



# DEPARTMENT OF MATHEMATICS

Semester : III

Integrated M.Sc. Mathematics

Academic Year : 2019 -20

Subject : 060090309 Ordinary Differential Equation

## Teaching Schedule

**Course Objectives:** Identify the essential characteristics of First, Second and higher ordered ordinary differential equations and develop the analytical methods to obtain the closed form solutions of them. Create and analyse mathematical models to explore the use of differential equations in various application problems.

**Course outcomes:** Upon completion of the course, students shall be able to

**CO1:** understand the different form of first order ordinary differential equations

**CO2:** solve the first order ordinary differential equations with appropriate mathematical approach

**CO3:** establish the relation between real situational problems and first order ordinary differential equations.

**CO4:** bifurcate the second order and higher linear homogeneous and non-homogeneous ordinary differential equations.

**CO5:** solve both kind of linear homogeneous and non-homogeneous second and higher order ordinary differential equations with respect to specific source term.

**CO6:** implement the knowledge of second and higher order ordinary differential equations to fix the relevant mathematical model into real phenomena.

Unit	Sub Unit	No. of Lect.(s)	Topics	Reference Chapter/ Additional Reading	Teaching Methodology to be used	Active Learning Activities	Evaluation Parameter
<b>Unit 1: First order and first degree ordinary differential equations</b>							
[20]	1.1	3	Differential equations and mathematical models	CH#2 Differential Equations Rukmangadachari	Chalk & Talk	<b>For Slow Learner:</b> Students must write answer of question(s) given by teacher after completion of each method and verified by teacher to resolve any query of students.	Unit Test -1 Assignment-1
	1.2	3	General, particular, explicit, implicit and singular solutions of a differential equation				
	1.3	5	Exact differential equations and integrating factors				
	1.4	3	Separable equations and equations reducible to this form				





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	1.5	3	Linear equation and Bernoulli equations			<b>For Active Learner:</b> Student will solve exercise given in book after completion of Unit.	
	1.6	3	Special integrating factors and transformations				
<b>Unit 2: Mathematical models using first order and first degree ordinary differential equations</b>							
[13]	2.1	2	Introduction to compartmental model	CH#2 Differential Equations Rukmangadachari	Chalk & Talk	<b>For Slow Learner:</b> Students must write answer of question(s) given by teacher after completion of each method and verified by teacher to resolve any query of students.  <b>For Active Learner:</b> Student will solve exercise given in book after completion of Unit.	Unit Test -1 and 2 Assignment-2
	2.2	2	Exponential decay model				
	2.3	2	Lake pollution model (case study of lake burley griffin)				
	2.4	2	Drug assimilation into the blood (case of a single cold pill, Case of a course of cold pills)				
	2.5	2	Exponential growth of population				
	2.6	2	Limited growth of population				
	2.7	1	Limited growth with harvesting				
<b>Unit 3: Second order and higher order linear ordinary differential equations:</b>							
[20]	3.1	3	General solution of homogeneous equation of second order	CH#3 Differential Equations Rukmangadachari	Chalk & Talk	<b>For Slow Learner:</b> Students must write answer of question(s) given by teacher after completion of each method and verified by teacher to resolve any query of students.  <b>For Active Learner:</b> Student will solve exercise given in book after completion of Unit.	Unit Test -2 Assignment-3
	3.2	3	Principle of super position for homogeneous equation				
	3.3	3	Wronskian: its properties and applications				
	3.4	3	Linear homogeneous and non-homogeneous equations of higher order with constant coefficients				
	3.5	3	Euler's equation				
	3.6	3	Method of undetermined coefficients				





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	3.7	2	Method of variation of parameters				
<b>Unit 4: Mathematical models using second order and higher order linear ordinary differential equations:</b>							
[12]	4.1	3	Equilibrium points, Interpretation of phase plane	CH#17 Thomas' calculus Maurice D. Weir and Joel Hass	Chalk & Talk	<b>For Slow Learner:</b> Students must write answer of question(s) given by teacher after completion of each method and verified by teacher to resolve any query of students. <b>For Active Learner:</b> Student will solve exercise given in book after completion of Unit.	Internal Examination Assignment-4
	4.2	3	Predatory-prey model and its analysis				
	4.3	3	Epidemic model of influenza and its analysis				
	4.4	3	Battle model and its analysis				

### Text books:

1. S.L. Ross, "Differential Equations", John Wiley and Sons, India, 3rd Edition, 2004
2. C.H. Edwards and D.E. Penny, "Differential Equations and Boundary Value problems Computing and Modeling", Pearson Education India, 2005.
3. Maurice D. Weir and Joel hass, "Thomas' calculus", Pearson Education India, 2016.
4. E Rukmangadachari, " Differential Equations" ,Pearson publications, 2012.

### Reference books:

1. Belinda Barnes and Glenn R. Fulford, "Mathematical Modeling with Case Studies,
2. A Differential Equation Approach using Maple and Matlab", Taylor and Francis group, London and New York, 2<sup>nd</sup> Edition. 2009.
3. B.V. Ramana, "Higher Engineering Mathematics", Tata Mcgraw Hill Publications
4. E. Kreyszig, "Advanced engineering mathematics", John Wiley and Sons, India 10<sup>th</sup> Edition ,2010

### Course Objectives and Course Outcomes Mapping:

- Identify the essential characteristics of First, Second and higher ordered ordinary differential equations : CO1, CO4
- Develop the analytical methods to obtain the closed form solutions of First, Second and higher ordered ordinary differential equations : CO2, CO5
- Create and analyse mathematical models to explore the use of differential equations in various application problems: CO3, CO6





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## Course Units and Course Outcomes Mapping:

Unit No.	Unit	Course Outcomes					
		C01	C02	C03	C04	C05	C06
1	First order and first degree ordinary differential equations	✓	✓				
2	Mathematical models using first order and first degree ordinary differential equations	✓	✓	✓			
3	Second order and higher order linear ordinary differential equations				✓	✓	
4	Mathematical models using second order and higher order linear ordinary differential equations				✓	✓	✓

## Programme Outcomes (PO)

### PO1: Knowledge

Provides knowledge about the fundamentals of pure, applied and computing mathematics and its applications to students that creates the opportunities in industries and research centers.

### PO2: Core Competence

Creates competency in science and mathematics to formulate, analyses and solve problem and/or also to pursue advanced study or research.

### PO3: Breadth

Trains students having good knowledge in unearth core of academia and industry by the roots of mathematics.

### PO4: Evaluation

Imparts in students to raise trial and error-based curiosity and problem-solving functionality with research based advanced tutorial for higher level decision makings tools.

## Programme Outcomes and Course Outcomes mapping:

Programme Outcomes	Course Outcomes					
	C01	C02	C03	C04	C05	C06
P01	✓		✓			✓
P02		✓		✓	✓	
P03					✓	✓
P04		✓				✓

