Enrollment No.: E22CSEU082J   Name: MADHAV GUPTA

Department/School: SCSET

END TERM EXAMINATION, ODD SEMESTER 2022-23

Course Code: EMAT101L   Max. Duration: 2 hours

Course Title: Engineering Calculus   Max. Marks: 35

Instructions:

1. There are total 6 questions. All questions are compulsory.

2. Programmable calculators are NOT allowed.

3. IN THE ANSWER SHEET, WRITE SERIAL-WISE AS THE SERIAL OF QUESTIONS GIVEN IN THE PAPER.
   DO NOT DO SOME PORTION OF A QUESTION ON ONE PAGE AND SOME PORTION ON ANOTHER PAGE.

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1. A company manufactures two types of products – Product (A) and (B). The revenue function of the company, in thousands, is $R = 8A + 5B + 2AB - A^2 - 2B^2 + 20$. Determine the quantity of Product A and Product B which lead to maximum revenue. Also calculate the maximum revenue. (5 marks)

2. Find radius and interval of convergence for power series $\sum_{n=1}^{\infty} \frac{2^n}{n}(4x - 8)^n$. (5 marks)

3. Evaluate the double integral $\int_0^2 \int_0^{4-x^2} \frac{xe^{2y}}{4 - y} dy\, dx$ (5 marks)

4. Find the volume of the region under the paraboloid $z = x^2 + y^2$ and above the triangle enclosed by the lines $y = x, x = 0$, and $x + y = 2$ in the xy plane. (6 marks)

5. Consider following function
$$f(x, y) = \begin{cases} \frac{x^2y^2}{x^2+y^2}, & \text{if } (x, y) \neq (0,0), \\ 0 & \text{if } (x, y) = (0,0) \end{cases}$$

Examine the continuity and differentiability of this function at point $(0,0)$ using definition of continuity and differentiability. (3+3 = 6 marks)

6. Consider following function
$$f(x) = \begin{cases} x^2 & \text{if } 0 \leq x < 1, \\ 2 - x & \text{if } 1 \leq x < 3, \\ x - 4 & \text{if } 3 \leq x < 4 \\ \sqrt{x - 4} & \text{if } 4 \leq x \leq 5. \end{cases}$$

Examine the differentiability of the function in the domain $(0, 5)$ (Using definition of differentiability), and determine $f'(x)$. Also, calculate area of the region bounded by the function $f(x)$ and the x-axis from point $x = 0$ to $x = 5$. (4 + 4 = 8 marks)