Course Code	Course Title	L	P	U
MAT123T	**Differential Equations I**	**4**	**0**	**4**

Course Objectives:

To put it briefly, the course objective of the course is to take the existing knowledge of calculus and apply it towards the construction and solution of mathematical models in the form of differential equations (i.e. equations with derivatives in them).

Course Outcomes: After the completion of this course, students will be able to

1. Understand all of the concepts relating to the order and linearity of ODEs, analytic and computational solution methods for ODEs, and the real-world applications of ODEs.

2. Apply the concepts, formulas, and understand the problem-solving procedures to thoroughly investigate relevant physical models.

3. Explain the concepts of solution methods, and related ideas at a fundamental level, as well as how and why we use the solution techniques that we use.

4. Determine the solutions of differential equations with given conditions

Mapping of Course Outcome(s):

PO/ CO		Program Outcomes					
		PO1	PO2	PO3	PO4	PO5	PO6
Course Outcome	CO1	S	S			M	S
	CO2	S	S			M	S
	CO3	S	S			M	S
	CO4	S	S			M	S

L-Low, M-Medium, S-Strong

Course contents:

Unit 1 (6 L)

Significance of ordinary differential equation. Geometrical and physical consideration. Formation of differential equation by elimination of arbitrary constant. Meaning of the solution of ordinary differential equation. Concept of linear and non-linear differential equations.

Unit 2 (8 L)

Equations of first order and first degree: Statement of existence theorem. Separable, Homogeneous and Exact equation. Condition of exactness, Integrating factor. Rules of finding integrating factor, (statement of relevant results only).

Unit 3 (9 L)

First order linear equations: Integrating factor (Statement of relevant results only). Equations reducible to first order linear equations (Bernoulli's Equation). Method of variation of parameters.

Unit 4 (4 L)

Equations of first order but not of first degree. Clairaut's equation. Singular solution.

Applications: Geometric applications, ω-trajectories, Orthogonal trajectories.

Unit 5 (18 L)

Higher order linear equations with constant co-efficients : Complementary function, Particular Integral. Method of undetermined co-efficients, Symbolic operator D. Method of variation of parameters. Exact Equation. Euler's homogeneous equation and Reduction to an equation of constant coefficients.

References

[1] An Introductory Course on Ordinary Differential Equation – D. A. Murray.
[2] Differential Equations – S. L. Ross.
[3] Differential Equations – H. T. H. Piaggio.
[4] A Text Book of Ordinary Differential Equations – Kiseleyev, Makarenko & Krasnov.
[5] Differential Equations with Application & Programs – S. Balachanda Rao, H. R. Anuradha.
[6] Text Book of Ordinary Differential Equations (2nd Ed.) – S. G. Deo, V. Lakshmikantham & V. Raghavendra (Tata McGraw Hill).
[7] An Introduction to Differential Equations - Ghosh & Maity.
[8] Differential Equations - Chakraborty & Ghosh.

Lecture-wise plan:

Lecture No.	Learning objective	Topics to be covered	Reference (Ch./Sec./ Page Nos. of Text Book)
1-6	To appreciate the connection between general laws of nature and diff. eqns.	Significance of ordinary differential equation. Geometrical and physical consideration	Ref 7
		Formation of differential equation by elimination of arbitrary constant	Ref 7
		Meaning of the solution of ordinary differential equation	Ref 7
		Concept of linear and non-linear differential equations.	Ref 7
7-14	Equations of first order and first degree	Statement of existence theorem	Ref 2
		Variable separable equation	Ref 7

		Homogeneous and Exact equation	Ref 7
		Condition of exactness	Ref 7
15-23	First order linear equations	Integrating factor.	Ref 7
		Rules of finding integrating factor, (statement of relevant results only)	Ref 7
		Equations reducible to first order linear equations (Bernoulli's Equation)	Ref 7
		Method of variation of parameters.	Ref 7
24	Equations of first order but not of first degree.	Clairaut's equation. Singular solution.	Ref 7
25-27	Applications	Geometric applications, ω-trajectories	Ref 7
		Orthogonal trajectories.	Ref 7
28-42	Higher order linear equations with constant co-efficient	Complementary function,	Ref 7
		Particular Integral. Method of undetermined co-efficient	Ref 7
		Symbolic operator D	Ref 7
		Method of variation of parameters	Ref 7
		Exact Equation	Ref 7
43-45	Higher order linear equations with variable co-efficient	Euler's homogeneous equation	Ref 7

Evaluation Scheme:

Component	Duration	Weightage (%)	Remarks
Internal I	To be decided	25	Closed Book
Mid term	2 hrs.	20	Closed Book
Internal II	To be decided	25	Closed Book
Comprehensive Exam	3 hrs.	30	Closed Book

1. **Attendance Policy:** A Student must normally maintain a minimum of **75% attendance** in the course without which he/she shall be disqualified from appearing in the respective examination.
2. **Make-up Policy:** A student, who misses any component of evaluation for genuine reasons, must immediately approach the instructor with a request for make-up examination stating reasons. **The decision of the instructor in all matters of make-up shall be final.**
3. **Chamber Consultation Hours:** During the Chamber Consultation Hours, the students can consult the respective faculty in his/her chamber without prior appointment.