LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **CHEMISTRY**

THIRD SEMESTER – **APRIL 2023**

UMT 3401 – MATHEMATICS FOR CHEMISTRY - II

Date: 12-05-2023   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.**	
a)	Define Gamma function.	
b)	Give an example for an ordinary differential equation.	
c)	Define Laplace Transform.	
d)	Write Newton's backward difference formula.	
e)	State Lagrange's Theorem	
2.	**Fill in the blanks.**	
a)	_____ denotes Jacobian of u, v with respect to x, y.	
b)	The linear differential equation of the first order is of the form_____.	
c)	If $L(f(t)) = F(s)$, then $L(f(at)) = $ _____.	
d)	_____ is a technique of obtaining the value of a function for any intermediate values of the independent variable.	
e)	A subset H of group G is called a subgroup of G if H forms a _____ with respect to the binary operation in G.	
	SECTION A - K2 (CO1)	
	Answer ALL the Questions	**(10 x 1 = 10)**
3.	**Choose the correct answer for the following.**	
a)	$\int_0^{\frac{\pi}{2}} \sin^7 \theta \cos^5 \theta \, d\theta = $ _____ (i) a) 120 b) $\frac{1}{120}$ c) 140 d) $\frac{1}{140}$	
b)	Clairant's equation is of the form a) $z = \frac{dy}{dx} x + c$ b) $z = px + qy + f(p, q)$	

1

c) $z = \frac{x}{y} + \frac{y}{q} + c$

d) $z = px + qy + \frac{p}{x} + \frac{q}{y}$

c)	Which is correct?
	(a) $L(f'(t)) = SL(f(t))$
	(b) $L(f'(t)) = SL(f(t)) - f(0)$
	(c) $L(f'(t)) = S^2 L(f(t))$
	(d) $L(f'(t)) = S^2 L(f(t)) - f(0)$
d)	Gauss Jordan method is _____ method. (a) Iterative (b) Direct (c) Indirect (d) None
e)	If n is any integer and $(a, n) = 1$ then, $a^{\phi(n)} \equiv$ _____ (a) $o(mod\ n)$ (b) $1(mod\ n)$ (c) $n(mod\ n)$ (d) $a(mod\ n)$
4.	**True or False.**
a)	$\Gamma(n + 1) = n!$ when n is a positive integer.
b)	If the auxiliary equation has two real and distinct roots m_1 and m_2 in a second order Linear differential equation, then $y = e^{m_1 x}$ and $y = e^{m_2 x}$ are solutions.
c)	$t^n f(t)$ is bounded near $t = 0$ for some number $n \geq 0$ is one of the sufficient conditions for the existence of Laplace Transforms.
d)	Gauss Seidal iteration method converges only for special system of equations.
e)	A group is said to an abelian group if it does not satisfy commutative property.

<div align="center">**SECTION B - K3 (CO2)**</div>

	Answer any TWO of the following **(2 x 10 = 20)**
5.	By changing the order of integration, evaluate $\int_0^\infty \int_x^\infty \frac{e^{-y}}{y} dx dy$.
6.	Let G denote the set of all matrices of the form $\begin{pmatrix} x & x \\ x & x \end{pmatrix}$ where $x \in R^*$. Prove that G is a group under matrix multiplication.
7.	Evaluate (i) $L(t^3 - 3t^2 + 2)$. (ii) $L(\sin^2 2t)$.

8.	Find a root of the equation $x^3 - x - 11 = 0$ correct to four decimal places using bisection method.

SECTION C – K4 (CO3)

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

9.	Determine $L^{-1}\left(\frac{s}{s^2 a^2 + b^2}\right)$.
10.	Evaluate $\iiint xyz \, dxdydz$ taken through the positive octant of the sphere $x^2 + y^2 + z^2 = a^2$.
11.	Solve $(D^2 + D + 1)y = x^2$.
12.	Solve using Gauss Elimination method $$2x + 3y - z = 5$$ $$4x + 4y - 3z = 3$$ $$2x - 3y + 2z = 2$$

SECTION D – K5 (CO4)

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

13.	The amount A of a substance remaining in a reacting system after an interval of time t in a certain chemical experiment is tabulated below:

t(min)	2	5	8	11
$A(gm)$	94.8	87.9	81.3	75.1

Obtain the value of A when $t = 9$ using Newton's backward interpolation.

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 the equation $\frac{d^2 y}{dt^2} + 2\frac{dy}{dt} - 3y = \sin t$ given that $y = \frac{dy}{dt} = 0$ when $t = 0$.
16.	(i) Find the order of $-1 \text{ and } 3$ in $(R^*, \cdot)$ (ii) Find the order of 2 & 3 in $(Z_8, \oplus)$ (iii) Find all the left cosets of $\{0,3,6,9\}$ in $(Z_{12}, \oplus)$ (iv) Find all the generators of the cyclic group $(Z_8, \oplus)$ (v) Why $(N, +)$ is not a group?

##########