

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034**B.Sc. DEGREE EXAMINATION – CHEMISTRY****SECOND SEMESTER – APRIL 2022****18/17/16UMT2AL03 – MATHEMATICS FOR CHEMISTRY - II**

Date: 27-06-2022

Dept. No.

Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

PART-A

Answer ALL questions

10X2=20

- Evaluate $\int_0^2 \int_0^b x dx dy$.
- Solve $\frac{dy}{dx} = \frac{y+3}{x+5}$.
- Show that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$
- Solve $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = 0$.
- Find $L^{-1}(te^{-at})$.
- Find the Laplace transform of $t^2 + 2t + 3$.
- Write the formula for Newton's forward interpolation.
- Find the roots of the given polynomial $f(x) = x^3 + 2x^2 - 3x - 5$.
- Define group with an example.
- Find the order of each element of the group $G = \{1, -1, i, -i\}$.

PART B

Answer any FIVE Questions

5x8=40

- Evaluate $\iint xy dx dy$ over the positive octant of the sphere $x^2 + y^2 = a^2$ by transforming into spherical coordinates.
- Evaluate $\int_0^{\frac{\pi}{2}} \int_0^{\infty} \frac{r dr d\theta}{(r^2+a^2)^2}$.
- Solve $p^2 + q^2 - 2px - 2qy + 1 = 0$.
- Prove that $\int_0^1 (x \log x)^4 dx = \frac{4!}{5^5}$.
- Find $L[t \sin(2t + 3)]$.
- Using Newton Raphson method find the real root of the equation $x^4 - x - 10 = 0$, which is near to $x = 2$, correct to four places of decimal.
- (i) If G is a group and a, x are elements in G , prove that a and $x^{-1}ax$ have the same order.
(ii) If a is an element in group G and $a^n = e$, prove that $O(a)$ divides n .
- State and prove the Cancellation laws in groups.

PART C

Answer any TWO Questions

2x20=40

- (a) Prove that $\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$.
(b) Evaluate $\int_0^{\infty} \int_0^{\infty} \frac{dx dy}{(x^2+y^2+a^2)^2}$ by changing into polar coordinates. (10+10)
- (a) Solve the differential equation $(D^2 - 4D + 3)y = \sin 3x \cos 2x$.
(b) Prove that the set of integers Z forms a group under usual addition. (10+10)
- Using Laplace transform solve the equation $\frac{d^2y}{dt^2} + \frac{2dy}{dt} - 3y = \sin t$ given that $y = \frac{dy}{dt} = 0$ when $t = 0$.

(20)

22. (a) Solve the system of equation by Gauss elimination method, $2x+4y+2z=15$,

$$2x+y+2z = -5, 4x+y-2z=0.$$

(b) Show that the set of all positive rational numbers forms an abelian group under the composition defined by $a * b = \frac{ab}{2}$.

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