

Roll No.

Exam Code : M-24

Subject Code—61372

B.Sc. EXAMINATION

(Main/Re-appear)

(Batch 2022 Onwards)

(Second Semester)

MATHEMATICS

CML-206, Core Course-III

Ordinary Differential Equations and Laplace
Transformation

Time : 3 Hours

Maximum Marks : 80

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. 1 is compulsory. All questions carry equal marks.

Compulsory Question

1. (a) Define Singular solution.

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P.T.O.

- (b) What is geometrical meaning of solution of Differential Equation $\frac{dy}{dx} = m$.
- (c) What is orthogonal trajectory ?
- (d) Solve the differential equation :
 $y = px + p - p^2$.
- (e) Solve the differential equation :

$$\frac{d^3 y}{dx^3} - 7 \frac{dy}{dx} - 6y = 0.$$

- (f) Write Laplace transform of $\sin at$.
- (g) What is auxiliary equation of differential

$$\text{equation } x^2 \frac{d^3 y}{dx^3} + \frac{d^2 y}{dx^2} = \frac{1}{x}.$$

- (h) Write inverse Laplace transform of

$$\frac{1}{s^2 - a^2}.$$

$$8 \times 2 = 16$$

Unit I

2. (a) Solve the differential equation : 8
 $(x^4 - 2xy^2 + y^4)dx - (2x^2y - 4xy^3 + \sin y)dy = 0$

(b) Solve the differential equation : 8

$$(3xy^2 - y^3)dx - (2x^2y - xy^2)dy = 0.$$

3. (a) Solve the differential equation : 8

$$p^3 + 2xp^2 - y^2p^2 - 2xy^2p = 0.$$

(b) Solve $e^{5x}(p - 1) + p^5e^{4y} = 0$. 8

Unit II

4. (a) Find the orthogonal trajectory for the family of curves $r = a(1 + \sin \theta)$. 8

(b) Solve the differential equation : 8

$$\frac{d^3y}{dx^3} - \frac{d^2y}{dx^2} - 6\frac{dy}{dx} = 1 + x^2.$$

5. (a) Solve the differential equation : 8

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x \sin x.$$

(b) Solve the differential equation : 8

$$(2x-1)^3 \frac{d^3y}{dx^3} + (2x-1) \frac{dy}{dx} - 2y = 0.$$

Unit III

6. (a) Solve the differential equation : 8

$$\frac{d^2 y}{dx^2} - \cot x \frac{dy}{dx} - (1 - \cot x)y = e^x \sin x.$$

- (b) Solve the differential equation : 8

$$x \frac{d^2 y}{dx^2} + (4x^2 - 1) \frac{dy}{dx} + 4x^3 y = 2x^3.$$

7. (a) Solve the differential equation : 8

$$(x^3 - x) \frac{d^2 y}{dx^2} + \frac{dy}{dx} + n^2 x^3 y = 0.$$

- (b) Solve the differential equation : 8

$$\frac{xdx}{z^2 - 2yz - y^2} = \frac{dy}{y+z} = \frac{dz}{y-z}.$$

Unit IV

8. (a) Find the Laplace transform of $t - \sin^2 t$. 8

- (b) Evaluate : $\int_0^\infty t^3 e^{-t} \sin t \, dt$. 8

9. (a) Find the inverse Laplace transform of the function $\frac{s}{(s^2 + a^2)^3}$. 8

(b) Solve the differential equation : 8

$$t \frac{d^2 y}{dx^2} + 2 \frac{dy}{dx} + ty = 0, y(0) = 1, y(\pi) = 0 \text{ by}$$

transform method.