

Roll No.

Total No. of Pages : 01

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B.Tech. (AI&DS/AI&ML/Blockchain/CE/CSE/Cyber Security/IOT/CS&D/EEE/ECE/DS/EE/ECE(Industry Integrated)/ETE/ECS/FT/IT/ME/Robotics & AI/CSE (Internet of Things and Cyber Security including block Chain Technology)) (Sem.–2)

ENGINEERING MATHEMATICS-II

Subject Code : BTAM201-23

M.Code : 93811

Date of Examination : 06-05-2025

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY** consisting of **TEN** questions carrying **TWO** marks each.
2. **SECTION - B & C.** have **FOUR** questions each.
3. Attempt any **FIVE** questions from **SECTION B & C** carrying **EIGHT** marks each.
4. Select at least **TWO** questions from **SECTION - B & C.**

SECTION - A

- 1. Write a short notes on :**

- a) Determine whether the system of equations : $x - 3z = -1$ and $2x - z = 3$ is consistent or not? Justify.

b) Find the column rank of the matrix $A = \begin{pmatrix} 1 & 1 & 2 \\ 1 & 4 & 3 \\ 3 & 3 & 6 \end{pmatrix}$.

- c) State Rank-Nullity theorem.
- d) If λ is an eigenvalue of the matrix A , then prove that $\alpha\lambda$ is an eigenvalue of αA , where α is a scalar.
- e) Let $T: V \rightarrow V$ be a Linear Transformation. Show that $T(O) = O$, where O is the zero element of vector space V .
- f) Write down the ordinary differential equation for simple population decay model.
- g) Find the particular integral of $(D^3 + 1)y = \cos(2x - 1)$.
- h) Find the differential equation of all ellipses centered at the origin and foci on x-axis.
- i) Construct the partial differential equation of $z = a(x + y) + b(x - y)$ by eliminating the arbitrary constants.

j) Find the solution of the partial differential equation $(D^4 - 2D^2D'^2 + D'^4)z = 0$.

SECTION - B

2. Using Gauss Elimination method, solve the following system of linear equations :

$$x + 3y - 2z = 0, \quad 2x - y + 4z = 0, \quad x - 11y + 14z = 0.$$

3. Determine the all values of k such that the rank of the matrix A is 3, where

$$A = \begin{bmatrix} 1 & 1 & -1 & 0 \\ 4 & 4 & -3 & 1 \\ k & 2 & 2 & 2 \\ 9 & 9 & k & 3 \end{bmatrix}.$$

4. Diagonalize the matrix $\begin{pmatrix} 0 & 2 & 1 \\ 2 & 0 & 3 \\ 1 & -3 & 0 \end{pmatrix}$.

5. Find a Linear transformation $T : \mathbb{R}^4 \rightarrow \mathbb{R}^3$ whose null space is generated by $(1, 2, 3, 4)$ and $(0, 1, 1, 1)$.

SECTION - C

6. If $\log \left(\frac{dy}{dx} \right) = (x + y)$ and $y(1) = 1$, then find $y(-1)$.

7. Solve $\frac{d^2y}{dx^2} + a^2y = \tan ax$, using the method of variation of parameters.

8. Find the general solution of the partial differential equation $(y + z)p + (2 + x)q = x + y$.

9. Solve $(p^2 + q^2)x = pz$ using Charpit's method.

NOTE : Disclosure of Identity by writing Mobile No. or Marking of passing request on any paper of Answer Sheet will lead to UMC against the Student.