CURRICULUM TRANSACTIONAL STRATEGY

MMT-C 203: Ordinary Differential Equations

Pre-requisites: Basic differential equations and methods to solve them; Theory regarding the existence and uniqueness of solutions.

COURSE OBJECTIVES

- To understand differential equations, its order and degree.
- To find out the singular solutions of Ist order differential equations.
- To get introduced with homogeneous and non-homogeneous linear ODE.
- To find the solution of second order differential equations and higher order equations by factorization of operators andvariation of parameters.
- To find the solution of differential equation in the form of infinite series by the Frobenius method.
- To get familiar with Bessel's and Legendre's equations.
- To find out the solution of Simultaneous system of ODEs by various methods.
- To understand the total differential equations and methods employed to solve them.
- To have the understanding when Pdx+Qdy+Rdz=0 isintegrable.
- To understand the basic definition of equi-continuity and Ascoli-lemma.
- To know when the initial value problem has a unique solution.
- To prove the uniqueness of solution by Gronwall inequality.
- To find the numerical solution of initial value problem.
- To understand the importance of Picard's theorem.
- To know the dependence of solutions on initial conditions and parameters.
- To understand the maximal and minimal solution of the system of ODEs.
- To be able to find the fundamental matrix of system of differential equations.
- To be able to prove the linear dependence and independence of solutions by Wronskian.

COURSE OUTLINE

UNIT I

- Differential equations, its order and degree.
- Singular solutions of Ist order differential equations.
- General theory of homogeneous and non-homogeneous linear ODE.
- Factorization of operators.
- Method of variation of parameters.

UNIT II

- Series solution of differential equations.
- Simultaneous system of ODEs and their solutions.
- Total differential equations.
- Necessary and sufficient condition for Pdx+Qdy+Rdz=0 to be integrable.
- Geometrical interpretation of Pdx+Qdy+Rdz=0.

UNIT III

- Equi-continuity and Ascoli-lemma.
- Lipschitz condition.
- Gronwall inequality and its generalization.
- Initial value problem and solution by the method of successive approximations.
- Picard's theorem for the existence and uniqueness of solution.
- Continuation of solutions.
- Dependence of solutions on initial conditions and parameters.

UNIT IV

- Maximal and minimal solution of the system of ODEs.
- Caratheodary theorem.
- Fundamental matrix and its properties.
- Wronskian and its properties.
- Pioncare-Bendixson theorem.

Classroom Transaction

Unit	Topic	Activity	No. of Tutorials	No. of lectures
I	Definitions of differential equations, its order and degree	Assignment	02	01
	Singular solutions of Ist order differential equations	Assignment	02	05
	General theory of homogeneous and non-homogeneous linear ODE	Assignment and Presentation	01	03
	Factorization of operators	Assignment	02	02
	Method of variation of parameters	Assignment	03	03

Unit	Topic	Activity	No. of Tutorials	No. of lectures
II	Series solution of differential equations	Assignment and Presentation	03	06
	Simultaneous system of ODEs and their solutions	Assignment	02	03
	Total differential equations with reference to examples and their solutions	Assignment	02	03
	Necessary and sufficient condition for Pdx+Qdy+Rdz=0 to be integrable	Assignment	02	02

Unit	Topic	Activity	No. of Tutorials	No. of lectures
III	Lipschitz condition and illustration with examples	Assignment	02	02
	Gronwall inequality and its generalization	Assignment	01	01
	Initial value problem and solution by the method of successive approximations	Assignment and Presentation	03	02
	Picard's theorem for the existence and uniqueness of solution	Assignment	04	04
	Continuation of solutions	Assignment	01	02
	Dependence of solutions on initial conditions and parameters	Presentation	01	03

Unit	Topic	Activity	No. of Tutorials	No. of lectures
IV	Maximal and minimal solution of the system of ODEs	Assignment	01	02
	Caratheodary theorem	Assignment	01	02
	Fundamental matrix and its properties	Presentation	03	04
	Wronskian and its properties	Assignment	03	04
	Pioncare-Bendixson theorem	Assignment	01	01

Text Books:

1. H. T. H. Piaggo, Differential equations; CBS Publishers & Distributors Pvt. Ltd.
2. D. Somasundaram, Ordinary differential equations-A first course; Narosa Publishing House.
3. Earl A. Coddington, An introduction to ordinary differential equations; Dover Publications.
4. M. D. Raisinghania, Ordinary and partialdifferential equations; S. Chand & Company Ltd.
5. Shepley L. Ross, Differential equations; John Wiley & Sons, Inc.