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S.No. 9058

22 SCACMM 2 A

(For candidates admitted from 2022-2023 onwards)

B.C.A./B.Sc. DEGREE EXAMINATION,
NOVEMBER 2022.

Part III — Allied
ALGEBRA AND CALCULUS

Time : Three hours

Maximum : 75 marks

SECTION A — (20 marks)

Answer ALL questions.

I. (A) Choose the best answer : $(5 \times 1 = 5)$

1. _____ is one of the roots of the equation $x^3 + x^2 + x = 0$.

- (a) -1 (b) 2
(c) 0 (d) 1

2. The characteristic equation of the matrix $A = \begin{pmatrix} 2 & 0 \\ 5 & 2 \end{pmatrix}$ is

- (a) $(2 - \lambda)^2 = 0$ (b) $2\lambda - 5 = 0$
(c) $\lambda^2 - 5 = 0$ (d) $4\lambda - 5 = 0$

3. If $\Delta = \left(\frac{\partial^2 z}{\partial x \partial y} \right)^2 - \frac{\partial^2 z}{\partial x^2} \frac{\partial^2 z}{\partial y^2} < 0$ and $\frac{\partial^2 z}{\partial x^2} < 0$ then the stationary point is a _____

- (a) minimum point (b) maximum point
(c) saddle point (d) none of the above

4. $\int_a^b f(x) dx + \int_b^c f(x) dx = \text{_____}$

- (a) $2 \int_a^c f(x) dx$ (b) $\int_a^c f(x) dx$
(c) 0 (d) $2 \int_b^c f(x) dx$

5. _____ is the particular integral of the differential equation $(2D^2 + 5D - 3)y = 6$.

- (a) 2 (b) -2
(c) 6 (d) 3

(B) Fill up the blanks : $(5 \times 1 = 5)$

6. Between two consecutive real roots a and b of the equation $f(x) = 0$ where $f(x)$ is a polynomial, then there lies atleast one real root of the equation _____

7. The rank of the matrix $\begin{pmatrix} 2 & 3 & 5 \\ 10 & 15 & 25 \end{pmatrix}$ is _____.

8. Write the condition for the point to be point of inflexion.

9. Evaluate $\int x \sin 2x \, dx = \text{_____}$.

10. The complementary function of the differential equation $(D^2 + D - 2)y = 4$ is _____.

II. Answer the following questions : $(5 \times 2 = 10)$

11. Increase by 7 the roots of the equation $3x^4 + 7x^3 - 15x^2 + x - 2 = 0$.

12. Determine whether the set of equations $4x + 3y = 12$
 $3x + 2.25y = 9$ are consistent or inconsistent.

13. Find the critical points of the function $f(x) = x^3 - 9x^2 + 15x$.

14. Evaluate $\int_0^\pi \frac{dx}{5 + 4 \cos x}$.

15. Solve $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} = 0$.

SECTION B — $(5 \times 5 = 25)$

Answer ALL questions, choosing either (a) or (b).

16. (a) Find the number of real roots of the equation $x^3 + 18x - 6 = 0$.

Or

(b) Remove the fractional coefficients from the equation $x^3 + \frac{1}{4}x^2 - \frac{1}{16}x + \frac{1}{72} = 0$.

17. (a) Verify Cayley Hamilton theorem for the matrix $A = \begin{pmatrix} 1 & 2 \\ 3 & 1 \end{pmatrix}$ and hence find $A^3 - 9A$.

Or

(b) Find the inverse of the matrix $\begin{pmatrix} 1 & 2 & -1 \\ 3 & 8 & 2 \\ 4 & 9 & -1 \end{pmatrix}$.

18. (a) If $Z = f(u, v, w)$ and $z = 3u^2 - 2v + 4w^3v^2$ find the total differential, dz .

Or

(b) Determine the stationary values of the function $f(x, y) = x^4 + 4x^2y^2 - 2x^2 + 2y^2 - 1$ and distinguish between them.

19. (a) Find $\int \frac{x+4}{6x-7-x^2} dx$.

Or

(b) Evaluate $\int \frac{3x-2}{\sqrt{4x^2-4x-5}} dx$.

20. (a) Solve $(D^2 - 3D - 4)y = 3e^{-x}$.

Or

(b) Solve $2\frac{d^2y}{dx^2} - 11\frac{dy}{dx} + 12y = 3x - 2$.

SECTION C — (3 × 10 = 30)

Answer any THREE questions.

21. Solve the equation $x^4 - 2x^3 + 4x^2 + 6x - 21 = 0$ given that two of its roots are equal in magnitude and opposite in sign.

22. Find the Eigen values and Eigen vectors of $\begin{pmatrix} 2 & -2 & 3 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{pmatrix}$.

23. Find the maximum and minimum values of the curve $f(x) = x^3 - 3x + 5$.

24. Obtain the half range cosine series for $f(x) = 3x$ in $0 \leq x \leq \pi$.

25. Solve $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 2y = x^2 + e^{2x}$.