



ST. FRANCIS DE SALES COLLEGE

A FRANSALIAN INSTITUTE OF HIGHER EDUCATION **AUTONOMOUS**

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END SEMESTER EXAMINATION – MAY 2025

MATHEMATICS - II SEMESTER BSC

24BSC23A/B: MATHEMATICS-II

Time: 3 Hours

Max. Marks: 80

Instruction: Answer all the questions

SECTION – A

Answer any **TEN** questions. Each question carries **TWO** marks.

(10X2=20)

1. Define a Group.
2. Find the number of generators of a cyclic group of order 15.
3. State the Euler's theorem.
4. Show that the angle between the radius vector and the tangent at any point on the curve equiangular spiral $r=ae^{\theta \cot \alpha}$ is constant.
5. Find $\frac{ds}{d\theta}$ for the curve $r=a(1+\cos\theta)$.
6. Find the asymptote parallel to the x axes for the curve $x^2y^2-a^2x^2=a^2y^2$.
7. Find the value of 'c' using Rolle's theorem for $f(x) = x^2 - 4x$ in $[2, -2]$.
8. State Cauchy's Mean Value theorem.
9. Evaluate $\lim_{x \rightarrow 0} \frac{a^x - b^x}{x}$ by using L'Hospital's rule.
10. Verify for exactness: $(2xy + 3y) dx + (x^2 + 3x) dy = 0$.
11. Find the general solution of $y = xp + p^2$.
12. Define an orthogonal trajectory of the given family of curves.



SECTION -B

Answer any **THREE** questions. Each question carries **FIVE** marks.

(3X5=15)

13. Show that $o(a) = o(a^{-1})$.
14. If the order of an element 'a' of a group G is 'n' and p is an integer prime to 'n' then a^p is also of order n.
15. $G = \{1, -1, i, -i\}$ of fourth roots of unity and $H = \{-1, 1\}$ be a subgroup of G. write all the right and left cosets of H in G.
16. Show that every cyclic group is abelian and the converse is not necessarily true.
17. State and prove Lagrange's theorem.

SECTION - C

Answer any **THREE** questions. Each question carries **FIVE** marks.

(3X5=15)

18. Find the angle between the radius vector and the tangent for the curve $r = a(1 + \cos\theta)$.
Also find the slope of the curve at $\theta = \frac{\pi}{6}$.
19. Show that the following pair of curves cut orthogonally
 $r^n = a^n \cos n\theta$, $r^n = b^n \sin n\theta$.
20. Find the radius of curvature at any point on the curve: $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$.
21. Find all the asymptotes to the curve $x^3 + 2x^2y + xy^2 - x^2 - xy + 2 = 0$.
22. Find the envelope of the family of straight lines $y = ax + \frac{a}{\alpha}$ where α is the parameter.

SECTION - D

Answer any **THREE** questions. Each question carries **FIVE** marks.

(3X5=15)

23. State and prove Rolle's theorem.
24. Verify Lagrange's mean value theorem for $f(x) = (x-1)(x-2)(x-3)$ in $[0,4]$.
25. Expand $e^x \cos y$ in a Taylor's series about the point $(1, \frac{\pi}{4})$ up to third degree terms.
26. Evaluate $\lim_{x \rightarrow 0} (\operatorname{cosec} x - \cot x)$ by using L'Hospital's rule.
27. Evaluate $\lim_{x \rightarrow 0} \left(\frac{a^x + b^x + c^x + d^x}{4} \right)^{\frac{1}{x}}$ by using L'Hospital's rule.



SECTION – E

Answer any **THREE** questions. Each question carries **FIVE** marks.

(3X5=15)

28. Solve $\frac{dy}{dx} + y \sec x = \tan x$.
29. Verify for exactness and solve the equation $(2x \log y) dx + (\frac{x^2}{y} + 3y^2) dy = 0$.
30. Solve $p^2 + 2py \cot x - y^2 = 0$.
31. Solve $p^3 - 4xyp + 8y^2 = 0$.
32. Show that the family $y^2 = 4a(x + a)$ is self-orthogonal.

