Roll No. .....

Exam Code : D-23

Subject Code—15050

Dual Degree B.Sc. (Hons.)

(Mathematics)–M.Sc. (Mathematics)

(Third Semester) (Batch 2017 Onwards)

EXAMINATION

ORDINARY DIFFERENTIAL EQUATIONS

BML-302

Time : 3 Hours *Maximum Marks : 70*

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) Give geometrical meaning of the solution of the differential equation $\frac{dy}{dx} = \frac{-y}{x}$.

(b) Solve $p = \tan(px - y)$.

(c) Define orthogonal and oblique trajectories.

(d) Determine the complementary function of the differential equation :

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

(e) Show that $y = e^{2x}$ is a part of complementary function for the differential equation :

$$(x+2)\frac{d^2y}{dx^2} - (2x+5)\frac{dy}{dx} + 2y = (x+1)e^x .$$

(f) Define total differential equation.

(g) Show that the condition of integrability is satisfied for the differential equation :

$$\left(yz + z^2\right)dx - xz\,dy + xy\,dz = 0 . \quad 7\times2=14$$

Unit I

2. (a) Solve the differential equation :

$$\left(2y\sin x + 3y^4 \sin x \cos x\right)dx -$$

$$\left(4y^3\cos^2 x + \cos x\right)dy = 0 . \quad 7$$

(b) Solve :

$$\left(y^3 - 2yx^2\right)dx + \left(2xy^2 - x^3\right)dy = 0. \qquad 7$$

3. (a) Solve the differential equation :

$$\left(1 - y^2 + \frac{y^4}{x^2}\right)p^2 - \frac{2y}{x}p + \frac{y^2}{x^2} = 0. \qquad 7$$

(b) Obtain the complete primitive and the singular solution of :

$$x\left(\frac{dy}{dx}\right)^2 - 2y\frac{dy}{dx} + 4x = 0. \qquad 7$$

Unit II

4. (a) Show that the orthogonal trajectories of :

$$x^2 + y^2 + 2gx + 1 = 0$$

is $x^2 + y^2 + 2fy - 1 = 0$. 7

(b) Solve :

$$\frac{d^2y}{dx^2} + y = \operatorname{cosec} x. \qquad 7$$

P.T.O.

5. (a) Solve the differential equation :

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x \sin x . \qquad 7$$

(b) Solve :

$$x^3 \frac{d^3y}{dx^3} + 2x^2 \frac{d^2y}{dx^2} + 2y = 10\left(x + \frac{1}{x}\right). \qquad 7$$

Unit III

6. (a) Solve the differential equation :

$$x\frac{d^2y}{dx^2} + (x-1)\frac{dy}{dx} - y = x^2 . \qquad 7$$

(b) Solve :

$$\frac{d^2y}{dx^2} + 2\tan x \frac{dy}{dx} + 5y = \sec x e^x$$

by removing the first derivative. 7

7. (a) Apply the method of variation of parameter to solve :

$$xy' - y = (x-1)(y'' - x + 1). \qquad 7$$

(b) Solve the differential equation :

$$\left(D^3 + 3D^2 + 2D\right)y = x^2 + 4x + 8$$

by the method of undetermined coefficients. 7

Unit IV

8. (a) Solve :

$$x\frac{dy}{dx} + z = 0\,;\quad x\frac{dz}{dx} + y = 0\,.$$ 7

(b) Solve the simultaneous equations :

$$\frac{dx}{y+z} = \frac{dy}{z+x} = \frac{dz}{x+y}\,.$$ 7

9. (a) Solve the differential equation :

$$yz\,dx + \left(x^2y - zx\right)dy + \left(x^2z - xy\right)dz = 0$$

by considering one variable as constant. 7

(b) Solve :

$$\left(y^2 + yz\right)dx + \left(zx + z^2\right)dy + \left(y^2 - xy\right)dz = 0\,.$$ 7