LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRD SEMESTER – **NOVEMBER 2022**

UMT 3401 – MATHEMATICS FOR CHEMISTRY - II

Date: 01-12-2022 Dept. No. Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

	SECTION A		
Answer ALL the Questions			
1.	**Answer the following**	**(5 x 1 = 5)**	
a)	Write recurrence formula of Gamma function.	K1	CO1
b)	Define an ordinary differential equation.	K1	CO1
c)	Define Laplace Transform.	K1	CO1
d)	Write Newton's forward difference formula.	K1	CO1
e)	State Lagrange's Theorem	K1	CO1
2.	**Choose the correct answer**	**(5 x 1 = 5)**	
a)	$\int_0^{\frac{\pi}{2}} \sin^7\theta \cos^5\theta \, d\theta =$ _____ a) 120 b) $\frac{1}{120}$ c) 140 d) $\frac{1}{140}$	K1	CO1
b)	Clairant's equation is of the form a) $z = \frac{dy}{dx}x + c$ b) $z = px + qy + f(p,q)$ c) $z = \frac{x}{y} + \frac{y}{q} + c$ d) $z = px + qy + \frac{p}{x} + \frac{q}{y}$	K1	CO1
c)	Which is correct? (a) $L(f'(t)) = SL(f(t))$ (b) $L(f'(t)) = SL(f(t)) - f(0)$ (c) $L(f'(t)) = S^2L(f(t))$ (d) $L(f'(t)) = S^2L(f(t)) - f(0)$	K1	CO1
d)	Gauss seidal method is _____ method. (a) Iterative (b) Directive (c) Indirect (d) None	K1	CO1
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) $a(mod\ n)$	K1	CO1

3.	**Fill in the blanks**		**(5 x 1 = 5)**
a)	$\frac{\partial(u,v)}{\partial(x,y)}$ denotes _____ of u, v with respect to x, y.	K2	CO1
b)	The linear differential equation of the first order is of the form_____.	K2	CO1
c)	If $L\big(f(t)\big) = F(s)$, then $L\big(f(at)\big) =$ _____.	K2	CO1
d)	In numerical methods, a process of finding the unknown values that lie in between the data points is called _____.	K2	CO1
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.	K2	CO1
4.	**State True or False**		**(5 x 1 = 5)**
a)	$\Gamma(n+1) = (n+1)!$ when n is a positive integer.	K2	CO1
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.	K2	CO1
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.	K2	CO1
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.	K2	CO1
e)	Any cyclic group is abelian.	K2	CO1

SECTION B

Answer any TWO of the following.			**(2 x 10 = 20)**
5.	Change the order of integration in the integral $\int_0^a \int_{x^2/a}^{2a-x} xy dx dy$ and evaluate it.	K3	CO2
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.	K3	CO2
7.	Evaluate (i) $L\left(\frac{1-e^t}{t}\right)$ (ii) $L^{-1}\left(\frac{S-3}{S^2+4S+13}\right)$	K3	CO2
8.	Find an iterative formula to find $\sqrt{N}$, where N is a positive number and hence find $\sqrt{12}$ correct to two decimal places.	K3	CO2

SECTION C

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

9.	Determine $L^{-1}\left(\frac{s}{s^2a^2+b^2}\right)$.	K4	CO3
10.	(i) Find the volume of a segment of height h of a sphere of radius a. (ii) Evaluate $\iint xydxdy$ taken over the positive quadrant of the circle $x^2 + y^2 = a^2$	K4	CO3
11.	Solve $(D^2 + D + 1)y = x^2$.	K4	CO3
12.	Solve using Gauss Elimination method $2x + 3y - z = 5$ $4x + 4y - 3z = 3$ $2x - 3y + 2z = 2$	K4	CO3

SECTION D

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

13.	The following are data from the steam table. TempC^0 (T) | 140 | 150 | 160 | 170 | 180 Pressure Kgf/cm^2(P) | 3.685 | 4.854 | 6.302 | 8.076 | 10.225 Using Newton's formula, find the pressure of the steam for temperatures 142^0 and $175^{0.}$	K5	CO4
14.	State and prove the relationship between beta and gamma functions.	K5	CO4

SECTION E

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

15.	Solve the equation $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} - 3y = sin\ t$ given that $y = \frac{dy}{dt} = 0$ when $t = 0$.	K6	CO5
16.	(i) Find the order of $-1\ and\ 3$ 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?	K6	CO5

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