Paper : **<u>Methods of Applied Mathematics</u>** Examination:

Time Allowed: 3 hours

Q1. **(a)** Solve the following linear system by Gauss's elimination method.

$$y+z=-2,\ 6y+6z=-12,\ x+y+z=2.$$

(b) **Solve the following linear system by Gauss-Jordan elimination method.**

$$x+2y+3z=5,\ 2x+5y+3z=3,\ 4x+4z=17.$$

Q2. **(a)** Solve the following linear system of equations by Carmmer's rule.

$$4x+3y=12,\quad 2x+5y=-8.$$

(b) Find invers of the matrix $A=\begin{bmatrix}-1 & 1 & 2\\ 3 & -1 & 1\\ -1 & 3 & 4\end{bmatrix}$

Q3. **(a)** Find the rank of matrix, $A=\begin{bmatrix}0 & 4 & 1\\ 2 & 6 & -2\\ 4 & 8 & -5\end{bmatrix}$

(b) Find the Eigen values of the matrix $A=\begin{bmatrix}-2 & 2 & -3\\ 2 & 1 & -6\\ -1 & -2 & 0\end{bmatrix}$

Q4 **(a)** Show that the following matrices A and B are symmetric

$$A = \begin{bmatrix} 1 & -3 & 4 \\ -3 & 2 & -5 \\ 4 & -5 & 0 \end{bmatrix} \text{ and } B = \begin{bmatrix} 5 & 6 & 7 \\ 6 & -8 & 3 \\ 7 & 3 & 1 \end{bmatrix}$$

(b) For the vectors $a = (4, 0, 1)$ *and* $b = (2, -5, 1)$ find $2a - 2b$.

Q5. **(a)** Using dot product, find the angle between vectors u = (1, 2, 3) and v = (4, −5, 6). Do the vectors form

an acute angle, right angle, or obtuse angle?

(b) Calculate the cross product for the vectors a = (1, 1, 0) and b = (3, 0, 0).

Q6. **(a)** Find the real and imaginary part of complex number $\left(\sqrt{2} + i\right)^2$

(b) Find the Divergence of the vector function $v = \left[3xz, 2xy, -yz^2\right]$

Q7. **(a)** Find the Curl of the vector field $v = \left[yz\ ,\ 3zx,\ z\ \right]$

(b) Find the general solution of differential equation $\dfrac{d^2y}{dx^2} + 5\dfrac{dy}{dx} - 6y = 0$

Q8. **(a)** Find the Laplace transform of the following function:

$$f(t) = t^2 - 2t$$

(b) Given $F(S) = L(f(t))$, find $f(t)$

$$F(S) = \frac{2S + 16}{S^2 - 16}$$

Paper : **Methods of Applied Mathematics** Examination:

Time Allowed : 3 hours

gadgets are not allowed.

Q1. **(a)** Solve the following linear system by Gauss's elimination method.

2x - 7y + 4z = 9,

x + 9 y - 6 z = 1,

-3x + 8y + 5 z = 6.

(b) Solve the following linear system by Gauss Jordan elimination method.

2x + 2y + 4z = 18,

x + 3 y +2 z = 13,

3x + y + 3 z = 14.

Q2. **(a)** Solve the following linear system of equations by Carmmer's rule.

$$x + 2z = 6$$

$$-3x + 4y + 6z = 30$$

$$-x - 2y + 3z = 8.$$

(b) Find invers of the matrix $A = \begin{bmatrix} 0 & 4 & 1 \\ 2 & 6 & -2 \\ 4 & 8 & -5 \end{bmatrix}$

Q3. **(a)** Find the rank of matrix $A = \begin{bmatrix} 1 & 0 & -1 \\ 3 & 2 & 4 \\ 6 & 4 & 8 \end{bmatrix}$

(b) Find the Eigen values of the matrix $A = \begin{bmatrix} 4 & 0 & 1 \\ -2 & 1 & 0 \\ -2 & 0 & 1 \end{bmatrix}$

Paper : **Methods of Applied Mathematics** Examination:

Time Allowed : 3 hours

Total Marks : 70 Passing Marks (35)

NOTE: *Attempt any five questions from the rest. All questions carry equal marks. Phones and other Electronic Gadgets are not allowed.*

Q1. Solve the following system of linear equations by

(a) Gaussian elimination method **(b)** Gauss - Jorden elimination method

$$x-3y+z=4,$$
$$2x-8y+8z=-2,$$
$$-6x+3y-15z=9.$$

Q2. **(a)** Use Cramer's Rule to solve the following system of linear equations

$x + y = 5$

$2x + 3y = 8$

(b) Find determinant of the matrix $A=\begin{bmatrix} 2 & 0 & 3 \\ -1 & 4 & -2 \\ 1 & -3 & 5 \end{bmatrix}$.

Q3. **(a)** Find the modulus and argument of the complex number $z=3+4i$

(b) Find the Eigen values of the matrix $A=\begin{bmatrix} -4 & -6 \\ 3 & 5 \end{bmatrix}$

Q4. **(a)** Let $A=\begin{bmatrix} -5 & 2 \\ -7 & -4 \end{bmatrix}, B=\begin{bmatrix} 0 & 0 \\ 2 & 7 \end{bmatrix}$. Determine whether $AB=BA$

(b) Prove that the matrix $A=\begin{bmatrix} 0 & -5 & 4 \\ 5 & 0 & -1 \\ -4 & 1 & 0 \end{bmatrix}$ is skew symmetric.

Q5. **(a)** For the vectors $u=(2,\ -1,\ 1)$, $v=(-4,\ 0,\ 5)$ and w = (0, 3, -8). Find $3u+v-4w$.

(b) Calculate the dot product of vectors u = (1, 2, 3) and v = (4, −5, 6). Do the vectors form an acute angle, right angle, or obtuse angle?

Q6. **(a)** Determine whether the vectors $v_1=(2,\ 2,\ 0)$, $v_2=(1,\ -1,\ 1)$ *and* $v_3=(4,\ 2,\ -2)$ are linear dependent or independent?

(b) Find the Gradient of the scalar function $f = x^4 + y^4$

Q7. **(a)** Find the Divergence of the vector function V = $[\sin xy,\ \sin xy,\ z\cos xy]$

(b) Find the Curl of the vector field V = $\left[y^n, z^n, x^n\right], \left(n \succ 0, \text{int}\,eger\right)$

Q8. **(a)** Find the Laplace transform of the following function:

$$f(t) = t^2 - 2t$$

(b) Given $F(s) = L\left(f(t)\right)$, find $f(t)$ $F(s) = \frac{4s - 3\pi}{s^2 + \pi^2}$

Q4. **(a)** Determine whether the vectors $v_1 = (2,\ 2,\ 0),\ v_2 = (1,\ -1,\ 1)\ and\ v_3 = (4,\ 2,\ -2)$ are linear dependent or independent?

(b) Let $u = (2,\ -1,\ 1)$, $v = (-4,\ 0,\ 5)$ and w = (0, 3, -8). Find $u + v - 4w$.

Q5. **(a)** Calculate the dot product of vectors u = (1, 2, 3) and v = (4, −5, 6). Do the vectors form an acute angle, right angle, or obtuse angle?.

(b) Calculate the cross product between a = (3, −3, 1) and b = (4, 9, 2).

Q6. **(a)** Find the Gradient of the scalar function $f = x^2 + y^2$

(b) Find the Divergence of the vector function $\left[x^3 + y^3,\ 3xy^2,\ 3zy^2\right]$

Q7. **(a)** Find the Curl of the vector field $\left[y\ ,\ 2x^2,\ 0\right]$

(b) Find the general solution of differential equation $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} - y = 0$

Q8. **(a)** Find the Laplace transform of the following function:

$$f(t) = a + bt + ct^2$$

(b) Given $F(S) = L\left(f(t)\right)$, find $f(t)$

$$F(S) = \frac{4S - 3\pi}{S^2 + \pi^2}$$