

**NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES
LAHORE CAMPUS**



Differential Equations -MT 1006 Outline according to OBE
Spring-2023

DEPARTMENT OF SCIENCES & HUMANITIES			
Department	Department of Computer Science	Dept. Code	CS, DS, SE
Course Title	Differential Equations	Course Code	MT1006
Pre-requisite(s)	Calculus & Analytical Geometry	Credit Hrs.	3
Moderator			
Course Instructor(s)			
Note:	It is a tentative schedule of the course. It may vary (if required).		

Course Objective	The objective is to impart training to the students in this important branch of Mathematics. Students are expected to learn, Convergence/Divergence of Series, system of linear equations & Differential Equations arising from different Physical systems. Attempt will be made to introduce the students how to solve Linear systems, Ordinary & Partial Differential Equations using different techniques. Concept of Fourier Series will also be explained for PDE's solution.
-------------------------	--

No.	Assigned Program Learning Outcome (PLO)	Level	Tool
01	An ability to identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural science and engineering sciences.	R	

I = Introduction, R = Reinforcement, E = Evaluation.

A = Assignment, Q = Quiz, M = Midterm, F=Final, LA=Linear Algebra, DE=Differential Equation.

No.	Course Learning Outcome (CLO) Statements	Tools
01	<ul style="list-style-type: none"> Solution of infinite sequences & series using different methods. 	Q1, A1, M1, F
02	<ul style="list-style-type: none"> Introduce the basic concepts, notions, Formulation of the DEs with applications 	A2, Q2

03	• Solution of some basic ODE's like Linear, Exact, Bernouli etc.	A2, Q2, M2
04	• Existence/Independence of solutions of Initial/Boundary value problems for second & higher order ODE's through different techniques.	M2, A3, Q3, F
05	• Solution of PDE's by Fourier series using orthogonal set of functions.	M2, F

Text Book(s)	Title	1. Thomas Calculus (14th Edition) 2. A first course in Differential Equations with modeling applications (9th Edition) 3. Differential Equations with boundary-value problems.
	Authors	G. B. Thomas / Dennis G. Zill (DE)
Ref. Book(s)	Title	Elementary Differential Equations (DE) with applications.
	Author	C. H. Edwards. David, E.

Week	Course Contents	Chapter	CLO
	<u>Infinite Sequences and Series</u>		
01	10.1 Introduction to Sequences 10.2 Infinite series	10	01
02	10.3 The integral test 10.4 Comparison tests	10	01
03	10.5 Absolute convergence; The ratio and root test 10.6 Alternating series and conditional convergence <u>Quiz#1</u>	10	01
04	10.7 Power series 10.8 Taylor and Maclaurin series	10	01
	<u>1st Order Differential Equations:</u>		
05	2.1 Basic concepts, formation and solution of differential equations by direct integration and by separating the variables. Direction Fields. 2.2 Separable variables.	2	02
06	Sessional Exam-I		
07-09	2.3 Linear Equations. 2.4 Exact Equations. <u>Solution by Substitution</u> 2.5 Equations (Homogeneous & Bernoulli's DE) reducible to linear equations & Riccati. 3.1 01 st order ODE's arising from Real life problems. 3.3 01 st order ODE's arising from Real life problems.	02 03	03
10-12	<u>2nd & Higher Order Differential Equations</u> 4.1 Initial and Boundary value problem, Existence of a unique solution. Homogeneous DEs', Linear Dependence and Independence. Wronskian and non-homogeneous Linear Differential Equation.	04	04

	<p>4.2 Reduction of order.</p> <p style="text-align: center;"><u>Quiz#2</u></p> <p>4.3 Homogeneous Linear Equations with Constant Coefficients.</p> <p>4.4 Undetermined coefficients-Superposition approach.</p> <p>4.5 The operator D, Inverse operator $1/D$, Solution of differential equations by operator D methods, Special cases.</p> <p>4.5 Undetermined coefficients-Annihilator approach.</p> <p>4.6 Variation of parameters.</p> <p>4.7 Cauchy Euler equation.</p> <p style="text-align: center;">Sessional Exam -II</p>		
13	<p style="text-align: center;"><u>Orthogonal Functions and Fourier Series</u></p> <p>11.1 Orthogonal Functions</p> <p>11.2 Fourier Series</p> <p>11.3 Fourier Cosine & Sine Series (Periodic functions and expansion of periodic functions in Fourier series and Fourier coefficients)</p> <p style="text-align: center;"><u>Quiz#3</u></p>	12	05
14-15	<p style="text-align: center;"><u>Partial Differential Equations</u></p> <p>12.1 Basic concepts and formation of partial differential equations. Linear homogeneous partial differential equations and relations to ordinary differential equations.</p> <p>12.2 Classical Equations & Boundary Value Problems.</p> <p>12.3 Heat Equation</p> <p>12.4 Wave Equation</p> <p>12.5 Laplace Equation</p>	11	05
	<p style="text-align: center;"><u>Series Solutions of Linear Equations: (If time permits)</u></p> <p>6.2 Solution about ordinary point & Singular points.</p>	6	optional
	FINAL EXAM		

Evaluation Scheme & Marks Distribution: **Relative grading scheme** will be used for final assignment of grades. Marks distribution is given below.

Assessment Tools	Total No.	Weightage
Quizzes	3 (at least)	10%
Assignments	3(at least)	10%
Sessional Exam	2	30%
Final Exam	1	50%

Important links:

<https://www.youtube.com/watch?v=8yEE2YURbAo&list=PLIXfTHzgMRUK56vbQgzCVM9vxjKxc8DCr&index=31>