Seat Number: - _____

Calculus.

Duration: $2^{1/2}$ Hrs Fy Cs - 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) The function f: R → R, check the differentiability for the function at the given points. CO1(U)
$f(x) = 3x^2 - 10, \quad x < 5$
$= 4x^2 + 3, \quad x \geq 5$, at $x = 5$.
2) Find the intervals on which the function f is increasing or decreasing. $f(x) = x^3 + 9x^2 + 30x + 7$. CO1(A)
3) Define composite function. Explain classification of functions. CO1(R)
4) Determine absolute extrema for the function, $f(x) = x - x^3$ on [0, 1]. CO1(A)
5) Find, at what value of x, the curve $y = 3x^2 - 2x^3$ is concave downward and when it is concave upwards. CO1(A)
6) Using Newton's method find the approximate root for the following equation, $f(x) = x^4 - x - 10$ lies in [1, 2]. CO1(U)

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

1) Define the properties of the definite integrals. CO2(R)
2) Solve $\frac{dy}{dx} = e^{x+y} + e^y x^3$. CO2(U)
3) Evaluate $\int_{-2}^{4} \left[\frac{4}{(1+2x)^3} - \frac{5}{1+2x}\right] dx$. CO2(U)
4) Evaluate $\int_0^3 \frac{1}{1+x^5} dx$ for n = 6 by Simpson's rule. CO2(U)
5) Write down the algebraic rules of limits of real valued functions. CO2(R)
6) If $f(x) = x^2$ find the area on the interval [1, 5]. CO2(A)

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

1) Evaluate $\frac{x^2-2xy-3y^2}{x-3y}$. CO3(U)
2) Check, $f(x, y) = \frac{4x^2-9y^2}{2x-3y}$ for $2x \neq 3y$
$= 5$ if $2x = 3y$ is f continuous at (3, 2) CO3(U)
3) Find the equation of tangent and normal for $x^3 + x^2y - 2xy^2 + 25 = 0$ at (-2, 3). CO3(A)
4) $f(x, y) = x^2 - y^2 + 2x + 8y - 70$. Find all local maximum and local minimum. CO3(A)
5) Show that $f_{xy} = f_{yx}$ for $(x, y) \neq (0, 0)$ $f(x, y) = \frac{xy+y2}{x^2}$ for $x \neq 0$, $f(x, y) = 0$, if $x = 0$. CO3(U)
6) Find $f(x, y) = x^3 + y^3$, $x = t^2 - 1$, $y = 4t + 1$. CO3(U)

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

1) Find $f(x, y) = x^2y^3 - x^3y^2$ at (2, 3) CO3(U)
2) Solve $\frac{dy}{dx} - \frac{3y}{x} = x$. CO3(U)
3) What is Newton's law of cooling? Express the derivations. CO2(R)
4) Evaluate $\int \left(\sqrt{\tan x} + \sqrt{\cot x}\right) dx$. CO2(U)
5) Evaluate using integration by parts method. CO2(U)
$\int x . \sqrt{x+1}\, dx$
6) Show that, the functions $f(x) = 10 + 12x + 6x^2 + x^3$ is always decreasing. CO1(A)

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