## Unit III

**6.** (a) State and prove orthogonality theorem of characteristics function. **12**

(b) Prove that the eigen values of SLVB problem are real. **3**

**7.** (a) Find non-trival solution of the SLBVP $\frac{d^2u}{dt^2} + \lambda u = 0$, where $u(0) = 0$, $u(\pi) = 0$. **8**

(b) Write a note on piriodic solution of linear and non-linear equation. **7**

## Unit IV

**8.** Construct Green's function for the homogeneous boundary value problem $\frac{d^4y}{dx^4} = 0$, $y(0) = y'(0) = y'(1) = y'(1) = 0$. **15**



**No. of Printed Pages : 05** **Roll No. .......................**

# 18AA1904

## M. Sc. EXAMINATION, May 2019

(First Semester)

(C Scheme) (Re-appear)

MATHEMATICS

MAT507C

Ordinary Differential Equations–I

*Time : 3 Hours*] [*Maximum Marks :* 75

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

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

## (Compulsory Question)

1. (a) Define Lipschitz condition and show that the function $f(t, y) = \sqrt{y}$ satisfies lip. condition on any rectangle R of the form R : $|t| \leq a,\ b \leq y \leq c,\ (a,\ b,\ c > 0)$. **3**

   (b) Let $u(t)$ be a non-zero solution of the ODE $\frac{d}{dt}\left\{p(t)\frac{dy}{dt}\right\} + q(t)\,u = 0,\ \ \forall t \in \mathrm{I}$. Prove that zeros of $u(t)$ can't have a clusture point in I. **4**.

   (c) Write short note on Fixed Point Theorem. **4**

   (d) Define Green's function and its properties. **4**

## Unit I

2. (a) State and prove e-approximation theorem. **8**

   (b) Define equicontinuous family of function. State and prove Ascali Theorem. **7**



3. (a) State and prove Uniqueness Theorem of IVP. **10**

   (b) Define continuation of solution of IVP. Prove that solution of a given IVP can be extended up to maximum internal of existence. **5**

## Unit II

4. (a) Check that whether or not the differential equation :

   $$(2x^2 + 2xy + 2xz^2 + 1)\,dx + dy + 2zdz = 0$$

   in integrable. If yes, solve it. **7**

   (b) State and prove Sturm Fundamental Comparison Theorem. **8**

5. (a) State and prove Wintror-Uniqueness Theorem. **8**

   (b) Solve the Riccati's equation : **7**

   $$x^2 y_1 + 2 - 2xy + x^2 y^2 = 0\,.$$

**9.** Reduce the following boundary value problem into an integral equation : **15**

$$\frac{d^2y}{dx^2} + xy = 1,\ y(0) = 0,\ y(l) = 1.$$

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