

**UNIVERSITY OF MADRAS**  
**M.Sc. DEGREE PROGRAMME IN MATHEMATICS**  
 SYLLABUS WITH EFFECT FROM 2023-2024

<b>Title of the Course</b>		<b>ORDINARY DIFFERENTIAL EQUATIONS</b>					
<b>Paper Number</b>		<b>CORE III</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	5	<b>Course Code</b>	428C1C
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>	<b>Total</b>		
		5	1	--	6		
<b>Pre-requisite</b>		UG level Calculus and Differential Equations					
<b>Objectives of the Course</b>		To develop strong background on finding solutions to linear differential equations with constant and variable coefficients and also with singular points, to study existence and uniqueness of the solutions of first order differential equations					
<b>Course Outline</b>		<b>UNIT-I : Linear equations with constant coefficients</b> Second order homogeneous equations-Initial value problems-Linear dependence and independence-Wronskian and a formula for Wronskian-Non-homogeneous equation of order two. <b>Chapter 2: Sections 1 to 6</b>					
		<b>UNIT-II : Linear equations with constant coefficients</b> Homogeneous and non-homogeneous equation of order n –Initial value problems- Annihilator method to solve non-homogeneous equation- Algebra of constant coefficient operators. <b>Chapter 2 : Sections 7 to 12.</b>					
		<b>UNIT-III :Linear equation with variable coefficients</b> Initial value problems -Existence and uniqueness theorems – Solutions to solve a non-homogeneous equation – Wronskian and linear dependence – reduction of the order of a homogeneous equation – homogeneous equation with analytic coefficients-The Legendre equation. <b>Chapter : 3 Sections 1 to 8 ( Omit section 9)</b>					
		<b>UNIT-IV :Linear equation with regular singular points</b> Euler equation – Second order equations with regular singular points – Exceptional cases – Bessel Function. <b>Chapter 4 : Sections 1 to 4 and 6 to 8 (Omit sections 5 and 9)</b>					

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	<p><b>UNIT-V</b> : Existence and uniqueness of solutions to first order equations: Equation with variable separated – Exact equation – method of successive approximations – the Lipschitz condition – convergence of the successive approximations and the existence theorem.</p> <p><b>Chapter 5 : Sections 1 to 6 ( Omit Sections 7 to 9)</b></p>
<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved</p> <p>(To be discussed during the Tutorial hour)</p>
<p>Skills acquired from this course</p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>
<p><b>Recommended Text</b></p>	<p>E.A.Coddington, <i>A introduction to ordinary differential equations</i> (3<sup>rd</sup> Printing) Prentice-Hall of India Ltd.,New Delhi, 1987.</p>
<p><b>Reference Books</b></p>	<ol style="list-style-type: none"> <li>1. Williams E. Boyce and Richard C. DI Prima, <i>Elementary differential equations and boundary value problems</i>, John Wiley and sons, New York, 1967.</li> <li>2. George F Simmons, <i>Differential equations with applications and historical notes</i>, Tata McGraw Hill, New Delhi, 1974.</li> <li>3. N.N. Lebedev, <i>Special functions and their applications</i>, Prentice Hall of India, New Delhi, 1965.</li> <li>4. W.T. Reid. <i>Ordinary Differential Equations</i>, John Wiley and Sons, New York, 1971.</li> <li>5. M.D.Raisinghania, <i>Advanced Differential Equations</i>, S.Chand&amp; Company Ltd. New Delhi 2001.</li> <li>6. B.Rai, D.P.Choudary and H.I. Freedman, <i>A Course in Ordinary Differential Equations</i>, Narosa Publishing House, New Delhi, 2002.</li> </ol>
<p><b>Website and e-Learning Source</b></p>	<p><a href="http://mathforum.org">http://mathforum.org</a>, <a href="http://ocw.mit.edu/ocwweb/Mathematics">http://ocw.mit.edu/ocwweb/Mathematics</a>,  <a href="http://www.opensource.org">http://www.opensource.org</a>, <a href="http://www.mathpages.com">www.mathpages.com</a></p>

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**Course Learning Outcome (for Mapping with POs and PSOs)**

Students will be able to

**CLO1:** Establish the qualitative behavior of solutions of systems of differential equations .

**CLO2:** Recognize the physical phenomena modeled by differential equations and dynamical systems.

**CLO3:** Analyze solutions using appropriate methods and give examples.

**CLO4:** Formulate Green's function for boundary value problems.

**CLO5:** Understand and use various theoretical ideas and results that underlie the mathematics in this course.

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1