23006

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BOARD DIPLOMA EXAMINATION, (C-23)

OCTOBER/NOVEMBER—2025

FIRST YEAR (COMMON) EXAMINATION

ENGINEERING MATHEMATICS—I

Time : 3 Hours] [*Total Marks* : 80

PART—A 3×10=30

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

1. Find the domain and range of $\{(2,1), (5,1), (8,1), (11,1), (14,1), (17,1)\}$.

2. Resolve $\frac{x}{(x-1)(x-3)}$ into partial fractions.

3. If $A = \begin{bmatrix} 2 & 3 & -1 \\ 7 & 8 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 & 1 \\ 2 & -4 & -1 \end{bmatrix}$, then find $A + B$.

4. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$, then find det A.

5. Prove that $\frac{\cos 16^\circ + \sin 16^\circ}{\cos 16^\circ - \sin 16^\circ} = \tan 61^\circ$

6. Prove that $\frac{\sin 2\theta}{1 + \cos 2\theta} = \tan\theta$.

7. Find the additive inverse of the complex number $(7 - 24i)$.

8. Find the equation of the straight line passing through the point (3, –4) and parallel to the line $x + 7y + 1 = 0$.

9. Evaluate $\lim_{x \to 0} \frac{\sin 7x}{x}$.

10. Find the derivative of $6x^2 + 12x - 13$ w.r.t. *x*.

PART—B

10×5=50

Instructions : (1) Answer *any* **five** questions.

(2) Each question carries **ten** marks.

11. Solve the equations by using Cramer's rule : $2x - y + 3z = 9$, $x + y + z = 6$ and $x - y + z = 2$.

12. *(a)* Prove that $\cos\theta + \cot(120° + \theta) + \cos(120° - \theta) = 0$.

(b) Prove that $\tan^{-1}1 + \tan^{-1}2 + \tan^{-1}3 = \pi$.

13. *(a)* Solve $\sin^2\theta - 2\sin\theta + 1 = 0, \sqrt{3}\cos\theta + \sin\theta = \sqrt{2}$.

(b) Solve $\triangle ABC$ with $a = 2,\ b = 2\sqrt{3},\ c = 4$.

14. *(a)* Find the equation of the circle having (6, 0) and (0, 8) as the end points of its diameter.

(b) Find the equation of the parabola whose focus is (1, –1) and directrix is $x - 2y + 1 = 0$.

15. *(a)* Find the derivative of $\log x + 2\tan^{-1}x + 8e^{-x}$ with respect to x.

(b) Find the derivative of $\frac{3x-1}{2x+1}$ with respect to *x*.

16. *(a)* If $y = x^{\sin x}$, then find $\frac{dy}{dx}$.

(b) If $4(x, y) = x \sin y + y \cos x$, find $\frac{\partial u}{\partial x}$ and $\frac{\partial u}{\partial y}$.

17. *(a)* Find the slopes of the tangent and normal to the curve $y = x^3$ at (2,4)

(b) A particle moves along a line such that $S(t) = t^3 - 9t^2 + 24t - 8$. Find its initial velocity.

18. *(a)* Find the maximum or minimum value of the function $f(x) = ax^2 + bx + c\ (a, b, c > 0)$.

(b) There is an error of 1% made in measuring the radius of a spherical balloon. Find approximate percentage error in its volume.

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