

BT-4/M-24**44156**

**APPLIED AND COMPUTATIONAL
MATHEMATICS
BS-207-A**

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Section. All questions carry equal marks.

Section A

1. (i) Solve the differential equation :

$$x \frac{dy}{dx} + y \log y = xye^x$$

- (ii) Solve :

$$x^2(y - px) = yp^2$$

2. By using Charpit's method, solve the differential equation

$$(p^2 + q^2)y = qz.$$

Section B

3. (i) Evaluate :

$$\int_0^1 \int_{x^2}^x (x^2 + y^2)^{\frac{-1}{2}} dy dx$$

by changing the order of integration.

- (ii) Evaluate $\iiint_R (x^2 + y^2 + z^2) dx dy dz$, R denotes the region bounded by :

$$x = 0, y = 0, z = 0 \text{ and } x + y + z = a (a > 0).$$

4. Show that the vector field $\vec{F} = 2x(y^2 + z^3)\hat{i} + 2x^2y\hat{j} + 3x^2z^2\hat{k}$ is conservative. Find its scalar potential and the work done in moving a particle from $(-1, 2, 1)$ to $(2, 3, 4)$.

Section C

5. (i) Find the Laplace transform of $t^2 \cos at$.
(ii) Find the inverse of the Laplace transform

$$\frac{2s-5}{4s^2+25} + \frac{4s-18}{9-s^2}.$$

6. Using the Laplace transform, solve the initial value problem :

$$\frac{d^2 y}{dt^2} + 2 \frac{dy}{dt} + 2y = 5 \sin t$$

where $y(0) = y'(0) = 0$.

Section D

7. (i) Compute real root of $x \log_{10} x - 1.2 = 0$.
- (ii) Find the approximate value, correct to three places of decimals, of the real root which lies between -2 and -3 of the equation $x^3 - 3x + 4 = 0$, using the method of false position three times in succession.
8. Apply Taylor series method of second order to integrate $y' = 2t + 3y$, $y(0) = 1$, $t \in [0, 0.1]$ with $h = 0.1$.

