Seat Number: - ____________

Duration: $2^{1/2}$ Hrs **H220A23CL** **Marks: - 75**

Note: - 1) All questions are Compulsory.
2) Figures to the right indicate maximum marks.

Q.1. Attempt any four from the following: **(20M)**

1) Define composite function. Explain classifications of functions. CO1(A)
2) The function F: R → R, check the differentiability for the function at the given points. CO1(U)
 $f(x) = x^2 + x + 1 \quad x \leq 1$
 $= 5x^4 - 2 \quad x \geq 1$, at $x = 1$
3) Find the intervals on which the function f is increasing or decreasing. CO1(A)
 $f(x) = 10 + 12x + 6x^2 + x^3$
4) For what values of x the curve, $f(x) = x4 - 6x^3 + 12x^2 + 5x + 7$ is concave upward & downward. CO1(A)
5) Find the points of local extrema at $f(x) = 5x^6 + 18x^5 + 15x^4 - 10$. CO1(U)
6) A rectangle has an area 50 sq.cm. Find its dimensions for least perimeter. CO1(A)

Q.2. Attempt any four from the following: **(20M)**

1) Evaluate $\int_0^{\pi/3} \sqrt{\sin x}\, dx$ for n = 6 by Simpson's Rule. CO2(U)
2) Evaluate $\int_{\pi/12}^{\pi/9} \frac{\sec(3t).\tan(3t)}{\sqrt[3]{2+\sec(3t)}} dt$ CO2(U)
3) List all the properties of definite integrals. CO2(R)
4) Solve $(x+1)\frac{dy}{dx} + 1 = 2e^{-y}$. CO2(U)
5) Explain Newton's law of cooling. CO2(R)
6) Use Euler's method with the step size of 0.1 to make table of approximate value of the solution of initial value problem. $y' = y - x$, $y(0) = 2$, over the interval $0 \leq x \leq 1$. CO2(U)

Q.3. Attempt any four from the following: **(20M)**

1) Evaluate $\left[\frac{xy+yz+zx+7}{5x+2y+z^2}\right]$ CO3(U)
2) Using definition, find f_x, f_y at (0, 0) for $f(x-y) = \frac{y^3+4x}{y}$, $f(x,0) = 0, \forall x$. CO3(U)
3) Find the equation at the tangent plane and normal line for the following: (CO3U)
 $x^2 - 4y = z^2$ at (1, 4, 3)
4) Prove that the function $(x, y) = 2x^4 + 3x^2y - y^2$ has neither a local maximum nor a local minimum at (0, 0). CO3(A)
5) Find the second order partial derivatives and check whether $f_{xy} = f_{yx}$ or not for any (x, y) CO3(A)
 $f(x, y) = x^4 + 7x^2y^3 - 5x^3y^2 + y^4$
6) Find the direction along with f.
 a) Increases most rapidly at u.
 b) Decreases most rapidly at u.
 c) No changes at u.
 Also mention the rate of changes in (a) and (b) where $f(x, y, z) = x^2 + y^2 + 2xyz$ at $u = (2, -1, 1)$.

Q.4. Attempt any five from the following: **(15M)**

1) Solve $\frac{dy}{dx} - \frac{y}{x} = 1$. CO1U)
2) List all the algebraic rules of limits of real valued functions with the names of it. CO2(R)
3) Evaluate $\int \frac{1}{1-6x-3x^2} dx$ using substitution method. CO2(U)
4) Evaluate $f(x,y) = x^2y^3 - x^3 - y^2$ at (2, 3). CO3(U)
5) Evaluate $\int 3x \cdot \sin x\, dx$ using integration by parts method. CO2(U)
6) Determine the absolute extrema for the function $f(x) = x^2 - 4x$ in (0, 2). CO1(A)

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