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Total No. of Pages : 02

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**B.Tech. (AI&ML/IOS/CE/DS/CSE/IT/Robotics & Artificial
Intelligence/Internet of Things and Cyber Security including Block Chain
Technology) (Sem.-1)**

MATHEMATICS-I

Subject Code : BTAM-104-18

M.Code : 75362

Date of Examination : 23-12-2023

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 atleast **TWO** questions from **SECTION - B & C**.

SECTION-A

1. **Answer briefly :**

a) Calculate $\left(\frac{1}{2}\right)$.

b) Show that $\beta(m, n) = \beta(n, m)$.

c) Compute $\lim_{x \rightarrow 0} \frac{x \cos x - \sin x}{x^2 \sin x}$.

d) If $A = \begin{bmatrix} 0 & 1 \\ 9 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 5 & 7 \end{bmatrix}$ Compute AB .

e) Find the eigen values of the matrix $\begin{bmatrix} 2 & 3 \\ 5 & 7 \end{bmatrix}$.

f) Define symmetric and skew-symmetric matrices.

g) State rank and nullity theorem.

h) Evaluate $\int_1^{\infty} \frac{dx}{x}$.

i) Find the rank of the matrix $\begin{bmatrix} 3 & 2 & 4 \\ 1 & -2 & 3 \\ -3 & -10 & 1 \end{bmatrix}$.

j) State Mean value theorem.

SECTION - B

2. Find the eigen value and eigen vector of the following matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & 9 \end{bmatrix}$

3. Find the maximum and minimum value of $f(x,y) = xy + \frac{1}{x} + \frac{1}{y}$

4. Verify Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 3 & 7 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{bmatrix}$

5. Find the volume generated by revolving the area bounded by the parabola $y^2 = 8x$ and its latus rectum about the x -axis.

SECTION - C

6. Solve the following system using Gauss elimination $2x - 2y = -6$, $x - y + z = 1$, $3y - 2z = -5$.

7. a) Find the volume of the solid generated by the revolution of the cardioid $r^2 = a^2 \cos 2\theta$ about the line $\theta = \frac{\pi}{2}$.

b) Show that $\int_0^{\frac{\pi}{2}} \frac{\sin x}{\sin x + \cos x} dx = \frac{\pi}{4}$.

8. a) Use Cramer's rule to solve : $-x + 3y - 2z = 5$, $4x - y - 3z = -8$, $2x + 2y - 5z = 7$.

b) Prove that $\beta(m, n) = \frac{rmrn}{r(m+n)}$

9. a) Show that the transformation $T : R^3 \rightarrow R^3$ define by $T(x, y, z) = ax + by + cz$ is linear, where a , b and c are fixed real numbers.

b) Let $T : R^3 \rightarrow R^3$ define by $T\{x, y, z\} = (x, x + y, x + y + z)$. Find the associated matrix corresponding to standard basis.

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