



LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – CHEMISTRY

THIRD SEMESTER – APRIL 2025

UMT 3401 – MATHEMATICS FOR CHEMISTRY - II



Date: 03-05-2025

Dept. No.

Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

SECTION A - K1 (CO1)

Answer ALL the Questions -

(10 x 1 = 10)

1. Answer the following

- Define gamma function.
- Describe partial differential equation.
- State piecewise continuous function.
- Write Newton's forward difference formula.
- Define Group.

2. MCQ

- $\frac{\partial(u,v)}{\partial(x,y)}$ denotes _____ of u, v with respect to x, y .
(i) Jordan form (ii) Jacobian form (iii) Gauss - Seidel form (iv) Lagrange form
- The solution of the differential equation $y = (x-a)p - p^2$ is
(i) $y = x^2 + c$ (ii) $y = (x-a)^2 + c$ (iii) $y = (x-a)c + c$ (iv) $y = (x-a)c - c^2$
- $L\{\cos 4t\} =$
(i) $\frac{4}{s^2+2^2}$ (ii) $\frac{s}{s^2+2^2}$ (iii) $\frac{s}{s^2+4^2}$ (iv) $\frac{4}{s^2+4^2}$
- Gauss seidel method is _____ method
(i) Iterative (ii) Directive (iii) Indirect (iv) None
- Z , the set of all integers is _____
(i) a group under usual addition (ii) a group under usual multiplication
(iii) a non-abelian group (iv) not a group under any operation

SECTION A - K2 (CO1)

Answer ALL the Questions

(10 x 1 = 10)

3. Fill in the blanks

- $\int_0^{\pi} \sin^5 x \cos^3 x \, dx =$ _____
- The solution of the differential equation $\frac{d^3y}{dx^3} - 3\frac{dy}{dx} + 2y = 0$ is _____.
- $L\left\{\frac{1-e^t}{t}\right\} =$ _____.
- In numerical methods, a process of finding the unknown values that lie in between the data points is called _____.
- The group of prime order is _____.

4. True or False

- $\Gamma(n+1) = (n)!$ when n is a positive integer.
- A solution containing as many arbitrary constants as there are independent variables is called a general integral.
- $L^{-1}\left\{\frac{1}{s^3}\right\} = t^2$.

d) A sequence matrix is said to be diagonally dominant matrix, if for every row of the matrix, absolute value of diagonal element in a row is less than or equal to sum of the absolute values of other elements in that row.

e) Every cyclic group is abelian.

SECTION B - K3 (CO2)

Answer any TWO of the following (2 x 10 = 20)

5. Calculate $\iint xy \, dx dy$ taken over the positive quadrant of the circle $x^2 + y^2 = a^2$.

6. Transform the partial differential equation $\frac{\partial^2 z}{\partial x^2} - 5 \frac{\partial^2 z}{\partial x \partial y} + 6 \frac{\partial^2 z}{\partial y^2} = 0$ to the form $\frac{\partial^2 z}{\partial u \partial v} = 0$ by substituting $u = x + \alpha y, v = x + \beta y$ for suitable constants α and β and obtain its complete integral.

7. Determine $L^{-1} \left(\frac{1}{(s+1)(s^2+2s+2)} \right)$.

8. (i) If G is a group, prove that the identity element is unique.
(ii) Prove that cancellation laws hold in the group. (4+6)

SECTION C – K4 (CO3)

Answer any TWO of the following (2 x 10 = 20)

9. By Newton-Raphson method, deduce the solution of the equation $x^3 + 2x^2 + 10x - 20 = 0$.

10. Define a subgroup. Explain two characterizations for a subgroup.

11. Using Gauss elimination method, estimate the solution of the following system of equations

$$\begin{aligned} 3x + 4y - z &= 8, \\ -2x + y + z &= 3, \\ x + 2y - z &= 2. \end{aligned}$$

12. Define cyclic group. Prove that $G = \{1, -1, i, -i\}$ is a cyclic group under usual multiplication.

SECTION D – K5 (CO4)

Answer any ONE of the following (1 x 20 = 20)

13. Using Laplace Transforms, solve the equation $\frac{d^2 y}{dt^2} + 2 \frac{dy}{dt} - 3y = \sin t$, given that $y = \frac{dy}{dt} = 0$ when $t = 0$.

14. State and prove the relationship between beta and gamma functions.

SECTION E – K6 (CO5)

Answer any ONE of the following (1 x 20 = 20)

15. Solve $(D^2+4D+5)y = e^x + x^3 + \cos 2x$.

16. From the following data, using Newton's forward and backward interpolation method, produce the number of persons having income in between

(i) 1000-1700 (ii) 3500-4000

Income	Below 500	500-1000	1000-2000	2000-3000	3000-4000
No. of Persons	6000	4250	3600	1500	650

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