



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – CHEMISTRY

FIRST SEMESTER – APRIL 2023

UMT 1302 – MATHEMATICS FOR CHEMISTRY

Date: 08-05-2023

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 marks)

a)	Define maximum & minimum value of a function of two variables.	K1	CO1
b)	Write the expansion of $(1 + x)^n$	K1	CO1
c)	Define even and odd function.	K1	CO1
d)	State De Movier's theorem.	K1	CO1
e)	Define correlation.	K1	CO1

2. Choose the correct answer for the following (5 x 1 = 5 marks)

a)	If $rt - s^2 = 0$ at a critical point (a, b) , then it is A. Maximum point B. Minimum point C. Neither maximum nor minimum D. None of these	K1	CO1
b)	$\frac{e^x - e^{-x}}{2} =$ A. $1 + \frac{x}{1!} + \frac{x^2}{2!} + \dots \dots \dots \infty$ B. $1 - \frac{x}{1!} + \frac{x^2}{2!} + \dots \dots \dots \infty$ C. $1 + \frac{x^2}{2!} + \frac{x^4}{4!} \dots \dots \dots \infty$ D. $x + \frac{x^3}{3!} + \frac{x^5}{5!} \dots \dots \dots \infty$	K1	CO1
c)	$\int_1^2 x^2 dx =$ A. $\frac{8}{3}$ B. $\frac{7}{3}$ C. $\frac{5}{3}$ D. $\frac{4}{3}$	K1	CO1
d)	$\sin n\theta =$ A. $n \cos^{n-1} \theta \sin \theta - \frac{n(n-1)(n-2)}{3!} \cos^{n-3} \theta \sin^3 \theta + \dots \dots \dots$ B. $n \cos^{n-1} \theta \sin \theta + \frac{n(n-1)(n-2)}{3!} \cos^{n-3} \theta \sin^3 \theta - \dots \dots \dots$ C. $n \cos^{n-1} \theta \sin \theta - \frac{n(n+1)(n+2)}{3!} \cos^{n-3} \theta \sin^3 \theta + \dots \dots \dots$ D. None of these	K1	CO1
e)	The regression coefficient of Y on X is given by A. $r \frac{\sigma_x}{\sigma_y}$ B. $r \frac{\sigma_y}{\sigma_x}$ C. $r^2 \frac{\sigma_x}{\sigma_y}$ D. $r^2 \frac{\sigma_y}{\sigma_x}$	K1	CO1

3. Fill in the blanks (5 x 1 = 5 marks)

a)	The formula for finding the angle ϕ between the tangent and the radius vector is _____	K2	CO1
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b)	The expansion of $\frac{e^x + e^{-x}}{2}$ is _____	K2	CO1
c)	If $f(x)$ is an even function of x , then $\int_{-a}^a f(x)dx =$ _____	K2	CO1
d)	The expansion of $\cos n\theta$ is _____	K2	CO1
e)	Spearman 's formula for the rank correlation coefficient is _____	K2	CO1
4.	Say TRUE or FALSE (5 x 1 = 5 marks)		
a)	The formula for finding the polar subnormal is $\frac{dr}{d\theta}$.	K2	CO1
b)	The number of terms in the expansion of $(x + a)^n$ is $n + 1$.	K2	CO1
c)	$\int_a^b f(x)dx = \int_b^a f(x)dx$	K2	CO1
d)	The value of $\frac{1+i}{1-i}$ is 1.	K2	CO1
e)	Correlation coefficient always lies between -1 and +1.	K2	CO1

SECTION B

Answer any TWO of the following (2 x 10 = 20 Marks)			
5	Compute the angle of intersection between the curves $x^2 = 4y$ and $y^2 = 4x$.	K3	CO2
6	Find the sum to infinity of the series $1 + \frac{3}{4} + \frac{3}{4} \cdot \frac{5}{8} + \frac{3}{4} \cdot \frac{5}{8} \cdot \frac{7}{12} + \dots$	K3	CO2
7	Compute $\int \frac{3x-1}{(x-1)^2(x+3)} dx$.	K3	CO2
8	Express $\frac{\sin 6\theta}{\sin \theta}$ in terms of $\cos \theta$.	K3	CO2

SECTION C

Answer any TWO of the following (2x 10 = 20 Marks)																			
9	Determine the sum of the series to infinity using binomial series expansion $\frac{15}{16} + \frac{15.21}{16.24} + \frac{15.21.27}{16.24.32} + \dots$	K4	CO3																
10	Evaluate $I = \int_0^{\pi/2} \frac{(\sin x)^{3/2}}{(\sin x)^{3/2} + (\cos x)^{3/2}} dx$	K4	CO3																
11	Determine the value of the $\left[\frac{1 + \sin \frac{\pi}{8} + i \cos \frac{\pi}{8}}{1 + \sin \frac{\pi}{8} - i \cos \frac{\pi}{8}} \right]^8$.	K4	CO3																
12	Calculate the mean and standard deviation for the following table giving the age distribution of 542 members.	K4	CO3																
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Age (in years)</td> <td style="padding: 5px;">20-30</td> <td style="padding: 5px;">30-40</td> <td style="padding: 5px;">40-50</td> <td style="padding: 5px;">50-60</td> <td style="padding: 5px;">60-70</td> <td style="padding: 5px;">70-80</td> <td style="padding: 5px;">80-90</td> </tr> <tr> <td style="padding: 5px;">No of Members</td> <td style="padding: 5px;">3</td> <td style="padding: 5px;">61</td> <td style="padding: 5px;">132</td> <td style="padding: 5px;">153</td> <td style="padding: 5px;">140</td> <td style="padding: 5px;">51</td> <td style="padding: 5px;">2</td> </tr> </table>		Age (in years)	20-30	30-40	40-50	50-60	60-70	70-80	80-90	No of Members	3	61	132	153	140	51	2		
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SECTION D

Answer any ONE of the following (1 x 20 = 20 Marks)			
13 (a)	Determine the maximum and minimum value of the function $f(x, y) = 4x^2 + 6xy + 9y^2 - 8x - 24y + 4$.	10	K5 CO4
(b)	Determine sum to infinity of the series $1 + \frac{1+3}{2!} + \frac{1+3+3^2}{3!} + \frac{1+3+3^2+3^3}{4!} + \dots$ to ∞ .	10	K5 CO4
14.(a)	Evaluate $\int \frac{2x+3}{x^2+x+1} dx$	10	K5 CO4
(b)	Expand $\sin^6 \theta$ and arrange in in a series of cosines of multiples of θ .	10	K5 CO4

SECTION E

Answer any ONE of the following

(1 x 20 = 20 Marks)

15 (a)	Reorganise and find the sum of the series $\sum_{n=0}^{\infty} \frac{(n+1)^3}{n!} x^n$.	10	K6	CO5																																	
(b)	By integrating prove that $\int_0^{\pi/4} \log(1 + \tan \theta) d\theta = \frac{\pi}{8} \log 2$.	10	K6	CO5																																	
16.(a)	By expanding $\cos^7 \theta$ justify that $2^6 \cos^7 \theta = \cos 7\theta + 7\cos 5\theta + 21\cos 3\theta + 35\cos \theta$.	10	K6	CO5																																	
(b)	<p>Ten competitors in a musical test where ranked by three judges A,B and C in the following order.</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 5px;"> <tr> <td style="padding: 2px;">Rank by A</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">6</td> <td style="padding: 2px;">5</td> <td style="padding: 2px;">10</td> <td style="padding: 2px;">3</td> <td style="padding: 2px;">2</td> <td style="padding: 2px;">4</td> <td style="padding: 2px;">9</td> <td style="padding: 2px;">7</td> <td style="padding: 2px;">8</td> </tr> <tr> <td style="padding: 2px;">Rank by B</td> <td style="padding: 2px;">3</td> <td style="padding: 2px;">5</td> <td style="padding: 2px;">8</td> <td style="padding: 2px;">4</td> <td style="padding: 2px;">7</td> <td style="padding: 2px;">10</td> <td style="padding: 2px;">2</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">6</td> <td style="padding: 2px;">9</td> </tr> <tr> <td style="padding: 2px;">Rank by C</td> <td style="padding: 2px;">6</td> <td style="padding: 2px;">4</td> <td style="padding: 2px;">9</td> <td style="padding: 2px;">8</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">2</td> <td style="padding: 2px;">3</td> <td style="padding: 2px;">10</td> <td style="padding: 2px;">5</td> <td style="padding: 2px;">7</td> </tr> </table> <p>Using rank correlation method, discuss which pair of judges has the nearest approach to common likings in music?</p>	Rank by A	1	6	5	10	3	2	4	9	7	8	Rank by B	3	5	8	4	7	10	2	1	6	9	Rank by C	6	4	9	8	1	2	3	10	5	7	10	K6	CO5
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