DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE, NOVEMBER – 2025

ENGINEERING MATHEMATICS - II

[Maximum Marks: **100**]   [Time: **3** Hours]

PART-A
[Maximum Marks: **10**]

I.   (Answer *all* questions in one or two sentences. Each question carries *2* marks)

1. Find a unit vector in the direction of $2\vec{i} + \vec{j} - 2\vec{k}$.

2. If $\begin{vmatrix} 3x & 7 \\ 2 & 3 \end{vmatrix} = 0 \; find \; x.$

3. If $A=\begin{bmatrix} 0 & 2 \\ -1 & 3 \end{bmatrix}$ and $B=\begin{bmatrix} 1 & 1 \\ 3 & -1 \end{bmatrix}, find \; (A + B)^T.$

4. Integrate $sec^2 x - \frac{1}{x} \; with \; respect \; to \; x.$

5. Solve $\frac{d^2 y}{dx^2} = \sin x.$ (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 dot product and angle between the vectors $6\vec{i} - 3\vec{j} + 2\vec{k} \; and \; 2\vec{i} + 2\vec{j} - \vec{k}$.

2.   Find the middle term (s) in the expansion of $(x + 2y)^7.$

3. Solve the system of equations by Cramer's Rule:
     $x - y + z = 4, \; 2x + y - 3z = 0, \; x + y + z = 2.$

4. If $A=\begin{bmatrix} 1 & 4 & 3 \\ -4 & 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 0 & 5 \\ -1 & 1 \end{bmatrix} find \; AB \; and \; BA.$

5. Evaluate $\int \sqrt{1 + sin2x} \, dx.$

6. Find the area enclosed between $y = x^2 and \; the \; straight \; line \; y = x + 2.$

7. Solve $\frac{dy}{dx} = \frac{1+y^2}{1+x^2}.$ (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 $\vec{a} \times \vec{b}$ if $\vec{a} = 2\vec{i} + 3\vec{j} + 6\vec{k}, \vec{b} = 3\vec{i} - 6\vec{j} + 2\vec{k}$.   (5)

b. Find the coefficient of x^{10} *in the expansion of* $\left(2x^2 - \frac{3}{x}\right)^{11}$.   (5)

c. Find the moment about the point $A(4,0,-3)$ *of a force represented by* $3\vec{i} + 2\vec{j} + 6\vec{k}$, *acting through the point* $B(2,-1,5)$.   (5)

OR

IV.   a. Find angle between the vectors $\vec{i} - 2\vec{j} + 3\vec{k}$ and $3\vec{i} - 2\vec{j} + \vec{k}$.   (5)

b. If $\vec{a} = 5\vec{i} - \vec{j} - 3\vec{k}$, *and* $\vec{b} = \vec{i} + 3\vec{j} - 5\vec{k}$. *Show that* $\vec{a} + \vec{b}$ *and* $\vec{a} - \vec{b}$ *are perpendicular*.   (5)

c. Expand binomially: $(2x + 3y)^4$.   (5)

UNIT – II

V.   a. If A= $\begin{bmatrix} 1 & 0 & 5 \\ -2 & 1 & 6 \\ 3 & 2 & 7 \end{bmatrix}$ compute $A + A^T$ and $A - A^T$.   (5)

b. 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)

c. Find the adjoint of the matrix A = $\begin{bmatrix} 1 & 1 & 1 \\ 2 & 1 & -3 \\ -1 & 2 & 3 \end{bmatrix}$.   (5)

OR

VI.   a. If A= $\begin{bmatrix} 5 & -3 \\ 2 & -2 \end{bmatrix}$ and B = $\begin{bmatrix} 7 & 5 \\ 4 & 3 \end{bmatrix}$ Show that $(AB)^{-1} = B^{-1}A^{-1}$.   (5)

b. Solve by determinants method $\frac{6}{x} + \frac{7}{y} = 5$, $\frac{2}{x} + \frac{5}{y} = 3$.   (5)

c. Find A and B if $A+B = \begin{bmatrix} 4 & 6 \\ 2 & 3 \end{bmatrix}$ and $A - B = \begin{bmatrix} -2 & 8 \\ 4 & -1 \end{bmatrix}$.   (5)

UNIT- III

VII.   a. Find $\int \frac{3\cos x + 4}{\sin^2 x} \, dx$.   (5)

b. Evaluate $\int_0^{\frac{\pi}{2}} x \sin x \, dx$.   (5)

c. Find $\int \frac{\sec^2 x}{1 + \tan x} dx$.   (5)

VIII. a. Find $\int \sin^2 x \, dx$. (5)

b. Evaluate $\int \sin^3 x \, \cos x \, dx$. (5)

c. Evaluate $\int_0^1 \frac{2x+1}{x^2+x+1} \, dx$. (5)

UNIT - IV

IX. a. Find the area bounded by the curve $y = x^2 - 5x + 6 \ and \ the \ x - axis$. (5)

b. Find the volume of a sphere of radius r using integration. (5)

c. Solve: $\frac{dy}{dx} + \sqrt{\frac{1-y^2}{1-x^2}} = 0$. (5)

OR

X. a. Find the area bounded by $y = x + sinx, the \ x - axis \ and \ the \ ordinates \ at$

$x = 0 \ and \ x = \frac{\pi}{2}$. (5)

b. Solve: $(x^2 + 1)\frac{dy}{dx} + 2xy = 4x^2$. (5)

c. Find the volume obtained by rotating one arch of the curve $y = 3sin2x$

about the axis. (5)

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