

## TEACHING PLAN

<b>Course Title: Ordinary Differential Equations with Applications</b>	<b>Duration of Examination: 3 hours</b>
<b>Course Code: MAMT-103</b>	<b>Maximum Marks: 100</b>

**Course Instructor: Dr. Sanjay Kumar**

### Unit I

LECTURE 1	Mathematical modeling by means of ordinary differential equations
LECTURE 2	Existence and uniqueness of solutions of initial value problems for first order differential equations
TUTORIAL 1	Exercises and examples related to Lecture 1 and Lecture 2
LECTURE 3	Picard's Theorem
LECTURE 4	Picard's Method of Successive Approximations
TUTORIAL 2	Examples and exercises related to Lecture 3 and Lecture 4
LECTURE 5	Singular solutions of first order ODEs
LECTURE 6	Lipschitz conditions
TUTORIAL 3	Examples and Exercises related to Lecture 5 and Lecture 6
LECTURE 7	Linear systems
LECTURE 8	Linear dependence and independence of solutions, Wronskian
TUTORIAL 4	Exercises related to Lecture 7 and Lecture 8

### Unit II

LECTURE 9	Solutions of homogeneous linear system of first order ODEs with constant coefficients
LECTURE 10	General theory of homogeneous linear ODEs
TUTORIAL 5	Exercises and examples related to Lecture 9 and Lecture 10
LECTURE 11	General theory of non-homogeneous linear ODEs
LECTURE 12	The General solution of the Homogeneous equation
TUTORIAL 6	Exercises and examples related to Lecture 11 and Lecture 12
LECTURE 13	The use of known solution to find another
LECTURE 14	Homogeneous equation with constant coefficients
TUTORIAL 7	Exercise and examples related to Lecture 13 and Lecture 14
LECTURE 15	Method of undetermined coefficients
LECTURE 16	Examples related to Method of undetermined coefficients
TUTORIAL 8	Exercises related to Lecture 15 and Lecture 16

### Unit III

LECTURE 17	Method of Variation of Parameters
LECTURE 18	Examples related to Method of Variation of Parameters
TUTORIAL 9	Exercises related to Lecture 17 and Lecture 18
LECTURE 19	Oscillations and the Sturm Separation Theorem
LECTURE 20	Examples related to Oscillations and the Sturm Separation Theorem
TUTORIAL 10	Exercises related to Lecture 19 and Lecture 20
LECTURE 21	Sturm-Liouville boundary value problem
LECTURE 22	Examples related to Sturm-Liouville boundary value problem
TUTORIAL 11	Exercises related to Lecture 21 and Lecture 22
LECTURE 23	Sturm-Liouville equations
LECTURE 24	Eigen value problems
TUTORIAL 12	Exercises related to Lecture 23 and Lecture 24

### Unit IV

LECTURE 25	Series solutions of non-autonomous systems
LECTURE 26	Second order Linear Equations
TUTORIAL 13	Examples and exercises related to Lecture 25 and Lecture 26
LECTURE 27	Ordinary points
LECTURE 28	Examples related to Ordinary points
TUTORIAL 14	Exercises related to Lecture 27 and Lecture 28
LECTURE 29	Regular Singular points
LECTURE 30	Examples related to Regular Singular points
TUTORIAL 15	Examples and exercises related to Lecture 29 and Lecture 30
LECTURE 31	Legendre and Bessel series
LECTURE 32	Frobenius method
TUTORIAL 16	Examples and exercises related to Lecture 31 and Lecture 32
Unit V	
LECTURE 33	Discrete dynamical systems
LECTURE 34	Examples related to Discrete dynamical systems
TUTORIAL 17	Exercises related to Lecture 33 and Lecture 34
LECTURE 35	Stability of dynamical systems
LECTURE 36	Examples related to Stability of dynamical systems
TUTORIAL 18	Exercises related to Lecture 35 and Lecture 36
LECTURE 37	Lyapunov exponential
LECTURE 38	Examples related to Lecture 37
TUTORIAL 19	Exercises related to Lecture 37 and Lecture 38
LECTURE 39	asymptotic stability
LECTURE 40	Examples related to Lecture 39
TUTORIAL 20	Exercises related to Lecture 39 and Lecture 40
Total Lectures: 40      Total Tutorials: 20      Total = 60	

**Textbooks:**

1. G F Simmons, Differential equations with applications and historical notes, Tata McGraw-Hill Edition, 2003.

**Reference books:**

1. S L Ross, Differential equations, Blaisdell publishing company, First Edition, 1964.
2. G Birkhoff and G C Rota, Ordinary differential equations, Boston, 1962.
3. E A Coddington and N Levinson, Theory of Ordinary differential equations, McGraw-Hill, New York, 1955.
4. Saber N Elaydi, An introduction to Differential Equations, Springer-verlag, Second edition, 1995.
5. V I Arnold, Ordinary Differential equations, PHI, New Delhi, 1998.

