H Roll No. ....

TMA–101

B. TECH. (CSE)
(FIRST SEMESTER)
MID SEMESTER
EXAMINATION, Jan., 2023

ENGINEERING MATHEMATICS—I

Time : 1½ Hours

Maximum Marks : 50

Note : (i) Answer all the questions by choosing any *one* of the sub-questions.

(ii) Each sub-question carries 10 marks.

1. (a) Prove that : (CO1)

$$(AB)\,C = A\,(BC)$$

where A, B and C are matrices conformable for multiplication.

OR

(b) Verify Cayley-Hamilton theorem for the matrix : (CO1)

$$A = \begin{bmatrix} 1 & 2 & 0 \\ 2 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$$

P. T. O.

2. (a) Test the consistency and solve the following system of equations : (CO2)

$$2x - y + 3z = 8$$
$$-x + 2y + z = 4$$
$$3x + y - 4z = 0$$

OR

(b) Examine the values of λ and μ so that the equations : (CO2)

$$x + y + z = 6,$$
$$x + 2y + 3z = 10$$

and $$x + 2y + \lambda z = \mu$$

have :

(i) a unique solution

(ii) an infinite number of solutions

3. (a) If $y = \left(x^2 - 1\right)^n$, use Leibnitz's theorem to show : (CO3)

$$\left(1 - x^2\right) y_{n+2} - 2xy_{n+1} + n\left(n + 1\right) y_n = 0$$

OR

(b) Define Cauchy's root test, and test for convergence of the series whose nth term is : (CO3)

$$\frac{n^{n^2}}{\left(n + 1\right)^{n^2}}$$

4. (a) If

$$u = \tan^{-1}\left(\frac{x^3 + y^3}{x + y}\right),$$

then show that : (CO3)

$$x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \sin 2u.$$

OR

(b) Find the first six terms of the expansion of the function $e^x \sin y$ in a Taylor's series about (0, 0). (CO3)

5. (a) Show that the function : (CO3)

$$f(x, y) = \frac{xy^3}{x^2 + y^6}, x \neq 0, y \neq 0$$

and $f(0,0) = 0$ is not continuous at (0, 0) in (x, y).

OR

(b) Show that : (CO3)

$$e^{e^x} = e\left[1 + x + x^2 + \frac{5}{6}x^3 + \frac{5}{8}x^4 + ...\right]$$