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LOYOLA COLLEGE (AUTONOMOUS), CHENNAI - 600 034

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

FOURTH SEMESTER - NOVEMBER 2016

MT 4200 - ADVANCED MATHEMATICS FOR PHYSICS

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

Max.: 100 Marks

PART - A

Answer ALL questions.

 $(10 \times 2 = 20)$

- 1. State Bernouli's formula.
- 2. Write any two properties of definite integral.
- 3. Solve $(D^2 + 4D + 4)y = 0$.
- 4. Define exact differential equation.
- 5. State the relation between Beta and Gamma integral.

6. If
$$u = (x - y)(y - z)(z - x)$$
, then prove that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$

- 7. Find a unit vector normal to the surface $x^2 + y^2 z = 10$ at (1,1,1).
- 8. State Greens theorem.
- 9. Define a cyclic group.
- 10. Define Kronecker's delta.

PART - B

Answer any FIVE questions.

 $(5 \times 8 = 40)$

11. Solve
$$\int_{0}^{\frac{\pi}{2}} \frac{(\sin x)^{\frac{3}{2}}}{(\sin x)^{\frac{3}{2}} + (\cos x)^{\frac{3}{2}}} dx = \frac{\pi}{4}.$$

- 12. Evaluate $\int x^4 \sin x \, dx$.
- 13. Solve $\frac{dy}{dx} + y \cos x = \frac{1}{2} \sin 2x$.
- 14. Solve $(D^2 + 16)y = \cos 4x$.
- 15. Change the order of integration and hence revaluate $\int_{1}^{3} \int_{y=0}^{\frac{5}{x}} x^2 dy dx$.
- 16. Find div curl \vec{F} if $\vec{F} = x^2y\vec{\imath} + xz\vec{\jmath} + 2yz\vec{\imath}\vec{k}$.
- 17. Show that the union of two subgroups of G is a subgroup iff one is contained in other.
- 18. Evaluate $\overline{2x^2 7x + 5}dx$.

PART - C

Answer any TWO questions.

$$(2 \times 20 = 40)$$

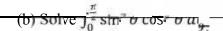
- 19. (a) Find the Fourier series to represent $x \pi$ in the interval $(-\pi, \pi)$.
 - (b) Find a sine series for f(x) = c in the range 0 to π .

(15+5)

20. Solve
$$(D^2 + 4D + 5)y = e^x + x^3 + \cos 2x$$
.

(20)

21. (a) By transforming into polar coordinates, evaluate
$$\iint \frac{x^2y^2}{x^2+y^2} dxdy$$
 over the annular region between the circles $x^2 + y^2 = a^2$ and $x^2 + y^2 = b^2$ ($b > a$).



(15+5)

- 22. (a) Verify Gauss divergence theorem for $\vec{F} = 4xz\vec{\imath} y^2\vec{\jmath} + yz\vec{k}$ over the cube bounded by x = 0, x = 1, y = 0, y = 1, z = 0, z = 1.
 - (b) If A_i and B_j are covariant vectors. Show that A_iB_j is a covariant tensor of order 2.

(15+5)