

SECTION – IV

Answer any **two** questions. These questions carry 15 marks each.

32. (a) Verify Mean Value Theorem for the function $x^2 + 2x - 1 = 0$ on $[0, 1]$.
- (b) Find the position and nature of stationery points of the function $f(x) = 3x^4 - 4x^3 - 8$.
33. (a) Solve the equation $x^6 - z^5 + 4z^4 - 6z^3 + 2z^2 - 8z + 8 = 0$.
- (b) Solve the hyperbolic equation $\cosh x - 5 \sinh x - 5 = 0$.
34. (a) Find the distance from the point P with coordinates $(1, 2, 3)$ to the plane that contains the points, A, B and C having coordinates $(0, 1, 0)$, $(2, 3, 1)$ and $(5, 7, 2)$.
- (b) The vertices of triangle ABC have position vector a, b and c relative to some origin O . Find the position vector of the centroid G of the triangle.
35. (a) Show that the value of the integral $I = \int_0^1 \frac{1}{(1+x^2+x^3)^{\frac{1}{2}}} dx$ lies between 0.810 and 0.882.
- (b) Find the length of the graph $f(x) = \frac{1}{3}x^3 + \frac{1}{4x}$ from $x = 1$ to $x = 3$.

(2 × 15 = 30 Marks)

Reg. No. :

Name :

First Semester B.Sc. Degree Examination, January 2024

First Degree Programme under CBCSS

Mathematics

Complementary Course for Chemistry and Polymer Chemistry

MM 1131.2 : MATHEMATICS I – CALCULUS AND APPLICATIONS IN CHEMISTRY – I

(2018 - 2000 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – I

All the first ten questions are compulsory. They carry 1 mark each.

- Find the 5th derivative of $x^4 + x$.
- Find the first derivative of $x \cos x$.
- State Rolle's theorem.
- State Leibnitz's theorem.
- State Demoivre's theorem.
- Find modulus of $1 + i$.
- Find the product of $(3 + 2i)$ and $(3 - 2i)$.

8. If $v = i - 2j$ is a velocity vector. Then find speed.

9. Explain basis vectors.

10. Evaluate $\int x \sin x$.

(10 × 1 = 10 Marks)

SECTION – II

Answer any **eight** questions. These questions carry **2** marks each.

11. Find the derivatives with respect to x of $f(t) = 2at$, where $x = at^2$.

12. Find $\frac{dy}{dx}$, if $y = 2^x$.

13. Express $\frac{2-3i}{(4+6i)}$ in the form $a + bi$.

14. Simplify the expression $z = i^{-2i}$.

15. Find $\frac{d}{dx}(\sinh x)$.

16. Express $\sinh^{-1} x$ in logarithmic form.

17. Two particles have velocities $v_1 = i + 3j + 6k$ and $v_2 = i - 2k$ respectively. Find the velocity u of the second particle relative to the first.

18. Find the direction of the line of intersection of the two planes $x + 3y - z = 5$ and $2x - 2y + 4z = 3$.

19. Show that if $a = b + \lambda c$, for some scalar λ , then $a \times b = b \times c$.

20. Determine whether $a = 2i + j - k$ and $b = -6i - 3j + 3k$ are parallel vectors.

21. Distinguish between vector and scalar quantity.

22. Find the area of the parallelogram with sides $i + 2j + 3k$ and $4i + 5j + 6k$.

(8 × 2 = 16 Marks)

SECTION – III

Answer any **six** questions. These questions carry **4** marks each.

23. Find the second derivative of $\frac{x^2 + 7}{x}$.

24. Find $\frac{dy}{dx}$ if $y^4 - 2y^3 + x^3 + x^3y^2 - \cos x = 8$.

25. Express $\sin 3\theta$ and $\cos 3\theta$ in terms of powers of $\cos \theta$ and $\sin \theta$.

26. Prove that $\cosh^2 x - \sinh^2 x = 1$.

27. Express $\cosh^{-1} x$ in logarithmic form.

28. Find the angle between $a = 2i + 3j + k$ and $b = -i + 5j = k$.

29. A line is given by $r = a + \lambda b$, where $a = i + 2j + 3k$ and $b = 4i + 5j + 6k$. Find the coordinates of the point P at which the line intersects the plane $x + 2y + 3z = 6$.

30. Evaluate $\int e^{ax} \cos bx \, dx$.

31. Find the area of the surface obtained by revolving the graph $f(x) = \sqrt{x}$ on the interval $[0, 2]$ about the x -axis.

(6 × 4 = 24 Marks)