UNIVERSITY OF MADRAS

B.Sc. DEGREE PROGRAMME IN MATHEMATICS

SYLLABUS WITH EFFECT FROM 2023-2024

<table>
<tr><td>Title of the Course</td><td colspan="6">DIFFERENTIAL EQUATIONS AND APPLICATIONS</td></tr>
<tr><td>Paper Number</td><td colspan="6">CORE M6</td></tr>
<tr><td>Category Core</td><td colspan="6">Year II | Credits 5 | Course Code 234C3B
Semester III</td></tr>
<tr><td>Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td></td><td>4</td><td colspan="2">1</td><td colspan="2">--</td><td>5</td></tr>
<tr><td>Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td>Objectives of the Course</td><td colspan="6">• Knowledge about the methods of solving Ordinary and Partial Differential Equations.
• The understanding of how Differential Equations can be used as a powerful tool in solving problems in science.</td></tr>
<tr><td>Course Outline</td><td colspan="6">UNIT-I: Ordinary Differential Equations: Variable Separable – Homogeneous Equation – Non-Homogeneous Equation of First Degree in two Variables – Linear Equation – Bernoulli’s Equation – Exact Differential Equations.
Chapter 2: Sections :1 – 6 Hours: 15</td></tr>
<tr><td></td><td colspan="6">UNIT-II: Equation Of First Order But Not Of Higher Degree: Equation Solvable for dy/dx – Equation Solvable for y – Equation Solvable for x – Clairauts’ Form – Linear Equations with Constant Coefficients – Particular Integrals of Algebraic, Exponential, Trigonometric Functions and Their Products.
Chapter 4 : Sections :1, 2.1, 2.2, 3.1,
Chapter 5: Section: 4 Hours: 15</td></tr>
<tr><td></td><td colspan="6">UNIT-III: Simultaneous Linear Differential Equations: Linear Equation of the Second Order – Complete Solution in Terms of a KnownIntegrals – Reduction to Normal Form – Change of the Independent Variable – Method of Variation of Parameters.
Chapter 6: Section: 6, Chapter 8: Sections :1 – 4 Hours: 15</td></tr>
<tr><td></td><td colspan="6">UNIT-IV: Partial Differential Equations: Complete Integral – Singular Integral – General Integral - Formation of PDE by Eliminating Arbitrary Constants and Arbitrary Functions – Lagrange’s Linear Equations – Simple Applications.
Chapter 12: Sections: 1, 2, 3.1, 3.2 and 4 Hours: 15</td></tr>
<tr><td></td><td colspan="6">UNIT-V: Special Methods: Standard Forms – Charpit’s Method –Simple Applications.
Chapter 12 Sections 5.1, 5.2, 5.3, 5.4 and 6 Hours: 15</td></tr>
<tr><td></td><td colspan="6">Total Hours:75</td></tr>
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Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Differential Equations and Its Applications by S. Narayanan and T.K. Manickavachagom Pillay, S. Viswanathan Publishers Pvt. Ltd.2006
	1. Differential Equations, Shepley L. Ross, 3rd Ed., John Wiley andSons, 1984. 2. Elements of Partial Differential Equations, I. Sneddon, McGraw-Hill, International Edition, 1967. 3. Differential equations with applications and historical notes, G.F. Simmons, 2nd Ed, Tata Mcgraw Hill Publications, 1991.
Reference Books	1. Introductory course in Differential Equations, D.A. Murray, Orientand Longman 2. Elementary Treaties on Differential Equations and their applications, H.T. H. Piaggio, C.B.S Publisher & Distributors,Delhi,1985. 3. Calculus and Analysis, Horst R. Beyer, Wiley, 2010. 4. Differential Equations and their Applications, Braun, M. (3rd Edn.), Springer- Verlag, New York. 1983. 5. Linear Partial Differential Equations for Scientists and Engineers Tyn Myint-U and Lognath Debnath. (4th Edn.) Birhauser, Berlin.2007. 6. Elementary Differential Equations and Boundary Value Problems, Boyce, W.E. and R.C. DiPrima. (7th Edn.) John Wiley and Sons, Inc., New York. 2001. 7. Ordinary and Partial Differential Equations, Sundrapandian, V. Tata McGraw Hill Education Pvt. Ltd. New Delhi, 2013
Website and e-Learning Source	https://nptel.ac.in https://www.mathhelp.com/

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Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Determine solutions of homogeneous equations, non-homogeneous equations of degree onein two variables, solve Bernoulli's equations and exact differential equations

CLO 2: Find the solutions of equations of first order but not of higher degree and to determineparticular integrals of algebraic, exponential, trigonometric functions and their products

CLO 3: Find solutions of simultaneous linear differential equations, linear equations of second orderand to find solutions using the method of variations of parameters

CLO 4: Form a PDE by eliminating arbitrary constants and arbitrary functions, find complete,singular and general integrals, to solve Lagrange's equations

CLO 5: Explain standard forms and Solve Differential equations using Charpit's method

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO 1	3	1	3	2	1	-	3	2	1
CLO 2	3	1	3	2	1	-	3	2	1
CLO 3	3	1	3	2	1	-	3	3	1
CLO 4	3	1	3	2	2	1	3	3	1
CLO 5	3	1	3	2	2	1	3	3	1