

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – CHEMISTRY

THIRD SEMESTER – NOVEMBER 2018

MT 3103 – MATHEMATICS FOR CHEMISTRYDate: 03-11-2018
Time: 01:00-04:00Dept. No.

Max. : 100 Marks

Section A**Answer ALL questions:****(10 x 2 = 20)**

1. What is the differential coefficient of $\sin x$?
2. If $y = e^x + x^2$, find $\frac{dy}{dx}$.
3. Integrate $ax^2 + bx + c$ with respect to x .
4. Write any two properties of definite integrals.
5. Expand $\log(1 + x)$.
6. Find the characteristic roots of the matrix $A = \begin{pmatrix} 4 & 1 \\ 3 & 2 \end{pmatrix}$.
7. Write the expansion of $\sin \theta$ in a series of ascending powers of θ .
8. Prove that $\cosh^2 x - \sinh^2 x = 1$.
9. What is the chance that a leap year selected at random will contain 53 Sundays?
10. Define the probability mass function of Poisson distribution.

Section B**Answer any FIVE questions:****(5 x 8 = 40)**

11. Find the differential coefficient of $\frac{(2x)}{(1+x^2)^{\frac{1}{2}}(1-x^2)^{\frac{3}{2}}}$.
12. Find the angle of intersection of the cardioids $r = a(1 + \cos \theta)$ and $r = b(1 - \cos \theta)$.
13. Evaluate $\int \frac{dx}{x^2+x+1}$.
14. Show that $\int_0^{\pi/2} \frac{(\sin x)^{1/2}}{(\sin x)^{1/2} + (\cos x)^{1/2}} dx = \frac{\pi}{4}$.
15. Show that $\log(x + 2h) = 2\log(x + h) - \log x - \left[\frac{h^2}{(x+h)^2} + \frac{h^4}{2(x+h)^4} + \frac{h^6}{3(x+h)^6} \right]$.
16. Find the sum to infinity of the series $1 + \frac{2^3}{2!} + \frac{3^3}{3!} + \dots$.
17. If $\sin(A + iB) = x + iy$, prove that (i) $\frac{x^2}{\cosh^2 B} + \frac{y^2}{\sinh^2 B} = 1$ (ii) $\frac{x^2}{\sin^2 A} - \frac{y^2}{\cos^2 A} = 1$.
18. Two unbiased dice are thrown. Find the probability that:
 - (i) both the dice show the same number
 - (ii) the first die shows 6
 - (iii) the total of the numbers on the dice is 8
 - (iv) the total of the numbers on the dice is greater than 8.

Section C

Answer any TWO questions:

(2 x 20 = 40)

19. (a) Find the maxima and minima of the function $x^3 - 18x^2 + 96x + 4$.

(b) Differentiate the following functions with respect to x :

(i) $y = \frac{(x^2+1)}{3x-2}$ (ii) $y = \sin x \log x$. (12 + 8)

20. (a) Evaluate $\int \frac{x^2}{(a+bx)^3} dx$.

(b) Find the sum to infinity of the series $\frac{2 \cdot 4}{3 \cdot 6} + \frac{2 \cdot 4 \cdot 6}{3 \cdot 6 \cdot 9} + \frac{2 \cdot 4 \cdot 6 \cdot 8}{3 \cdot 6 \cdot 9 \cdot 12} + \dots$. (10+10)

21. (a) Expand $\cos^6 \theta$ in series of cosines of multiples of θ .

(b) Find the characteristic roots and the characteristic vectors of the matrix

$$A = \begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}.$$

(8 + 12)

22. (a) Ten coins are thrown simultaneously. Find the probability of getting at least seven heads.

(b) Calculate the mean and standard deviation for the following table giving the age distribution of 542 members.

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

(8 + 12)
