuity of the following function at $x = 4$

$$f(x) = \begin{cases} x^2 + x + 2 & ; 2 \le x \le 4 \\ 3x + 4 & ; 4 < x \le 6 \end{cases}$$

x) Find the values of x for which the function $f(x) = x^3 - 75x + 10$ is decreasing.

y) Solve graphically

$$Maximise\ z = 6x + 4y$$

$$s.t.\quad 2x + 3y \le 30$$

$$3x + 2y \le 24$$

$$x + y \ge 3$$

$$And\ x \ge 0, y \ge 0$$

z) The demand function for a certain commodity is given by $D(p_1, p_2) = 5 + 2p_1p_2 - p_1^3$. Find the marginal Demand at $p_1 = 2$ and $p_2 = 6$

Q.3 Attempt the following: (5 x 4=20)

a) Find the sum borrowed by Rohit from a bank on compound interest of 5% per year, to be calculated annually, if he had to pay back Rs.26,460 after 2 years

b) The point P (7, a) lies on the line joining A (-5, 2) and B (3, 6). Find the ratio in which P divides AB and hencefind a

c) The marginal demand $MD = 2p + 3p^2$ and D =79 when p = 3. Find the demand function when p = 2.

d) Find $\dfrac{dy}{dx}$ if i)$y = 7x^5 - 4(5^x) + 6log$ ii) $y = 2x^3 - 5^x + 4e^x$

<center>OR</center>

Q.III Attempt the following: (5 x 4=20)

w) How much time will the principal of Rs.400 take to be Rs.1000 at the simple interest of 12.5% per annum?

x) Find the coordinates of the points on y axis which are at distance of 13 units from (5,4).

<center>2</center>

y) The marginal revenue of selling x items is $MR = x^2 + 3x - 1$. Find the total revenue and average revenue at $x = 6$.

z) Find $\dfrac{dy}{dx}$ if $y = \dfrac{1}{\sqrt{2x^2+5}+\sqrt{2x^2+1}}$.

Q.4 Attempt the following: (5 x 4=20)

a) Vishal takes a friendly loan from his friend and promises to pay him regularly a sum of Rs.800 at the end of each month, for a duration of 1 year. Assuming the rate of interest at 11% compounded monthly find the amount received by his friend at the end of the year, using the ordinary annuity principle.

b) Prove that (-1, 2) (3, -1) and (2, 6) are the vertices of an isosceles right angled triangle.

c) Find the elasticity of y w.r.t. x if $y = 1 + 2x - x^2$ for $i)\ x = 1$ and $ii)x = 10$

d) Evaluate the following integrals:

    i. $\int 10^{(7x+8)} + (2x - 1)^5 dx$
    ii. $\int (3x + 2)^2 + (5x - 1)^3\, dx$

<div align="center">OR</div>

Q.IV Attempt the following: (5 x 4=20)

w) For the ordinary annuity of Rs.3000 per month for 1 year at 12% to be calculated monthly, find its present value.

x) Find the equation of the line passing through (2, 3) and parallel to $3x - 4y - 7 = 0$

y) Examine the following function for maximum and minimum $P = x^4 - 4x$.

z) Evaluate the following integrals:

    i. $\int \dfrac{x^2+4x-5}{x(x-1)} dx$
    ii. $\int e^{2x+7} + \dfrac{1}{2x+9} dx$