National University

Of Computer & Emerging Sciences
Karachi

Course Outlines of BS (CS) Degree Program

Course Instructor(s)	Mr.Jamilusmani /Dr.KhusroMian /Mr.Usama/Mr.Mairaj /Ms.Urooj /Ms.Alishba/Ms. Asma/Ms.Javeria	**Semester**	Spring
Batch/Section(s)	2022/	**Year**	2023
Course Title	MT1006 Differential Equations	**Credit Hours**	3
Prerequisite(s)	MT1001- Calculus and Analytical Geometry	**Course TA**	

Text Book	Differential Equations with Boundary-Value Problems-9E / Dennis G. Zill
Ref. Book	Elementary Differential Equations (DE) with applications. / C. H. Edwards. David, E.

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	Tools
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, DE=Differential Equation.

No.	Course Learning Outcome (CLO) Statements	Tools
01	Solution of different type of ODE's using different methods. Like Linear, Exact, Bernoulli etc.	Q1, A1, M1, F
02	Existence/Independence of solutions of Initial/Boundary value problems for second and higher ODE's through different techniques	Q2, A2 ,M2, F
03	solution of PDE's by Fourier series using orthogonal set of functions	Q3,Q4 A3,A4, F

Week	Contents/Topics	Exercises	Questions	Assessment
1	**Introduction to Differential Equations:** Basic concepts, Types of DE, formation of DE (elimination of arbitrary constants), solution of differential equations Initial value problems	1.1 1.2	1-42 1-14,39-44	**CL01** Q1 A1 M1 F
2 3	**First order Differential Equations:** Separable variables, Linear Equations. Exact Equations ,Integrating factors	2.2 2.3 2.4	1-30 1-40 1-38	
4	Solution by Substitution: Homogeneous equations, Bernoulli's DE and reducible to linear equations. Numerical methods (Euler's)	2.5 2.6	1-30 1-10	
5	**Modelling with 1st Order Differential Equations:** (Linear and Nonlinear) Growth and Decay, Newton law of cooling, Series Circuit, Logistic equation.	3.1 3.2	2-5,13-17, 29-34 1-4	
6	**Midterm 1**			
7	**Higher Order Differential Equations:** Initial and Boundary value problem, Existence of a unique solution. Homogeneous DEs', Linear Dependence and Independence. Wronskian and non-homogeneous Linear Differential Equation	4.1	1-36	**CLO2** Q2 A2 M2 F
8 9 10	Reduction of order. Homogeneous Linear Equations with Constant Coefficients. Undetermined Coefficients-Superposition approach Variation of parameters. Cauchy Euler equation. Chain rule and Extrema for function of two variables(**ANTON**)	4.2 4.3 4.4 4.6 4.7 13.5 13.8	1-16 1-40,49-58 1-42 1-32 1-36 1-30 5-20	
11	**Midterm 2**			
12 13	**Fourier Series:** Orthogonal Functions Fourier Series (Fourier coefficients) Fourier Cosine & Sine Series (Periodic functions, Even and odd function ,Half range expansion)	11.1 11.2 11.3	1-12 1-22 1-34	**CLO3** Q3 A3
14 15	**BVP in Rectangular Coordinates:** **Partial Differential Equations:** Basic concepts and formation of partial differential equations. Linear homogeneous partial differential equations, Separable Partial differential equations and classification of PDE's Heat Equation. Wave Equation.	12.1 12.3 12.4	1-25 1-8 1-6	 Q4 A4 F
16	Laplace Equation.	12.5	1-10	

Grading Criteria:

Marks Distribution:

Particulars	**% Marks**
1. Quizzes (at least 3)	10
2. Assignments (at least 3)	10
4. First Mid Exam	15
5. Second Mid Exam	15
6. Final Exam	50
Total:-	**100**

Important Instructions to be followed for this Course

- Be in the classroom on time. Any student who arrives more than 5 min late in the class would be marked LATE. Anybody coming to class more than 15 minutes late will be marked ABSENT.
- Turn off your cell phones or other electronic devices before entering the class.
- Maintain the decorum of the classroom all the time.
- Avoid a conversation with your classmates while a lecture is in progress.
- Use parliamentary language in the classroom as well as in assignments. Refrain from using impolite, vulgar, or abusive language in the classroom and in-class presentations and assignments.
- Submit your assignments on time; no assignment will be accepted after the deadline.
- There would be no re-take of any quiz.

Instructions / Suggestions for satisfactory progress in this course:

- On average, most students find at least three hours outside of class for each class hour necessary for satisfactory learning.
- Chapters should be read, and homework should be attempted before class.
- Do not get behind. You are encouraged to work with other students. Plus, I am always available during office hours to help you.
- The homework assigned is a minimum. You may always work extra hours on your own.
- Use the few minutes you usually have before the start of each class to review the prior meetings' notes and homework. This will save us valuable in-class time to work on new material.
- Develop a learning habit rather than memorizing.
- Work in groups whenever appropriate.
- Apply the learned principles and gained knowledge.
- Be creative in thinking, but stick to the topic assigned for discussions, assignments, and presentations.
- Always bring your textbooks with you in the class.

Note: Students are welcome to get help from the Teacher.

Signature: Jamilusmani Date:18-01-2023