TED (15/19) 2002
(Revision-2015/19)

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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/ COMMERCIAL PRACTICE, APRIL - 2025

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 length of the vector $3i + 4j + \hat{k}$.
2. Find the numerical value of $\begin{vmatrix} \text{Sin}\,\theta & \text{Cos}\,\theta \\ -\text{Cos}\,\theta & \text{Sin}\,\theta \end{vmatrix}$
3. Find the values of a, b, c & d if the matrices $A = \begin{bmatrix} 1 & 7 \\ 2 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ are equal.
4. Evaluate $\int 2x + 3e^x + \text{Sin}\,x\,dx$
5. Find the order and degree of the differential equation

$\left(\frac{d^3y}{dx^3}\right)^2 + 4\left(\frac{d^2y}{dx^2}\right)^4 + 5\frac{dy}{dx} - 4y = 0$ (5 x 2 = 10)

PART – B
Maximum marks: 30

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

1. For the given vectors $\vec{a} = 2i - j + 2\hat{k}$ and $\vec{b} = -\,i + + j - \hat{k}$ find the unit vector in the direction of $\vec{a} + \vec{b}$
2. Find the coefficient of x^{11} in the expansion of $\left(x^4 - {}^1/_{x^3}\right)^{15}$
3. Solve $x + y - z = 4 \quad 3x - y + z = 4$ and $2x - 7y + 3z = -6$ using Cramer's rule
4. Express the matrix $A = \begin{bmatrix} 1 & 4 & 5 \\ 2 & 2 & 3 \\ 3 & 1 & 0 \end{bmatrix}$ as the sum of symmetric and skew symmetric matrices.
5. Find $\int_0^{\pi/2} \text{Cos}\,4x\,\text{Cos}\,x\,dx$.
6. Find the area enclosed by one arch of the curve $y = \text{Sin}\,3x$ and the x - axis.
7. Solve $x(1 + y^2)dx + y(1 + x^2)dy = 0$. (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) If $\vec{a} = 2i + 3j + 4\hat{k}$ and $\vec{b} = \hat{\imath} + \hat{\jmath} + \hat{k}$ find $\vec{a} + \vec{b}$ (4)

(b) A force is represented in magnitude and direction by the line joining the ……..
A (1, −2, 4) and B (5, 2, 3). Find the moment about the points (-2, 3, 5) (6)

(c) Find the middle term in the expansion of $(x + +2y)^7$ (5)

OR

IV. (a) Find the values of λ so that the two vectors $2\hat{\imath} + 3\hat{\jmath} - \hat{k}$ and
$4\hat{\imath} + 6\hat{\jmath} - \lambda\hat{k}$ are (1) parallel & (2) perpendicular (5)

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

(c) Expand $\left(x - {}^{1}/_{x}\right)^6$ binomially. (5)

UNIT - II

V. (a) If $A = \begin{bmatrix} 3 & 1 & -1 \\ 0 & 1 & 2 \end{bmatrix}$ show that AA^T is symmetric. (5)

(b) Find A^{-1} if $A = \begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$ (5)

(c) Solve for x if $\begin{vmatrix} x+1 & 2 & 3 \\ 1 & x+2 & 3 \\ 1 & 2 & x+3 \end{vmatrix} = 0$ (5)

OR

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

(b) Solve the following system of equations by finding the inverse of the coefficient matrix, $x + y + z = 1$ $\quad 2x + 2y + 3z = 6$ $\quad x + 4y + 9z = 3$ (5)

(c) Solve using determinants $\frac{5}{x} + \frac{2}{y} = 4$, $\quad \frac{2}{x} - \frac{1}{y} = 7$ (5)

UNIT - III

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

(b) $\int x^2 \log x\, dx$ (5)

(c) $\int_0^{\pi/2} \sqrt{1 + \text{Sin } 2x}\ \ dx$ (5)

OR

VIII. (a) $\int \frac{x^2+2}{x} dx$ (3)

(b) $\int e^x\, \text{Sec}^2(e^x) dx$ (3)

(c) $\int \frac{2x\,dx}{x^2+1}$ (3)

(d) $\int_0^{\pi/2} x \cos x\, dx$ (3)

(e) $\int_0^{\pi/2} \frac{\text{Sin } x\, dx}{\sqrt{1-\text{Cos } x}}$ (3)

UNIT – IV

IX. (a) Find the area enclosed by the curve $y = x^2$ and the straight line $y = 3x + 4$ (5)

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

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

OR

X. (a) Find the area enclosed between the parabola $y = x^2 - x - 2$ and the x - axis. (5)

(b) Find the volume generated by rotating the area bounded by $y = 2x^2 + 1$ the y axis and the lines y = 3, y = 9 about the y - axis. (5)

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