LR-2135

M. A. / M. Sc. (Second Semester) Examination, May-June 2023

MATHEMATICS

Paper : Fifth (i) (Optional)

(Differential Equation-II)

Time Allowed : Three hours

Maximum Marks : 40

Note : Attempt questions of all *two* sections as directed. Distribution of marks is given with sections.

Section-'A'

(Short Answer Type Questions)   5×3=15

Note : Attempt all *five* questions. *One* question from each unit is compulsory. Each question carries 03 marks.

Unit-I

1. Discuss dependence of solution on initial conditions of differential equation.

Or

Discuss differentiability and continuity.

Unit-II

2. Define the following : (any **two**)

   (a) Foci

   (b) Umlanfsatz

   (c) Autonomous system

   (d) Saddle points

Unit-III

3. Explain principal solution.

Or

State and prove Sturm theorem.

Unit-IV

4. Explain periodic solution and non-linear problems.

Or

Discuss fixed point theorem for Implicit functions.

Unit-V

5. Discuss Aprori bounds in brief.

Or

Explain eigen values and the corresponding eigen functions of the boundary value problems.

Section-'B'

(Long Answer Type Questions)   5×5=25

Note : *Answer all five questions.* ***One*** *question from each unit is compulsory. Each question carries 05 marks.*

Unit-I

6. State and prove Peano's theorem on continuity of functions with intial conditions.

Or

Let ϕ be the solution of (E_m) on $a \le t \le b$ there exists

a $\delta > 0$ such that

$$\forall \, (\tau, \xi, \mu) \in U_\mu \text{ with}$$
$$0 \le \left| \xi - \phi(\tau) \right| + \left| \mu - \mu_0 \right| < \delta$$

then there exists a unique solution ψ of (E_m) on $a \le t \le b$.

Unit-II

7. State and prove Poincare-Bendixson theorem.

Or

Explain with example :

(a) Index of a stationary point

(b) Rotation point

Unit-III

8. Discuss Sturm-Liouville boundary value problems and their solutions with special reference of number of zeros.

Or

State and prove non-oscillation theorem.

Unit-IV

9. Discuss linear equation with some applictions.

Or

Explain application of fixed point theorem for solution of linear equations and non-linear problems.

Unit-V

10. Explain the solution of non-linear problems with second order differentiability and initial boundary conditions taking any choice.

Or

Discuss the solution of second order equations of the form $x'' = f(t, x, x')$ with boundary conditions

$x(0) = 0$, $x(p) = 0$, where x and f denote function of vectors with real components.