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

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. If $\vec{a} = 2\vec{i} + 3\vec{j} - \vec{k}$ and $\vec{b} = 3\vec{i} + \vec{j} - \vec{k}$ find $\vec{a}.\vec{b}$
2. Evaluate $\begin{vmatrix} \sin\theta & -cos\theta \\ \cos\theta & \sin\theta \end{vmatrix}$
3. If A= $\begin{bmatrix} 1 & 2 \\ 3 & 0 \end{bmatrix}$, B= $\begin{bmatrix} 4 & 1 \\ 0 & 6 \end{bmatrix}$ find $(A+B)^T$
4. Integrate $3x^2 - 4x + 6$ $with\ respect\ x.$
5. Find the order and degree of the differential equation $5\frac{d^3y}{dx^3} - 6\left(\frac{dy}{dx}\right)^2 + 4y = 0$

(5 x 2 = 10)

PART-B

[Maximum Marks: **30**]

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

1. Find the unit vector in the direction of $\vec{a} + \vec{b}$ where $\vec{a} = 2\vec{i} + 3\vec{j} + 4\vec{k},\ \vec{b} = -\vec{i} + 3\vec{j} + 2\vec{k}$.
2. Find the coefficient of x^4 in the expansion of $\left(x^4 - \frac{1}{x^3}\right)^{15}$.
3. Solve the system of equations by Cramer's rule. $x + 2y + z = 7$, $x + 3z = 11$, $2x - 3y = 1$
4. If A= $\begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ Show that $A^2 - 4A - 5I = 0$.
5. Find (i) $\int e^{\tan x} sec^2 x dx$ (ii) $\int \frac{2x+2}{x^2+2x+1} dx$
6. Solve $x\frac{dy}{dx} + 3y = 5x^2$
7. Solve $\frac{d^2y}{dx^2} = xe^x + \cos x$

(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. Show by vector method that the points P(1,1,0),Q(2,1,-1) and R(3,1,-2) are collinear. (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 the vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are perpendicular to each other. (5)

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

OR

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

b. If $\vec{a} = 2\vec{i} + 2\vec{j} - \vec{k}$ and $\vec{b} = 6\vec{i} - 3\vec{j} + 2\vec{k}$ find $\left|\vec{a} \times \vec{b}\right|$ (5)

c. Find the middle term in the expansion of $(x + 2y)^4$ (5)

UNIT – II

V. a. Solve $2x - y = 7$

$5x + 2y = 4$ (5)

b. Find the values of ***a,b,c*** and ***d*** that satisfy the matrix relationship

$\begin{bmatrix} a+4 & b-a \\ c+d & a+b+c \end{bmatrix} = \begin{bmatrix} 6 & 1 \\ 3 & 9 \end{bmatrix}$ (5)

c. Find the inverse of matrix A = $\begin{bmatrix} 1 & 0 & 2 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{bmatrix}$ (5)

OR

VI. a. Solve for $'x'$ if $\begin{vmatrix} 1 & 2 & 3 \\ 1 & x & 3 \\ 4 & 5 & 1 \end{vmatrix} = 0$ (5)

b. If A=$\begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$, B= $\begin{bmatrix} 6 & 8 \\ 0 & 1 \end{bmatrix}$ Show that $(AB)^T = B^T A^T$ (5)

c. Solve the system of equations $3x + y - z = 3$, $-x + y + z = 1$, $x + y + z = 3$ by finding the inverse of the coefficient matrix. (5)

UNIT- III

VII. a. Evaluate $\int xsec\,(x^2)\,tan(x^2)\;dx$. (5)

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

c. Find $\int_0^1 \frac{1}{\sqrt{1-x^2}} dx$ (5)

OR

VIII. a. Integrate the following with respect *x*.

(i) cot *x* (ii) $x^2(x-1)$ (3+2=5)

b. Find $\int x^2 \cos x dx$ (5)

c. Evaluate $\int_0^{\frac{\pi}{4}} \frac{sec^2 x}{1+\tan x} dx$ (5)

UNIT - IV

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

b. Find the volume of the solid generated when the area bounded by the parabola $y = x^2$, the X-axis and the ordinates $x = 0$ & $x = 2$ is revolved about the X-axis. (5)

c. Solve $\frac{dy}{dx} + y \cot x = 2 \cos x$ (5)

OR

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

b. Solve $\frac{dy}{dx} = 3x + 4$ (Given $y = 15$ when $x = 2$) (5)

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

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