TED (15/19)-2002
(Revision – 2015/19)

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Reg.No…………….
Signature…………..

DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/ COMMERCIAL PRACTICE , APRIL – 2023

ENGINEERING MATHEMATICS-II

(Maximum Marks : 100) (Time : 3 hours)

PART – A

(Maximum Marks : 10)

Marks

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

1. Find the unit vector in the direction of $\vec{a} = 2\hat{\imath} + 3\hat{\jmath} + \hat{k}$
2. Find the value of x if $\begin{vmatrix} x & 3 \\ 4 & 6 \end{vmatrix} = 0$.
3. Find $A + 2B$ if $A = \begin{bmatrix} 3 & 1 & 0 \\ 1 & -1 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 2 & -1 \\ 2 & 0 & 1 \end{bmatrix}$.
4. Evaluate $\int \cos^2 x \, dx$.
5. Solve $\frac{d^2y}{dx^2} = e^x$. (5x2=10)

PART –B

(Maximum Marks : 30)

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

1. If $\vec{a} = 5\hat{\imath} - \hat{\jmath} - 3\hat{k}$, $\vec{b} = \hat{\imath} + 3\hat{\jmath} - 5\hat{k}$, Show that $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are perpendicular to each other.
2. Find the middle term(s) in the expansion of $\left(2x + \frac{3}{x}\right)^9$.
3. Solve the following system of equations using Cramer's rule.
   $x + y - z = 4$
   $3x - y + z = 4$
   $2x - 7y + 3z = -6$
4. Show that $A.\ adj\ (A) = |A| . I_3$ if $A = \begin{bmatrix} 3 & -2 & 1 \\ 2 & 1 & 0 \\ 2 & -1 & 3 \end{bmatrix}$
5. Find (i) $\int x \log x \, dx$ (ii) $\int \sqrt{x}\,(1 - x)\, dx$
6. Find the volume of a sphere of radius 'r' using integration.
7. Solve $(x^2 + 1)\frac{dy}{dx} + 2xy = 4x^2$

(5x6=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 value of λ so that the vectors $\vec{a} = 2\hat{\imath} - 3\hat{\jmath} + \hat{k}$ and $\vec{b} = 4\hat{\imath} - 6\hat{\jmath} + \lambda\hat{k}$ are (i) Parallel (ii) Perpendicular. (5)

(b) Find the 10^{th} term in the expansion of $\left(x^2 - \frac{1}{x^2}\right)^{20}$. (5)

(c) 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)

OR

IV. (a) Find the work done by the force $\vec{F} = \hat{\imath} + 2\hat{\jmath} + \hat{k}$ acting on a particle which is displaced from the point with position vector $2\hat{\imath} + \hat{\jmath} + \hat{k}$ to the point with position vector $3\hat{\imath} + 2\hat{\jmath} + 4\hat{k}$. (5)

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

(c) Find the moment of the force $\vec{F} = 4\hat{\imath} + \hat{k}$ about the point with position vector $2\hat{\imath} + \hat{\jmath} - \hat{k}$ which is acting through the point with position vector $\hat{\imath} - \hat{\jmath} + 2\hat{k}$ (5)

UNIT – II

V. (a) If $A = \begin{bmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{bmatrix}$, Find $A^2 - 5A + 6I$. (5)

(b) Write the Matrix $A = \begin{bmatrix} 2 & 3 & 4 \\ 5 & 3 & -4 \\ 6 & 8 & 1 \end{bmatrix}$ as a sum of a symmetric matrix and a skew symmetric matrix. (5)

(c) Find the values of x if $\begin{vmatrix} 3 & 1 & 9 \\ 2x & 2 & 6 \\ x^2 & 3 & 3 \end{vmatrix} = 0$. (5)

OR

VI. (a) If $A = \begin{bmatrix} 1 & 1 & -1 \\ -2 & 3 & -4 \\ 3 & -2 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & -2 & -1 \\ 6 & 12 & 6 \\ 5 & 10 & 5 \end{bmatrix}$, show that $AB = 0$. (4)

(b) Solve the system of equations by finding the inverse of the coefficient matrix.

$$3x + y - z = 3$$
$$-x + y + z = 1$$
$$x + y + z = 3$$

(6)

(c) Find the value of x if $\begin{vmatrix} x & 1 & 3 \\ 4 & 1 & -1 \\ 2 & 0 & 3 \end{vmatrix} = \begin{vmatrix} 2 & -1 & 1 \\ 3 & 0 & 1 \\ -1 & 0 & 2 \end{vmatrix}$. (5)

UNIT –III

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

(b) Evaluate $\int \frac{1}{x(\log x)^2} dx$. (5)

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

OR

VIII. (a) Evaluate $\int \frac{2x^4}{1+x^{10}} dx$. (5)

(b) Evaluate $\int tan^{-1} x\, dx$. (5)

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

UNIT – IV

IX. (a) Find the area enclosed by one arch of the curve $y = 2 \sin 3x$ and the X-axis. (5)

(b) Find the volume generated by the rotation of the area bounded by the curve $y = 2x^2 + 1$, the y-axis and the lines $y = 8$, $y = 9$ about the $y =$ axis. (5)

(c) Solve $\frac{dy}{dx} + y \cot x = \operatorname{cosec} x$. (5)

OR

X. (a) Find the area enclosed between two parabolas $y^2 = x$ and $x^2 = y$. (5)

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

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

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