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# DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE — APRIL, 2019

## ENGINEERING MATHEMATICS - II

[*Time*.: 3 hours

(Maximum marks : 100)

### PART — A

(Maximum marks : 10)

Marks

I Answer *all* questions. Each question carries 2 marks.

1. Find the unit vector in the direction of $2\hat{i} - 3\hat{j} + \hat{k}$.
2. Evaluate $\begin{vmatrix} \sec\theta & \tan\theta \\ \tan\theta & \sec\theta \end{vmatrix}$
3. If A = [0 2 3] B = [1 4 –1]. find $A^T B$.
4. Integrate $\sec^2 x - \frac{1}{x}$ with respect to x.
5. Find the order and degree of the differential equation
$$\frac{d^3y}{dx^3} + \frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = e^x$$ (5 × 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 $6\hat{i} - 3\hat{j} + 2\hat{k}$ and $2\hat{i} + 2\hat{j} - \hat{k}$.
2. Find the middle terms in the expansion of $(x + 2y)^7$
3. Solve by Cramer's rule, Given
$$2x - 3y + z = -1, \quad x + 4y - 2z = 3, \quad 4x - y + 3z = 11$$
4. If $A = \begin{bmatrix} 1 & 2 \\ 4 & 9 \end{bmatrix}$ verify that $AA^{-1} = A^{-1}A = I$.
5. Evaluate $\int_0^{\pi/2} \cos 4x \cos x \, dx$.
6. Obtain the volume of a sphere of radius 'r' using integration.
7. Solve $\frac{dy}{dx} + y \cot x = 2 \cos x$. (5 × 6 = 30)

Marks

## PART — C

(Maximum marks : 60)

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

### UNIT — I

III (a) If $\vec{a} = 5\hat{i} - \hat{j} - 3\hat{k}$, $\vec{b} = \hat{i} + 3\hat{j} - 5\hat{k}$. Show that the vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are perpendicular to each other. 5

(b) Expand $\left(x^3 - \frac{1}{x^2}\right)^5$ binomially. 5

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

OR

IV (a) The constant forces $2\hat{i} - 5\hat{j} + 6\hat{k}$, $-\hat{i} + 2\hat{j} - \hat{k}$ and $2\hat{i} + 7\hat{j}$ act on a particle from the position $4\hat{i} - 3\hat{j} - 2\hat{k}$ to $6\hat{i} + \hat{j} - 3\hat{k}$. Find the total work done. 5

(b) Find the coefficient of $x^{18}$ in the expansion of $\left(x^4 - \frac{1}{x^3}\right)^{15}$ 5

(c) Find the area of parallelogram whose adjacent sides are represented by the vectors $\vec{a} = \hat{i} - \hat{j} + 3\hat{k}$ and $\vec{b} = 2\hat{i} - 7\hat{j} + \hat{k}$. 5

### UNIT — II

V (a) If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ show that $A^2 - 4A - 5I = 0$. 5

(b) Solve 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) If $A = \begin{bmatrix} 1 & 2 & 3 \\ -4 & 5 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ -1 & 1 \end{bmatrix}$ compute AB and BA. 5

OR

VI (a) Find inverse of $\begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}$ 5

(b) If $A = \begin{bmatrix} 1 & 0 & 5 \\ -2 & 1 & 6 \\ 3 & 2 & 7 \end{bmatrix}$ compute $A + A^T$ and $A - A^T$. Hence show that one is symmetric and the other is skew-symmetric. 5

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



Marks

### UNIT — III

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

(b) Find $\int x^2 e^{2x}\, dx$. 5

(c) Evaluate $\int_0^{\pi} \cos^2 2x\, dx$. 5

OR

VIII (a) Find $\int \sqrt{1+\sin 2x}\, dx$. 5

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

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

### UNIT — IV

IX (a) Find the area enclosed between $y = x^2$ and the straight line $y = x + 2$. 5

(b) 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 $x = 0$ and $x = \frac{\pi}{4}$ about x axis. 5

(c) Solve $\frac{dy}{dx} = e^{3x+y}$ 5

OR

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

(b) Solve $\frac{d^2y}{dx^2} = \operatorname{cosec}^2 x$. 5

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