LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **PHYSICS**

FOURTH SEMESTER – **APRIL 2016**

MT 4200 - ADVANCED MATHEMATICS FOR PHYSICS

Date: 27-04-2016 Dept. No. Max. : 100 Marks

Time: 09:00-12:00

Section A

Answer ALL questions: **10 × 2= 20**

1. Evaluate $\int \frac{dx}{4x^2-4x+2}$.
2. Define Even and odd function.
3. State the necessary and sufficient condition for the ordinary differential equation to be exact.
4. Write the general solution when the roots are real and distinct.
5. Prove that $\beta(m.n) = \beta(n,m)$.
6. Define Beta function.
7. Define irrotational vector.
8. State Gauss theorem.
9. Define group.
10. Give an example to show that every group need not be an abelian group.

Section B

Answer any FIVE questions: **5 × 8 = 40**

11. Evaluate $I = \int_0^{\frac{\pi}{2}} \log \sin x \, dx$.
12. Express $f(x) = \frac{(\pi-x)}{2}$ as a fourier series with period 2π, to be valid in the interval 0 to 2π.
13. Evaluate $\int (3x-2)\sqrt{x^2+x+1}dx$.
14. Solve $(D^2 - 3D + 2)y = \sin 3x$.
15. Solve $xdx + ydy = a^2 \frac{xdy-ydx}{x^2+y^2}$.
16. Evaluate $\iint xy(x+y)dxdy$ over the area between the curves $y = x^2$ and $y = x$.
17. If $\vec{F} = x^2y\vec{i} + y^2z\vec{j} + z^2x\vec{k}$, then find curl curl $\vec{F}$.
18. Prove that the set $\{1, \omega, \omega^2\}$ is an abelian multiplicative finite group of order 3.

Section C

Answer any TWO questions: **2 × 20 = 40**

19. (a) Find the Cosine series in the range 0 to π for $f(x) = \begin{cases} x, & 0 < x < \frac{\pi}{2} \\ \pi - x, & \frac{\pi}{2} < x < \pi \end{cases}$.

(b) Define Half Range Fourier Series. **(16+4)**

20. (a) Solve $(D^2 + 16)y = 2e^{-3x} + \cos 4x$

(b) Solve $x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = logx.$ **(10+10)**

21. (a) Express $\int_0^1 x^m(1 - x^n)^p\, dx$ in terms of Gamma function and evaluate the integral

$\int_0^1 x^5(1 - x^3)^{10}\, dx$.

(b) Prove that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}.$ **(15+5)**

22. Verify Stoke's theorem for $\vec{F} = (x^2 - y^2)\vec{\imath} + xy\vec{\jmath}$ in the rectangular region in the XOY plane bounded by the lines $x = 0, x = a, y = 0$ and $y = b$. **(20)**

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