Registration No.: | | | | | | | | | | |

Total Number of Pages: 02 **Course: Integrated Dual Degree (B.Tech and M.Tech)**

Sub_Code: RMA2A001

2nd Semester Back Examination: 2023-24

SUBJECT: Mathematics-II

BRANCH(S):

AE,AEIE,AERO,AUTO,CHEM,CIVIL,CSE,CSEAI,CSEAIME,CSEDS,CSIT,CST,ECE,EEE,EIE,ELECTRICAL,ELECTRICAL & C.E,ELECTRONICS & CE,CSE,ME

Time: 3 Hour

Max Marks: 100

Q.Code: P221

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) If A is a square matrix such that $A^2 = A$, then $(I - A)^3 + A$ is equal to

b) The rank of the matrix $M = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ is _____.

c) The modulus of eigenvalues of an orthogonal matrix is _____.

d) If A is a square matrix of order 3 such that $|A| = 3$, then adj (adj A) is_____.

e) What would be the length of the curve, if the radius of the curve is 24.69 m and the angle is given as 12˚42'?

f) Find the additive inverse of a matrix A = $\begin{bmatrix} 2 & 1 \\ -3 & 0 \end{bmatrix}$

g) What is the flux through a cube of side 'a' if a point charge of q is at one of its corner?

h) The resistivity of a material of resistance is 200 ohm, length 10 m and area twice that of the length is _____.

i) How many odd and even phases are required respectively to sort the given array using odd-even sort.arr = {3, 2, 3, 8, 5, 6, 2, 1}.

j) Find b_n when we have to find the half range sine series of the function x^2 in the interval 0 to 3.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 × 8)**

a) Find all solutions of the following system of linear equations.

$4x_2 + 8x_3 = 12$

$x_1 - x_2 + 3x_3 = -1$

$3x_1 - 2x_2 + 5x_3 = 6$

b) Find Inverse of the following matrix using Gauss-Jordan Elimination method

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

c) Find eigenvalues of the following 2 x 2 matrix

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

d) Prove that each complex n×n matrix A can be written as A = B + iC,

e) Determine the length of y=ln (sec x)between $0 \le x \le \pi/4$

f) Compute divF$^{\rightarrow}$ and curlF$^{\rightarrow}$ for F=x2yi$^{\rightarrow}$−(z3−3x) j$^{\rightarrow}$+4y2k$^{\rightarrow}$

g) Find the line integral of $\oint_C (1 + x^2y)ds$
Where C is considered as an ellipse
r(t) = (2cos t) + (3sin t)
for $0 \le t \le 2\pi$

h) Verify Green's theorem in a plane for $\int_C [(3x2 - 8y2)\,dx + (4y - 6xy)dy]$
Where, C is the boundary of the region defined by the lines x = 0, y = 0 and x + y = 1.

i) Evaluate $\iint_s (z+3y-x^2)dS$ where S is the portion of $z = 2 - 3y + x^2$ that lies over the triangle in the xy-plane with vertices (0, 0), (2, 0) and (2, −4)

j) Find the Fourier series of the function $f(x) = x^2, -\pi < x < \pi$.

k) Identify whether the following functions are even, odd, or neither
$f(x) = x^2 - 1$
$g(x) = |x - 1|$
$h(x) = -3x^5$

l) Let W be the set of 3×3 skew-symmetric matrices. Show that W is a subspace of the vector space V of all 3×3 matrices. Then, exhibit a spanning set for W.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Solve the given set of equations by using Gauss elimination method: **(16)**

$$x + y + z = 4$$
$$x + 4y + 3z = 8$$
$$x + 6y + 2z = 6$$

Q4 **a)** Find eigenvalues and eigenvectors corresponding to counterclockwise rotation through the angle $\pi/2$ about the origin in $\mathbb{R}^2$. **(8x2)**

b) Diagonalize the given matrix:

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

Q5 **a)** Find the gradient ∇f(x, y) of each of the following functions: **(8x2)**
I) $f(x, y) = x^2 - xy + 3y^2$ II) $f(x, y) = \sin 3x.\cos 3y$

b) Vector field $a = x^3\hat{j} - y^3\hat{i}$ and C is the circle of radius R centred on the origin.

Derive $\oint_C a.dl$

Q6 **a)** Find the Fourier transform of e^{-ax^2}, where $a > 0$. **(8x2)**

b) Find the Sine Transform of e^{-ax}, where $a > 0$