Code: 20SC01T

I/II Semester Diploma Examination, Nov/Dec 2024

ENGINEERING MATHEMATICS

TIME: 3 HOURS

MAX MARKS: 100

Note: i) Answer any 5 questions from SECTION-A, each question carries 4 marks.

ii) Answer any 10 questions from SECTION-B, each question carries 5 marks.

iii) Answer any 5 questions from SECTION-C, each question carries 6 marks.

SECTION – A

1. If $A = \begin{bmatrix} 4 & 5 \\ 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 6 \\ 1 & 3 \end{bmatrix}$, find the matrix $A + 2B$.

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

3. If the matrix $A = \begin{pmatrix} x & 1 \\ 3 & 4 \end{pmatrix}$ is singular then find 'x'.

4. Find the slope of the line whose angle of inclination is 45° with the positive x-axis.

5. Find the slope of the straight line passing through the points (2, 6) and (4, 9).

6. Convert 150° into radian and $\frac{3\pi}{2}$ into degree.

7. If $y = x^2 + 3\sin x + e^x + 1$ then find $\frac{dy}{dx}$.

8. Find the slope of the tangent to the curve $y = x^3 + 1$ at (1, 2)

9. Integrate $x^2 + \frac{1}{x} + e^x + 2$ with respect to x.

10. Evaluate $\int_1^2 x \, dx$

SECTION – B

11. Verify whether $AB = BA$ for the matrices $A = \begin{bmatrix} 3 & 7 \\ 4 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 7 & 3 \end{bmatrix}$.

12. Find adjoint of the matrix $A = \begin{bmatrix} 4 & 2 \\ 3 & 1 \end{bmatrix}$.

13. Find characteristic equation of the matrix $A = \begin{bmatrix} 3 & 2 \\ 4 & 5 \end{bmatrix}$.

14. Find equation of the straight line passing through the point (3,2) and having slope 5.

15. Find the equation of the straight line passing through the points (4,2) and (6,4).

16. Find the equation of straight line having x-intercept 2 and y-intercept 3 units respectively

17. Show that the two lines $2x + y - 4 = 0$ and $6x + 3y + 10 = 0$ are parallel.

18. Find the slope, x-intercept and y-intercept of the line
$6x + 5y + 10 = 0$

19. Find the value of $\sin 150° + \cos 120°$.

20. Simplify:
$\sin(90° + \theta) + \cos(180° - \theta) + \tan(270° - \theta) + \cot(360° - \theta)$

21. Write the formula of $\sin(A + B)$ and hence find the value of $\sin 75°$

22. Prove that $\sin 2A = 2\sin A \cos A$ using compound angle formula.

23. If $y = x^2 + 3x + 7$, then find $\dfrac{d^2y}{dx^2}$

24. If $y = x \sin x$, then find $\dfrac{dy}{dx}$

25. If $y = \dfrac{1+x}{1-x}$, find $\dfrac{dy}{dx}$

26. Evaluate $\int (x^2(1 + x))dx$.

27. Evaluate $\int_0^1 (x^2 + 1)\, dx$.

28. Evaluate $\int x\, e^x\, dx$.

SECTION – C

29. Solve the equations $3x + 2y = 8$ and $4x + 5y = 6$ by applying Cramer's rule.

30. Identify the singular and non-singular matrices in the following matrices.
$A = \begin{bmatrix} 1 & 7 \\ 0 & 3 \end{bmatrix}$ $B = \begin{bmatrix} 3 & 1 \\ 9 & 3 \end{bmatrix}$ $C = \begin{bmatrix} 7 & 2 \\ 1 & 3 \end{bmatrix}$

31. Find the equation of a line passing through the point $(1, 3)$ and parallel to the line $5x + 2y + 10 = 0$.

32. Prove that $\sin 3A = 3\sin A - 4\sin^3 A$

33. Write the compound angle formula for $\tan(A + B)$ and hence prove that $\tan\left(\dfrac{\pi}{4} + A\right) = \dfrac{1 + \tan A}{1 - \tan A}$

34. Write product rule and hence find the derivative of $y = x^2\, e^x \sin x$

35. If y is the distance travelled in meters by a particle in time x sec is given $x^3 + 5x^2 + 3x - 12$. Find the velocity and acceleration when $x = 1$ sec.

36. Find equation of tangent to the curve $y = x^2 + x$ at the point $(1,2)$.

37. Find the area under the curve $y = 2x + 1$ with x-axis and ordinates $x = 0$ & $x = 2$

38. Find the volume of solid generated by revolving the curve $y^2 = 3x^2 - 1$ about the axis between $x = 1$ and $x = 3$.

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