

DIPLOMA FIRST SEMESTER EXAMINATION 2026
(JUT)
ENGINEERING MATHEMATICS

DIPLOMA WALLAH

Time: 3 Hours

Full Marks: 70

Instructions:

1. Question No. 1 is **Compulsory** (7 MCQ x 2 Marks = 14 Marks).
2. Answer any **FOUR** questions from the remaining (Q.2 to Q.7).
3. All questions carry equal marks (14 Marks each).

Q1. Answer all questions (Compulsory):

7 × 2 = 14

1.1 If matrix A is such that $A = A^T$, it is called:

- | | |
|--------------------|---------------|
| (a) Skew-Symmetric | (b) Symmetric |
| (c) Identity | (d) Singular |

1.2 The slope of a straight line parallel to the X-axis is:

- | | |
|-------|--------------|
| (a) 1 | (b) ∞ |
| (c) 0 | (d) -1 |

1.3 The value of $\cos(-60^\circ)$ is:

- | | |
|------------------|----------|
| (a) 1/2 | (b) -1/2 |
| (c) $\sqrt{3}/2$ | (d) 1 |

1.4 What is the derivative of $\log x$ with respect to x ?

- | | |
|-----------|-----------|
| (a) e^x | (b) $1/x$ |
| (c) x | (d) 0 |

1.5 The integration of $\int e^x dx$ is:

- | | |
|---------------|------------------|
| (a) $e^x + c$ | (b) $\log x + c$ |
| (c) xe^x | (d) e^{-x} |

1.6 A matrix A is singular if its determinant $|A|$ is:

- | | |
|-------|--------------|
| (a) 1 | (b) -1 |
| (c) 0 | (d) Infinity |

1.7 The distance between points (0,0) and (3,4) is:

(a) 7

(b) 5

(c) 25

(d) 1

Q2. (A) Solve using **Cramer's Rule**: $x + y + z = 6, 2x - y + z = 3, x - 2y + 3z = 6.$ 7

(B) Find the **Inverse** of matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \\ 3 & 1 & 2 \end{bmatrix}.$ 7

Q3. (A) Find the equation of a line passing through (3, -4) and perpendicular to $5x - y = 2.$ 7

(B) Find the coordinates of the **Centroid** of a triangle with vertices (1, 2), (3, 4), and (5, 6). 7

Q4. (A) If $A + B + C = \pi,$ prove: $\sin 2A + \sin 2B + \sin 2C = 4 \sin A \sin B \sin C.$ 7

(B) Prove that $\cos 20^\circ \cos 40^\circ \cos 60^\circ \cos 80^\circ = 1/16.$ 7

Q5. (A) Find the derivative of $\cos x$ from the **First Principle**. 7

(B) Differentiate $y = (\sin x)^{\log x}$ with respect to $x.$ 7

Q6. (A) Find the **Maxima and Minima** of $f(x) = 2x^3 - 15x^2 + 36x + 10.$ 7

(B) Evaluate: $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x + \sqrt{\cos x}}} dx.$ 7

Q7. Write short notes on any FOUR of the following: **4 × 3.5 = 14**

(a) Resolve into Partial Fractions: $\frac{3x+1}{(x-1)(x+2)}$

(b) Eigenvalues of matrix $\begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix}$

(c) Area bounded by parabola $y^2 = 4x$ and line $x = 4$

(d) Prove that $\tan 75^\circ = 2 + \sqrt{3}$

(e) Define Unit Matrix and Scalar Matrix with examples.