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(Revision - 2015)

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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE, NOVEMBER – 2020

ENGINEERING MATHEMATICS – II

[Maximum Marks: 75] [Time: 2.15 Hours]

PART-A

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

I.

1. Find the value of x for which $x(\hat{\imath} + \hat{\jmath} + \hat{k})$ is a unit vector
2. Find the numerical value of $\begin{vmatrix} \cos\frac{\pi}{8} & \sin\frac{\pi}{8} \\ \sin\frac{\pi}{8} & \cos\frac{\pi}{8} \end{vmatrix}$
3. If A is a square matrix, prove that AA^T is a symmetric matrix
4. Find $\int \sec x dx$
5. Solve $\frac{dy}{dx} + 3y = 0$ (3 x 2 = 6)

PART-B

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

II

1. a) Show by vector method that the points with position vectors $2\hat{\imath} - \hat{\jmath} + 3\hat{k}$, $3\hat{\imath} - 5\hat{\jmath} + \hat{k}$ and $-\hat{\imath} + 11\hat{\jmath} + 9\hat{k}$ are collinear.

   b) if $\left|\vec{a}\right| = \sqrt{26}$, $\left|\vec{b}\right| = 7$ and $\left|\vec{a} \times \vec{b}\right| = 35$, find $\vec{a} \times \vec{b}$.
2. Find the middle terms in the expansion of $\left(3x + \frac{5}{x}\right)^{11}$.
3. If $A = \begin{bmatrix} 1 & 4 & 3 \\ -4 & 0 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 2 \\ 0 & 5 \\ -1 & 1 \end{bmatrix}$, verify that matrix multiplication is non-commutative.
4. Find (a) $\int \frac{4\cos x + 7}{sin^2 x} dx.$ (b) $\int \frac{x^2}{(1+x^3)^4} dx$
5. Evaluate $\int_0^{\frac{\pi}{2}} cos^3 x \, dx.$
6. Find the area enclosed between the curves $y = x^2$ and $2x + y - 3 = 0.$
7. Solve $(1 + x^2)\frac{dy}{dx} + y = e^{\tan^{-1} x}.$ (4 x 6 = 24)

PART-C

(Answer ***any of the three units*** from the following. Each full question carries 15 marks)

UNIT - I

III. 1. Show that each of the given three vectors is a unit vector:

$$\frac{1}{7}(2\hat{\imath}+3\hat{\jmath}+6\hat{k}), \frac{1}{7}(3\hat{\imath}-6\hat{\jmath}+2\hat{k}), \frac{1}{7}(6\hat{\imath}+2\hat{\jmath}-3\hat{k})$$

Also, show that they are mutually perpendicular to each other. (6)

2. Find μ and λ if $(2\hat{\imath}+6\hat{\jmath}+27\hat{k})\times(\hat{\imath}+\lambda\hat{\jmath}+\mu\hat{k})=0$. (4)

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

OR

IV 1. 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 displaces it from the position $4\hat{\imath}-3\hat{\jmath}-2\hat{k}$ *to* $6\hat{\imath}+\hat{\jmath}-3\hat{k}$. Find the total work done. (5)

2. The two adjacent sides of a parallelogram are $2\hat{\imath}-4\hat{\jmath}+5\hat{k}$ and $\hat{\imath}-2\hat{\jmath}-3\hat{k}$. Find a unit vector parallel to its diagonal. Also, find its area. (5)

3. Find the constant term in the expansion of $\left(3x^2+\frac{1}{2x^3}\right)^{10}$ (5)

UNIT - II

V 1. Solve using Cramer's rule:

$x-y+z=4,\ 2x+y-3z=0,\ x+y+z=2.$ (5)

2. If $A=\begin{bmatrix}5 & -3\\ 2 & -2\end{bmatrix}$, $B=\begin{bmatrix}7 & 5\\ 4 & 3\end{bmatrix}$ show that $(AB)^{-1}=B^{-1}A^{-1}$. (6)

3. Find the values of x, y and z if $2\begin{bmatrix}x^2\\ -y\\ z\end{bmatrix}+\begin{bmatrix}0\\ x\\ -y\end{bmatrix}=\begin{bmatrix}0\\ z\\ \frac{-5}{2}\end{bmatrix}$ (4)

OR

VI 1. Solve x if $\begin{vmatrix}3 & 1 & 9\\ 2x & 2 & 6\\ x^2 & 3 & 3\end{vmatrix}=0$. (4)

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

3. Solve the following system of equations by finding the inverse of the coefficient matrix:

$x + y + z = 1,\ 2x + 2y + 3z = 6,\ x + 4y + 9z = 3$ (5)

UNIT - III

VII 1. Find $\int tan^2\, x\, dx$ (3)

2. Find $\int \sqrt{5x + 4dx}$ (3)

3. Find $\int_0^{\frac{\pi}{4}} \frac{sec^2 x}{\sqrt{1-tan^2\, x}} dx$ (4)

4. $\int_0^2 x^2 log\, x\, dx$ (5)

OR

VIII 1. Evaluate $\int \frac{3x+2}{\sqrt{x}} dx$ (3)

2. Evaluate $\int \frac{e^{2x}}{1+e^{2x}} dx$ (3)

3. Evaluate $\int_0^{\pi} \frac{1-\sin\, x}{(x+cos\, x)^2} dx$ (4)

4. Evaluate $\int_0^{\frac{\pi}{2}} x\cos 3x\, dx$ (5)

UNIT – IV

IX 1. Obtain the area bounded by the curve $y = x + \sin x$, the x-axis and the ordinates at $x = 0$ and $x = \frac{\pi}{2}$. (5)

2. Find the volume of the ellipsoid when the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ is rotated about the x-axis. (5)

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

OR

X 1. Find the area enclosed between the parabola $y = x^2 - x - 2$ and the x-axis. (5)

2. Find the volume obtained by rotating one arch of the curve $y = 3\, sin2x$ about the x-axis. (5)

3. Solve: $3e^x \tan y\, dx + (1 - e^x) sec^2 y\, dy = 0.$ (5)
