

DIPLOMA FIRST SEMESTER EXAMINATION 2026 (JUT)

ENGINEERING MATHEMATICS

DIPLOMA WALLAH

TIME: 3 HOURS

FULL MARKS: 70

1. Question Number 1 is **Compulsory** ($7 \times 2 = 14$ Marks).
2. Answer any **FOUR** questions from the remaining (Q.2 to Q.7).
3. Calculations must be shown clearly where necessary.

Q1. Choose the correct answer from the following:

14

1.1 If $|A| \neq 0$, then the matrix A is called:

- (a) Singular (b) Non-singular
(c) Identity (d) Null Matrix

1.2 The midpoint of the line segment joining $(2, 4)$ and $(4, 6)$ is:

- (a) $(3, 5)$ (b) $(6, 10)$
(c) $(1, 1)$ (d) $(0, 0)$

1.3 The trigonometric ratio $\tan(90^\circ - \theta)$ is equivalent to:

- (a) $\tan \theta$ (b) $\cot \theta$
(c) $-\tan \theta$ (d) $\sin \theta$

1.4 The derivative of $\sin x$ with respect to x is:

- (a) $\cos x$ (b) $-\cos x$
(c) $\tan x$ (d) $\sec^2 x$

1.5 The value of the integral $\int \cos x \, dx$ is:

- (a) $\sin x + c$ (b) $-\sin x + c$
(c) $\tan x + c$ (d) 0

1.6 The intercept form of a straight line equation is:

- (a) $y = mx + c$ (b) $x/a + y/b = 1$
(c) $ax + by + c = 0$ (d) $x \cos \alpha + y \sin \alpha = p$

1.7 The transpose of a row matrix is always a:

- (a) Square matrix (b) Column matrix
(c) Scalar matrix (d) Diagonal matrix

Q2. (A) Solve using **Cramer's Rule**: $x + y + 2z = 4$, $2x - y - z = 1$, $3x - 2y - z = 3$. 7

(B) Find the Inverse of Matrix $A = \begin{vmatrix} 1 & -2 & 2 \\ 0 & 1 & -2 \\ 0 & 0 & 1 \end{vmatrix}$. 7

Q3. (A) Find the equation of a line passing through $(-2, -4)$ and perpendicular to $3x - y + 5 = 0$. 7

(B) Reduce the equation $\sqrt{3}x + y + 8 = 0$ into Normal Form and find p and α . 7

Q4. (A) Prove that: $\cos \alpha + \cos \beta + \cos \gamma + \cos(\alpha + \beta + \gamma) = 4 \cos \frac{\alpha+\beta}{2} \cos \frac{\beta+\gamma}{2} \cos \frac{\gamma+\alpha}{2}$. 7

(B) Solve for x : $\tan^{-1}(1/2) + \tan^{-1}(1/3) = \pi/4$. 7

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

(B) If $y = e^{m \cos^{-1} x}$, prove that $(1 - x^2)y_2 - xy_1 - m^2y = 0$. 7

Q6. (A) Find the **Area** bounded by the parabola $y^2 = 8x$ and its latus rectum. 7

(B) Evaluate the integral: $\int \frac{dx}{x^2 + 4x + 13}$. 7

Q7. Answer any FOUR (Short Notes): 14

(a) Define Orthogonal Matrix and prove it with an example.

(b) Successive differentiation: If $y = e^{ax} \sin bx$, find y_2 .

(c) Explain the formula for the Centroid of a triangle.

(d) Prove that: $\sin(2A) = \frac{2 \tan A}{1 + \tan^2 A}$.

(e) Write the difference between Local Maxima and Local Minima with a graph sketch.

