

**DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/
COMMERCIAL PRACTICE, NOVEMBER - 2024**

ENGINEERING MATHEMATICS - II

[Maximum marks: 100]

[Time: 3 Hours]

PART – A

Maximum marks: 10

I. (Answer *all* the questions. Each question carries **2** marks)

1. Find the unit vector in the direction of $2i + j + 2k$.
2. Solve for x if $\begin{vmatrix} x & 16 \\ 4 & x \end{vmatrix} = 0$.
3. If $A = \begin{bmatrix} 1 & 2 \\ -2 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 0 \\ 5 & -7 \end{bmatrix}$. Find $5A - B$.
4. Evaluate $\int x^2(x + 1)dx$.
5. Solve $\frac{dy}{dx} = 2y$. (5 x 2 = 10)

PART – B

Maximum marks: 30

II. (Answer any *five* of the following questions. Each question carries **6** marks)

1. Find the unit vector perpendicular to the vectors $\vec{a} = i + j + k$ and $\vec{b} = i + 3j - k$
2. Find the term independent of x in the expansion of $\left(x^3 + \frac{3}{x^2}\right)^{15}$
3. Find A, B if $A + B = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$, $A - B = \begin{bmatrix} 5 & 4 & 3 \\ 2 & 1 & 0 \end{bmatrix}$
4. Solve the system $x + y + z = 1, 2x + 2y + 3z = 6, x + 4y + 9z = 3$ by finding the inverse of the coefficient matrix.
5. Evaluate $\int \left(x + \frac{1}{x}\right)^2 dx$
6. Evaluate $\int_0^\pi \cos^2 x dx$
7. Solve $(1 + x^2) \frac{dy}{dx} + y = e^{\tan^{-1}(x)}$ (5 x 6 = 30)

PART – C

Maximum marks: 60

(Answer *one full* question from each unit. Each full question carries **15** marks)

UNIT – I

- III.** (a) Find the dot product and angle between the pair of vectors $i - 2j + 3k$ and $3i - 2j + k$ (5)
- (b) A force $F = 4i - 3k$ passes through the point A whose position vectors is given by $2i - 2j + 5k$. Find the moment of the force about the point B whose position vector is $i - 3j + k$ (5)
- (c) Find the 7th term in the expansion of $\left(x^2 + \frac{2}{x}\right)^{10}$ (5)

OR

- IV.** (a) If $\vec{a} = 5i - j - 3k$, $\vec{b} = i + 3j - 5k$, show that the vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are perpendicular to each other. (5)
- (b) Find the area of a triangle whose vertices are represented by vectors $A(i - k)$, $B(2i + j + 5k)$ and $C(j + 2k)$. (5)
- (c) Find the middle term of $\left(2x + \frac{3}{x}\right)^9$ (5)

UNIT - II

- V.** (a) Solve for x if $\begin{vmatrix} 2 & 1 & x \\ 3 & -1 & 2 \\ 1 & 1 & 6 \end{vmatrix} = \begin{vmatrix} 4 & x \\ 3 & 2 \end{vmatrix}$ (5)
- (b) If $A = \begin{bmatrix} 5 & 3 \\ 2 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 7 & 5 \\ 4 & 3 \end{bmatrix}$. Show that $(AB)^{-1} = B^{-1}A^{-1}$ (5)
- (c) Solve the system $x + 2y - z = -3$, $3x + y + z = 4$, $x - y + 2z = 6$ by Cramer's rule. (5)

OR

- VI.** (a) If $A = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$, $B = [1 \quad 4 \quad -1]$. Find AB and BA . (5)
- (b) If A is a square matrix, prove that $(A + A^T)$ is symmetric and $(A - A^T)$ is skew symmetric. (5)
- (c) Find the inverse of $\begin{bmatrix} 3 & 1 & -1 \\ -1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ (5)

UNIT - III

- VII. (a) Evaluate $\int \operatorname{cosec} x \, dx$ (5)
(b) Find $\int_0^\pi \frac{1}{1+\sin x} \, dx$ (5)
(c) Find $\int x \sin x \, dx$ (5)

OR

- VIII. (a) Find $\int \frac{1+\cos x}{(x+\sin x)^2} \, dx$ (5)
(b) Find $\int x^2 e^{-x} \, dx$ (5)
(c) Find $\int_1^e \frac{\sin(\log x)}{x} \, dx$ (5)

UNIT - IV

- IX. (a) Find the volume of the solid generated by the rotation of the area bounded by the curve $y = 2\cos x$, the x - axis and the lines $x = 0, x = \frac{\pi}{4}$ about the x - axis. (5)
(b) Solve $\frac{dy}{dx} + y \cot x = 2\cos x$ (5)
(c) Solve $3e^x \tan y \, dx + (1 - e^x) \sec^2 y \, dy = 0$ (5)

OR

- X. (a) Find the area bounded by the curve $x = 4 - y^2$ about the y - axis (5)
(b) Solve $dy = e^{3x+y} \, dx$ (5)
(c) Solve $x \frac{dy}{dx} + 3y = 5x^2$ (5)
