LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FIRST SEMESTER – **NOVEMBER 2022**

UMT 1302 – MATHEMATICS FOR CHEMISTRY

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

Time: 01:00 PM - 04:00 PM

SECTION - A

Answer ALL the Questions

1.	**Answer the following**		**(5 x 1 = 5)**
a)	What is the differential coefficient of x^n?	K1	CO1
b)	Write the expansion of $(1-x)^{-n}$.	K1	CO1
c)	Evaluate $\int xe^x dx$.	K1	CO1
d)	Write the expansion of $\sin n\theta$.	K1	CO1
e)	For a binomial distribution the mean is 6 and the standard deviation is $\sqrt{2}$. Find the value of p and q.	K1	CO1
2.	**Fill in the blanks**		**(5 x 1 = 5)**
a)	The length of the polar subtangent of a curve at a given point is given by ……	K1	CO1
b)	The expansion of $\frac{e^x+e^{-x}}{2}$ is ……	K1	CO1
c)	$\int cos^2 x\, dx$ is ……	K1	CO1
d)	The value of $(cos\theta - isin\theta)^5$ is ……	K1	CO1
e)	The mean of Poisson distribution is …….	K1	CO1
3.	**Choose the correct answer**		**(5 x 1 = 5)**
a)	If a point is not having maxima or minima at a point, then a. $r = 0$ b. $r > 0$ c. $r < 0$ d. None of these	K2	CO1
b)	Which of the following can be used to find the infinite sum? a. Binomial series expansion b. Binomial distribution c. Poisson distribution d. None of the above	K2	CO1
c)	$\int \frac{x}{x+5} dx$ is …… a. 0 b. $1-(x+5))$ c. 1 d. $x - 5\log(x+5)$	K2	CO1

d)	$\frac{a+ib}{c+id}$ =……. a. $(ac+bd)-i\,(bc-ad)$ b. $\frac{ac+bd}{c+d}$ c. $\frac{(ac+bd)+i((bc-ad))}{c^2+d^2}$ d. None of the above	K2	CO1
e)	The correlation coefficient $\rho(x,y)$ lies between…… a. 0 and 1 b. -1 and 1 c. -2 and 0 d. -1 and 2	K2	CO1
4.	**Say True or False**	**(5 x 1 = 5)**	
a)	The slope of the tangent in the polar coordinates is $tan\Psi = \Psi + \theta$.	K2	CO1
b)	There is an additional factor only in the numerator for every successive term for binomial expansion.	K2	CO1
c)	Integration can also be used to find area of the given region.	K2	CO1
d)	If n is any integer, then $(cos\theta + isin\theta)^n = cosn\theta + isin\, n\theta$.	K2	CO1
e)	The mean and variance of binomial distribution is np and $\frac{np}{q}$.	K2	CO1

SECTION - B

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

5.	Predict the length of the subtangent, subnormal, tangent and normal at the point (a,a) on the cissoid $y^2 = \frac{x^3}{2a-x}$.	K3	CO2
6.	Determine the sum of the series to infinity using binomial series expansion $\frac{15}{16}+\frac{15}{16}.\frac{21}{24}+\frac{15}{16}.\frac{21}{24}.\frac{27}{32}+\cdots$	K3	CO2
7.	(i) Solve $\int \frac{x-1}{(x-2)(x-3)}dx$. (ii) Show that $sin^5\theta = \frac{1}{16}[sin5\theta - 5sin3\theta + 10sin\theta]$. **(5+5) Marks**	K3	CO2
8.	Determine the mean and standard deviation for the following table giving the age distribution of 542 members.	K3	CO2

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

SECTION - C

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

9.	Determine the angle of intersection between the curves $x^2 = 4y$ and $x^2 = 4y$.	K4	CO3
10.	Calculate the sum of the series using exponential series expansion $1+\frac{1+3}{2!}+\frac{1+3+3^2}{3!}+\frac{1+3+3^2+3^3}{4!}+\cdots\infty$.	K4	CO3
11.	(i) Determine $\int \frac{2x+1}{\sqrt{3+4x-x^2}}dx$. (ii) Estimate the value of $cos5\theta$ in terms of $cos\theta$. **(6+4) Marks**	K4	CO3

12.	Calculate the correlation coefficient for the following heights (in inches) of fathers (X) and their sons (Y): X: 65, 66, 67, 67, 68, 69, 70, 72 Y: 67, 68, 65, 68, 72, 72, 69, 71	K4	CO3

SECTION - D

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

13.	Estimate the maximum and minimum value of the function $f(x, y) = x^3 + y^3 - 3x - 12y + 20.$	K5	CO4
14.	(i) Derive the series expansion for $\log(1 + x)$. (ii) Is $log\sqrt{2} = 1 + \left(\frac{1}{2} + \frac{1}{3}\right)\frac{1}{4} + \left(\frac{1}{4} + \frac{1}{5}\right)\frac{1}{4^2} + \left(\frac{1}{6} + \frac{1}{7}\right)\frac{1}{4^3} + \cdots$ Justify your answer. **(10+10) Marks**	K5	CO4

SECTION - E

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

15.	(i) Integrate $\int \frac{2x+3}{x^2+x+1} dx.$ (ii) By expanding $sin^5\theta cos^2\theta$, justify that $2^6 sin^5\theta cos^2\theta = sin7\theta - 3sin5\theta + sin3\theta + 5sin\theta.$ **(10+10) Marks**	K6	CO5
16.	The following information shows the marks received by 10 contestants in a music competition from three judges: Rank by A: 80, 68, 70, 75, 59, 78, 73, 60, 66, 64 Rank by B: 80, 76, 68, 78, 70, 65, 83, 85, 74, 66 Rank by C: 64, 68, 58, 60, 75, 74, 70, 56, 66, 62 Using rank correlation method, discuss which pair of judges have the nearest approach to common likings in music?	K6	CO5

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