LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FOURTH SEMESTER – NOVEMBER 2016

MT 4204 - ADVANCED MATHS FOR CHEMISTRY

Date: 11-11-2016   Dept. No.   Max. : 100 Marks
Time: 01:00-04:00

PART A

Answer ALL the questions. $(10 \times 2 = 20)$

1. Show that $\beta(m, n) = \beta(n, m)$.
2. Find $\lceil(4)$.
3. Find the Laplace transform of t^3.
4. Show that $\vec{A} = 3y^4z^2\vec{i} + 4x^3z^2\vec{j} - 3x^2y^2\vec{k}$ is solenoidal.
5. Define a reciprocal equation.
6. Find the sum and product of the roots of equation $3x^3 + 6x^2 + 12x + 15 = 0$.
7. If the regression coefficient of Y on X is 0. 665 and the regression coefficient of X on Y is 0. 54, then what is the coefficient of correlation?
8. Write the normal equation of the curve $Y = a + bX + cX^2$.
9. State the formula for Newton's forward interpolation.
10. Find the range in which the real root of equation $x^2 - 5x + 2 = 0$ lies.

PART B

Answer any FIVE questions. $(5 \times 8 = 40)$

11. By changing the order of integration, evaluate $\int_0^{-\infty} \int_x^{\infty} \frac{e^{-y}}{y} \, dy dx$.

12. Evaluate $\int \frac{x^2 y^2}{x^2 + y^2} \, dx dy$ over the annular region between the circles
    $x^2 + y^2 = a^2, x^2 + y^2 = b^2$ $(b > a)$.

13. Find the Laplace transform of
    $$f(t) = \begin{cases} e^t & 0 < t < 1 \\ 0 & t > 1 \end{cases}$$

14. Find $L^{-1}\left(\frac{s}{(s^2 + a^2)^2}\right)$

15. Show that the roots of the equation $x^3 + px^2 + qx + r = 0$ are in arithmetic progression if
    $2p^3 - 9pq + 27r = 0$.

16. Find the directional derivative of $\varphi(x, y, z) = xy^2 + yz^3$ at the point $(2, -1, 1)$ in the direction of the vector $\vec{i} + 2\vec{j} + 2\vec{k}$.

17. Calculate the correlation of coefficient for the following data:

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

18. Solve the system of equation using Cramer's rule:
    $x + 2y + 3z = 10, 2x - 3y + z = 1, 3x + y - 2z = 9$.

Answer any TWO questions: $(2 \times 20 = 40)$

19. a) Find the volume of solid bounded by the surface $x = 0$, $y = 0$, $z = 0$, $x + y + z = 1$.

   b) Prove that $\int_0^\infty e^{-x^2} \, dx = \frac{\sqrt{\pi}}{2}$. $(10 + 10)$

20. a) Find $L(t^2 e^{-3t})$.

   b) Using Laplace transform, solve the differential equation $y'' + 2y' - 3y = \sin t$ given that $y(0) = y'(0) = 0$. $(5 + 15)$

21. a) Solve the equation $6x^5 - x^4 - 43x^3 + 43x^2 + x - 6 = 0$.

   b) If $\varphi(x, y, z) = x^2 y^3 z^4$, find *divgrad* φ and *curlgrad* φ. $(12 + 8)$

22. a) Solve using Gauss Seidel method:
   $28x + 4y - z = 32$, $x + 3y + 10z = 24$, $2x + 17y + 4z = 35$.

   b) Find the root of $4x - e^x = 0$ that lies between 2 and 3 correct to 4 decimal places. $(12 + 8)$