

Roll No.

Exam Code : D-22

Subject Code—11730

Dual Degree B. Sc. (Hons.)

Mathematics-M. Sc. Mathematics

EXAMINATION

(Third Semester)

(Batch 2016 Onwards)

ORDINARY DIFFERENTIAL EQUATIONS

BML-302

Time : 3 Hours

Maximum Marks : 70

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

Compulsory Question

1. (a) Find the value of k , assuming that the differential equation :

$$(x^2 - 2xy + ky^2)dx + (4y^3 + 6xy - x^2)dy = 0$$

is exact.

2

P.T.O.

- (b) Solve the differential equation : 2

$$p = \tan(px - y)$$

- (c) Define Orthogonal trajectory. 2

- (d) Solve : 2

$$\frac{d^2 y}{dx^2} + 3y = 0$$

- (e) Using the method of undetermined coefficients find particular integral of the given differential equation : 2

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

- (f) Define total differential equation. 2

- (g) Solve the differential equation : 2

$$\frac{dx}{z^2 y} = \frac{dy}{z^2 x} = \frac{dz}{y^2 x}$$

Section I

2. (a) Solve the differential equation : 7

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

- (b) Solve the differential equation : 7

$$\left(xy^2 - e^{x^{-3}}\right)dx - x^2ydy = 0$$

3. (a) Solve the differential equation : 7

$$xp^2 - 2yp - ax = 0$$

- (b) Find the complete primitive and singular solution of : 7

$$(xp - y)^2 = p^2 - 1$$

Section II

4. (a) Find the orthogonal trajectory of :

$$\frac{x^2}{a^2} + \frac{y^2}{b^2 + \lambda} = 1$$

where λ is a parameter. 7

- (b) Solve the differential equation : 7

$$\left(D^4 + 2D^3 - 3D^2\right)y = x^2 + 3e^{2x} + 4\sin x$$

5. (a) Show that $\frac{1}{D-a}X = e^{ax} \int e^{-ax} X dx$, and

hence find $\frac{1}{D-a}e^{ax}$. 7

(b) Solve the differential equation : 7

$$(1+x)^2 \frac{d^2 y}{dx^2} + (1+x) \frac{dy}{dx} + y = \sin[2 \log(1+x)]$$

Section III

6. (a) Solve the equation by removing the first derivative : 7

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

(b) Apply method of variation of parameters to solve the differential equation : 7

$$\frac{d^2 y}{dx^2} - 6 \frac{dy}{dx} + 9y = \frac{e^{3x}}{x^2}.$$

7. (a) Solve $x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} - 9y = 0$, given that $y = x^3$ is a part of solution. 7

(b) Solve the differential equation : 7

$$\left(\frac{d^2 y}{dx^2} + y \right) \cot x + 2 \left(\frac{dy}{dx} + y \tan x \right) = \sec x.$$

Section IV

8. (a) Solve the simultaneous equations : 7

$$\frac{dx}{dt} + \frac{dy}{dt} - 2y = 2 \cos t - 7 \sin t$$

$$\text{and } \frac{dx}{dt} - \frac{dy}{dt} + 2x = 4 \cos t - 3 \sin t.$$

(b) Solve the simultaneous equations : 7

$$\frac{dx}{y} = \frac{dy}{x} = \frac{dz}{xyz^2(x^2 - y^2)}$$

9. (a) Solve the differential equation : 7

$$3x^2 dx + 3y^2 dy - (x^3 + y^3 + e^{2z}) dz = 0.$$

(b) Solve the differential equation : 7

$$z(1 - z^2) dx + z dy - (x + y + xz^2) dz = 0.$$