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Roll No. 22.94038..........

TMA–101

B. TECH. (FIRST SEMESTER)

MID SEMESTER

EXAMINATION, Nov., 2022

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) Find the inverse of the following matrix employing elementary transformations :

(CO1)

$$A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$$

P. T. O.

OR

(b) For which value of λ the rank of the matrix $A = \begin{bmatrix} 1 & 5 & 4 \\ 0 & 3 & 2 \\ \lambda & 13 & 10 \end{bmatrix}$ is 2 ? (CO1)

2. (a) Find the rank of the matrix by normal form method : (CO1)

$$A = \begin{bmatrix} 1 & 2 & -1 & 3 \\ 4 & 1 & 2 & 1 \\ 3 & -1 & 1 & 2 \\ 1 & 2 & 0 & 1 \end{bmatrix}$$

OR

(b) Find the value of a, b for which the following systems has a : (CO1)

(i) unique solution

(ii) no solution

(iii) infinite solutions

$$3x - 2y + z = b$$

$$5x - 8y + 9z = 3$$

$$2x + y + az = -1.$$

3. (a) Find the eigen values and vectors of the following matrix : (CO1)

$$A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$$

OR

(b) State and verify the Cayley-Hamilton theorem for the matrix : (CO1)

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

4. (a) Find the value of nth derivative of : (CO2)

$$y = \left(\sin^{-1} x\right)^2$$

at $x = 0$.

OR

(b) If : (CO2)

$$y = \sin\left(\frac{\log y}{a}\right)$$

prove that :

$$(1 - x^2)y_{n+2} - (2n + 1)x \, . \, y_{n+1} + (n^2 + a^2)y_n = 0$$

5. (a) If $x^x y^y z^z = 2$, show that at $x = y = z$: (CO1)

$$\frac{\partial^2 z}{\partial x \partial y} = -(x \log ex)^{-1}$$

OR

(b) If $f(x, y)$ and $\phi(x, y)$ are homogeneous functions of x, y of degree P and Q respectively and $u = f(x, y) + \phi(x, y)$ show that : (CO2)

$$f(x, y) + \frac{Q-1}{P(P-Q)}\left[x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}\right] - \frac{1}{P(P-Q)}\left[x^2\frac{\partial^2 u}{\partial x^2} + y^2\frac{\partial^2 u}{\partial y^2} + 2xyy^2\frac{\partial^2 u}{\partial x \partial y}\right] = 0.$$

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