LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FIRST SEMESTER – **NOVEMBER 2019**

UMT 1302 – MATHEMATICS FOR CHEMISTRY

Date: 05-11-2019 Dept. No. Max. : 100 Marks

Time: 09:00-12:00

SECTION – A

ANSWER ALL QUESTIONS: **(10 x 2 = 20)**

1. If $y = x^x$, then find $\frac{dy}{dx}$.
2. Find the slope of the curve $r = e^{\theta}$ at $\theta = 0$.
3. Find the first order partial derivatives of $u = 2xyz^4 - 4yz$.
4. Prove that $\frac{e^2-1}{e^2+1} = \frac{\frac{1}{1!}+\frac{1}{3!}+\frac{1}{5!}+\ldots\infty}{1+\frac{1}{2!}+\frac{1}{4!}+\ldots\infty}$.
5. Write the expansions for $\log(1-x)$ and e^x.
6. Write the Bernoulli's formula for integration by parts.
7. Write down the expansion of $cosn\theta$.
8. Evaluate $\int \frac{1}{1+16x^2}\,dx$.
9. The mean and variance of a binomial distribution are 4 and $\frac{4}{3}$ respectively. Find $P(X \geq 1)$.
10. Define Poisson distribution.

SECTION – B

ANSWER ANY FIVE QUESTIONS: **(5 x 8 = 40)**

11. Show that in the parabola $y^2 = 4ax$, the subtangent at any point is double the abscissa and the subnormal is constant.
12. a) Find the angle at which the radius vector cuts the curve $\frac{l}{r} = 1 + e\cos^{-}$.

    b) Find the slope of the tangent with the initial line for the cardioid $r = a(1-\cos^{-})$ at $^{-} = \frac{®}{6}$.

    (4 + 4)
13. Find the sum to infinity of the series $1 + \frac{2}{6} + \frac{2.5}{6.12} + \frac{2.5.8}{6.12.18} + \cdots$.
14. Evaluate $\int_0^{\frac{\pi}{2}} \frac{a\,sinx+bcosx}{sinx+cosx}\,dx$.
15. (a) Using Bernoulli's formula, evaluate $\int x^2 e^{-2x}\,dx$.

    (b) Using reduction formula, evaluate $\int_0^{\pi/2} sin^7 x\,dx$. **(5+3)**
16. Express $sin7\theta$ in terms of $sin\theta$.
17. Calculate the mean and standard deviation for the following frequency distribution:

Marks	0-10	10-20	20-30	30-40	40-50	50-60
No. of students	12	18	27	20	17	6

18. The rank of same 16 students in Mathematics and Physics are as follows. Two numbers within brackets denote the ranks of the students in Mathematics and Physics: (1,1) (2,10) (3,3) (4,4) (5,5) (6,7) (7,2) (8,6) (9,8) (10,11) (11,15) (12,9) (13,14) (14,12) (15,16) (16,13). Calculate the rank correlation coefficient for proficiencies of this group in Mathematics and Physics.

SECTION – C

ANSWER ANY TWO QUESTIONS: **(2 x 20 = 40)**

19. (a) Find the angle of intersection of the cardioids $r = a(1 + \cos\theta)$ and $r = b(1 - \cos\theta)$.
    (b) Discuss the Maxima and Minima of the function $u(x,y) = x^3y^2(6 - x - y)$. **(8+12)**

20. (a) Show that the sum of the series $1+\frac{1+3}{2!}+\frac{1+3+3^2}{3!}+\frac{1+3+3^2+3^3}{4!}+\ldots\ldots\infty=\frac{1}{2}e\left(e^2-1\right)$.

    (b)Evaluate $\int \frac{1}{x(x-1)(x+1)}\,dx$. **(12+8)**

21. (a) Show that $\log\sqrt{12} = 1 + \left(\frac{1}{2}+\frac{1}{3}\right)\frac{1}{4} + \left(\frac{1}{4}+\frac{1}{5}\right)\frac{1}{4^2} + \cdots$
    (b) Prove that $32cos^6\theta = cos6\theta + 6cos4\theta + 15cos2\theta + 10$. **(12+8)**

22. Obtain the equations of two lines of regression for the following data. Also obtain the estimate of X for $Y = 70$.

X	65	66	67	67	68	69	70	72
Y	67	68	65	68	72	72	69	71

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