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)

1. Find a unit vector in the direction of $\vec{a} = 3\hat{\imath} + 2\hat{\jmath} - \hat{k}$

2. Evaluate $\begin{vmatrix} \sec\theta & \tan\theta \\ \tan\theta & \sec\theta \end{vmatrix}$

3. If $A = \begin{bmatrix} 4 & 5 \\ 3 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 2 \\ -3 & -4 \end{bmatrix}$ Find $(A+B)^T$.

4. Evaluate $\int \sin^2 x\, dx$

5. Solve $\frac{dy}{dx} = 4x + 5$ (3 x 2 = 6)

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

II.

1. Find the dot product and angle between the pairs of vectors $\hat{\imath} - 2\hat{\jmath} + 3\hat{k}$

   and $3\hat{\imath} - 2\hat{\jmath} + \hat{k}$.

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

3. Solve the following system of equations using determinants.

   x +2y – z = -3, 3x + y + z = 4, x – y +2z=6

4. Find the inverse of $\begin{bmatrix} 3 & -2 & 3 \\ 2 & 1 & -1 \\ 4 & -3 & 2 \end{bmatrix}$

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

6. Find the area enclosed between the curve y = x^2 and the straight line y = 3x + 4

7. Solve $\frac{dy}{dx} + y \tan x = \sec x$ (4 x 6 = 24)

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

UNIT I

III.

(a) 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.   5

(b) Find the area of a triangle whose vertices are A ($\hat{\imath} - \hat{k}$), B($2\hat{\imath} + \hat{\jmath} + 5\hat{k}$), C($\hat{\jmath} + 2\hat{k}$) 5

(c) Expand $(2x+3y)^5$ binomially.   5

OR

IV. (a) Find the middle term in the expansion of $\left(2a - \dfrac{b}{3}\right)^{12}$ 5

(b) Find the work done by a force $\vec{F} = 2\hat{\imath} + \hat{\jmath} + \hat{k}$ acting on a particle such that the
particle is displaced from the point (3, 3, 3) to a point (4,-1,2)   5

(c) Find the moment of a force represented by $\hat{\imath} + \hat{\jmath} + \hat{k}$, acting through the point
$-2\hat{\imath} + 3\hat{\jmath} + \hat{k}$ about the point $\hat{\imath} + 2\hat{\jmath} + 3\hat{k}$ 5

UNIT II

V. (a) Find a, b, c if $\begin{bmatrix} a + 3 & 3a - 2b \\ 3a - c & a + b + c \end{bmatrix} = \begin{bmatrix} 2 & -7 + 2b \\ b + 4 & 8a \end{bmatrix}$ 5

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

(c) Solve $\dfrac{5}{x} + \dfrac{2}{y} = 4,$ $\dfrac{2}{x} - \dfrac{1}{y} = 7$ by determinant method   5

OR

VI. (a) If $\begin{vmatrix} 4 & 1 & 3 \\ 2x & 3 & 6 \\ x^2 & 1 & 3 \end{vmatrix} = 0$ find x.   5

(b) If $A = \begin{bmatrix} 2 & -1 \\ 3 & 0 \\ 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 0 & 1 \\ 1 & 3 & 1 \end{bmatrix}$ verify that $(AB)^T = B^T A^T$ 5

(c) Find A and B if $A - B = \begin{bmatrix} 3 & 5 \\ 1 & 2 \end{bmatrix}$ and $A + B = \begin{bmatrix} 1 & 1 \\ 3 & 2 \end{bmatrix}$ 5

UNIT III

VII (a) Evaluate (1) $\int_0^1 \frac{1}{1+x^2} dx$ (2) $\int (3x + 4)(2x - 1) dx$ 5

    (b) *Evaluate* $\int \frac{4 \cos x + 5}{\sin^2 x} dx$ 5

    (c) *Evaluate* $\int_1^2 \frac{x^2 + 1}{x^3 + 3x} dx$ 5

OR

VIII.(a) *Evaluate* $\int_0^\pi \cos^2 2x \; dx$ 5

    (b) *Evaluate* $\int \frac{\sec^2 x}{\sqrt{1 - \tan^2 x}} \; dx$ 5

    (c) *Evaluate* $\int_0^2 x^2 \log x \; dx$ 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 generated when the portion of the parabola $y^2 = 4x$ between x =0

        and   x = 4 revolves about the   x – axis .   5

    (c) *Solve* $\frac{dy}{dx} = e^{3x+2y}$ 5

OR

X. (a) Find the volume of the solid generated by revolving the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ about

       the x - axis.   5

    (b) *Solve* $x \frac{dy}{dx} + 3y = 5x^2$ 5

    (c) Solve $\frac{d^2 y}{dx^2} = \sec^2 x$ 5

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