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Total No. of Pages : 02

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B.Tech. (Artificial Intelligence & Machine Learning / Artificial Intelligence (AI) and Data Science / Artificial Intelligence / Computer Engineering / CSE / Data Science / ECE / IT / Mechanical Engineering)

B.Tech. (CSE) (Artificial Intelligence & Machine Learning / Cyber Security / Data Science / IOT) / CSE (Internet of Things and Cyber Security including Block Chain Technology)

PIT B.Tech Computer Engg. / PIT B.Tech CSE (Sem.-1)

MATHEMATICS-I

Subject Code : BTAM-104-18

M.Code : 75362

Date of Examination : 01-02-22

Time : 2 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE question(s), each question carries 12 marks.

1. a) Find the volume of the solid obtained by revolving the lemniscates $r^2 = a^2 \cos 2\theta$ about the initial line.
- b) Use Taylor's theorem to express the polynomial $2x^3 + 7x^2 + x + 6$ in the power of $(x - 2)$

2. a) Show that $2^{2n-1} \beta(n, m) = \frac{\sqrt{\pi} \Gamma(n)}{\Gamma\left(n + \frac{1}{2}\right)}, n > 0.$

b) Evaluate $\int_0^a \frac{dx}{(a^n - x^n)^{\frac{1}{n}}}.$

3. Find the value of λ for which the equations :

$$(\lambda - 1)x + (3\lambda + 1)y + 2\lambda z = 0,$$

$$(\lambda - 1)x + (4\lambda - 2)y + (\lambda + 3)z = 0,$$

$$2x + (3\lambda + 1)y + 3(\lambda - 1)z = 0$$

are consistent and find the ratio of x, y, z when λ has the smallest of these values. What happens when λ has the greatest of these values?

4. a) Use Gauss Jordan method to find the inverse of a matrix $\begin{bmatrix} 2 & 1 & -1 & 2 \\ 1 & 3 & 2 & -3 \\ -1 & 2 & 1 & -1 \\ 2 & -3 & -1 & 4 \end{bmatrix}$.

b) Find the rank of the matrix $\begin{bmatrix} 8 & 1 & 3 & 6 \\ 0 & 3 & 2 & 2 \\ -8 & -1 & -3 & 4 \end{bmatrix}$

5. a) Find all the Eigen values and Eigen vectors of the matrix $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$.

b) Find the rank and nullity of the matrix $\begin{bmatrix} 1 & -2 & 2 & 3 & 6 \\ 0 & -1 & -3 & 1 & 1 \\ -2 & 4 & -3 & -6 & 11 \end{bmatrix}$.

6. Determine the coordinate vectors of $p = 4 - 2x + 3x^2$ relative to the following bases.

a) The standard basis for P_2 , $S = \{1, x, x^2\}$.

b) The basis for P_2 , $A = \{p_1, p_2, p_3\}$, where $p_1 = 2, p_2 = -4x, p_3 = 5x^2 - 1$.

7. a) Find linear transformation $T : R^4 \rightarrow R^3$ whose null space is generated by $(0, 1, 2, 3)$ and $(-1, 2, 3, 0)$

b) Prove that the subspace of R^3 consisting of triplet (a, b, c) with $c = 0$ is a subspace of R^3 , which is isomorphic to R^2 .

8. Show that the Matrix $A = \begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$ is similar to the diagonal matrix. Also find the transforming matrix and the diagonal matrix.

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