MODEL QUESTION PAPER

Subject: Engineering Mathematics II

Max Marks: 100 Marks **Time: 3 Hrs**

PART A

(Answer all questions. 2 Marks each)

I

1. **Find a unit vector in the direction of $\vec{a} = 2\hat{\imath} + 3\hat{\jmath} + \hat{k}$.**
2. **If $\begin{vmatrix} x^2 & 3 \\ 4 & 1 \end{vmatrix} = \begin{vmatrix} 9 & 4 \\ 8 & 5 \end{vmatrix}$, find *x*.**
3. **$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 0 & -2 \\ -3 & -3 \end{bmatrix}$ Find $(A + B)^T$.**
4. **Evaluate $\int_0^1 \frac{1}{1+x^2} dx$.**
5. **Solve $\frac{dy}{dx} = \frac{y}{x}$.**

(5 x 2Marks = 10 Marks)

PART B (Answer any 5 questions. 6 Marks each)

II

1. **If $\vec{a} = 2\hat{\imath} + 2\hat{\jmath} - \hat{k}$, $\vec{b} = 6\hat{\imath} - 3\hat{\jmath} + 2\hat{k}$ Find (i) $\vec{a}.\vec{b}$ and (ii) $\vec{a} \times \vec{b}$.**
2. **Find the middle terms in the expansion of $\left(3x - \frac{x^3}{6}\right)^7$.**
3. **Solve the following system of equations using determinants. $3x - 2y + 3z = 8$, $2x + y - z = 1$, $4x - 3y + 2z = 4$.**
4. **Find the inverse of $\begin{bmatrix} 2 & 3 & 1 \\ 1 & 2 & 3 \\ 3 & 1 & 2 \end{bmatrix}$.**
5. **Evaluate $\int_0^{\pi/4} x^2 sin2x dx$.**
6. **Find the volume of a sphere of radius '*r*' using integration.**
7. **Solve $(1 + x^2)\frac{dy}{dx} + y = e^{tan^{-1}x}$.**

(6 x 5 Marks = 30 Marks)

PART C (Answer one full question from each module. 15 Marks each)

Module I

III

1. **Find the dot product and angle between the pairs of vectors $3\hat{\imath} + 4\hat{\jmath} - 5\hat{k}$ and $\hat{\imath} - 3\hat{\jmath} + 2\hat{k}$. 5**

2. Find the area of a triangle whose vertices are $A(\hat{\imath} - \hat{k})$, $B(2\hat{\imath} + \hat{\jmath} + 5\hat{k})$, and $C(\hat{\jmath} + 2\hat{k})$. 5

3. Expand $\left(\frac{y}{3} - \frac{6}{y^6}\right)^5$ binomially. 5

OR

IV 1. Obtain the coefficient of x^{12} in $\left(x^2 - \frac{1}{x^2}\right)^{10}$. 5

2. Find the workdone in moving an object from '*A*' with position vector $2\hat{\imath} - 6\hat{\jmath} + 7\hat{k}$ to the point '*B*' with position vector $3\hat{\imath} - \hat{\jmath} + 5\hat{k}$ by a force $\vec{F} = \hat{\imath} + 3\hat{\jmath} - \hat{k}$. 5

3. Find the projection of the line joining (1,-2,-1) to (3,1,1) on the vector $4\hat{\imath} - 3\hat{\jmath} + 12\hat{k}$. 5

Module II

V 1. If $\begin{vmatrix} 2 & 1 & x \\ 3 & -1 & 2 \\ 1 & 1 & 6 \end{vmatrix} = \begin{vmatrix} 4 & x \\ 3 & 2 \end{vmatrix}$ Find *x*. 5

2. If $A = \begin{bmatrix} 0 & -3 & 1 \\ 2 & -1 & 1 \\ 2 & -1 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 0 & -1 & 1 \\ 0 & 1 & -1 \\ 0 & 3 & -3 \end{bmatrix}$ Find AB and BA. Do A and B Commute? 5

3. Solve the system of equations by finding the inverse of the coefficient matrix $x - y + z = 4, 2x + y - 3z = 0, x + y + z = 2.$ 5

OR

VI 1. Solve $\frac{2}{x} + \frac{5}{y} = 3, \frac{6}{x} + \frac{7}{y} = 5$ using determinants. 5

2. If $A = \begin{bmatrix} 3 & 1 & -1 \\ 0 & 1 & 2 \end{bmatrix}$ find AA^T and A^TA and hence show that both AA^T and A^TA are symmetric matrices. 5

3. Find A and B if $A + 2B = \begin{bmatrix} 3 & 1 & 0 \\ 1 & -1 & 2 \end{bmatrix}$, and $2A + 3B = \begin{bmatrix} 1 & 2 & -1 \\ 2 & 0 & 1 \end{bmatrix}$. 5

Module III

VII 1. Evaluate (i) $\int \frac{3cosx+4}{sin^2x} dx$ (ii) $\int sin^2x dx$ 3+2

2. Evaluate (i) $\int \frac{x}{1+x^4} dx$ (ii) $\int \frac{sin(logx)}{x} dx$. 3+2

3. Evaluate $\int_1^e logx\, dx$ 5

OR

VIII 1. Evaluate $\int_0^{\pi/4} cos4xos2xdx$ **.** **5**

2. Evaluate if (i) $\int xsec^2xdx$ **(ii)** $\int \frac{1}{1-4x}dx$ **.** **3+2**

3. Evaluate $\int_0^{\pi/2} \sqrt{1+sin2x}\,dx$ **5**

Module IV

IX 1. Find the area bounded by the curve $y = x^2 + x$ **and the X- axis.** **5**

2. Obtain the volume of the solid obtained by rotating one arch of the curve $y = 2sin3x$ **about the X- axis.** **5**

3. Solve $\frac{dy}{dx} + ycotx = 2cosx$ **5**

OR

X 1. Find the area bounded by the curve $y = 6x - 2x^2$ **and the line** $y = 3x$**.** **5**

2. Solve $\frac{d^2y}{dx^2} = sec^2x$**.** **5**

3. Solve $\frac{dy}{dx} + \sqrt{\frac{1-y^2}{1-x^2}} = 0$ **.** **5**