

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI-600 034.  
B.Sc. DEGREE EXAMINATION –PHYSICS  
FOURTH SEMESTER – APRIL 2003  
**MT 4200/ MAT 200 ADVANCED MATHEMATICS FOR PHYSICS**

26.04.2003

9.00 – 12.00

Max: 100 Mark

*Answer ALL questions. Each question carries TWO marks. (10 × 2 = 20 Marks)*

01. State Bernoulli's formula.

02. Evaluate  $\int_0^{\pi/2} \log(\tan \theta) d\theta$ .

03. Solve  $(D^3 - 2D + 4)y = 0$ .

04. Define exact differential equation.

05. State the relation between Beta and Gamma integral.

06. Find  $\frac{\partial(x, y, z)}{\partial(r, \theta, \phi)}$  where  $(r, \theta, \phi)$  are spherical coordinates.

07. Find the unit vector normal to the surface  $x^2 + y^2 + z^2 = 7$  at  $(1, -1, 2)$ .

08. State Gauss Divergence theorem.

09. Define a cyclic group.

10. Define contravariant and covariant vectors.

**PART – B**

(5 × 8 = 40 Marks)

*Answer any FIVE questions. Each question carries EIGHT marks*

11. (a) Evaluate  $\int \frac{xdx}{\sqrt{x^2 + x + 1}}$ .

(b) Evaluate  $\int (\log x)^2 dx$ . (4 + 4)

12. Find a sine series for

$$F(x) = x; 0 < x < \frac{\pi}{2}$$

$$= 0; < c < \pi$$

13. (a) Solve (8)

(b) Solve  $\cos^2 x$ .

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

(b) Test the exactness and solve

$$(1 + e^{x/y}) dx + dy = 0. \quad (4 + 4)$$

15. a) By changing the order of integration evaluate  
 b) Evaluate to . (5+3)
16. (a) compute the divergence and curl of the vector.

$$(x^2+yz) + (y^2+zx) + (z^2+xy)$$

- (b) Determine the constants a, b, c so that the  
 Vector =  $(x + 2y + az) + (bx - 3y - z) + (4x + cy + 2z)$   
 is irrotational. (4 + 4)

17. Show that the union of two subgroups of G is a subgroup if and only if one is contained in the other (8)
18. Evaluate (8)

**PART – C** (2 × 20 = 40 Marks)

*Answer any TWO questions. Each question carries TWENTY marks*

19. (a) Prove that  
 Hence evaluate

- (b) Show that . (12 +8)

20. (a) Solve  $(D^2 + 1) y = x^2 e^{2x}$ .

- (b) Solve  $(x + y - 1)dy = (x + y + 1) dx$ . (10+10)

21. (a) Find the area bounded by the curves

$$y^2 = 4 - x \text{ and } y^2 = 4 - 4x.$$

- (b) Use the substitution  $x + y + z = u$ ,  $y + z = uv$ ,  $z = uvw$  to evaluate the integral taken over the tetrahedral volume enclosed by the planes  $x = 0$ ,  $y = 0$ ,  $z = 0$  and  $x + y + z = 1$ . (10 +10)

22. (a) State Green's theorem and verify Green's theorem in the plane for where C is the closed curve and the region bounded by  $y = x$  and  $y = x^2$ .

- (b) If is also a tensor. (12+8)

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