COMSATS University Islamabad Lahore Campus
Department of Mathematics
Defence Road, Off Raiwind Road, Lahore

COURSE HANDBOOK

1	**Course Title**	Differential Equations
2	**Course Code**	MTH-242
3	**Credit Hours**	3(3,0)
4	**Semester**	Fall 2023
5	**Resource Person**	Farrukh Shehzad
6	**Supporting Team Members**	
7	**Contact Hours (Theory)**	3 hours per week
8	**Contact Hours (Lab)**	Not Applicable
9	**Office Hours**	Schdule your pre-appointment
10	**Course Introduction**	

Study of differential equations plays a key role in understanding and solving the real life problems because differential equations express relationships between changing quantities. So this course is essential for students of engineering, physical sciences and computer science. The general objective of this course is to teach students various analytic techniques to compute solutions to various differential equations.

11	**Learning Objectives**

After completing this course, the student will be able to:

- Describe differential equations
- Differentiate between first order and second order differential equations
- Differentiate between homogeneous and non-homogeneous equations
- Describe various types of equations including Legendre and Bessel equations
- Solve differential equations by using different methods

12	**Course Contents**

Mathematical and physical meaning of first order differential equations, Linear differential equations, Second order linear homogeneous differential equations with constant coefficients, , Second order linear non-homogeneous differential equations with constant coefficients, Higher order linear differential equations, System of simultaneous linear differential equations, Series solution of differential equations, Nonlinear systems of differential equations, Partial differential equations, First order partial differential equations, Solution using method of separation of variables, Classification of linear second order partial differential equations, Two dimensional partial differential equations and their solutions.

13	**Lecture/Lab Schedule**	
Weeks	**Topic of Lecture**	**Reading Assignment**
Week 1	• Mathematical and physical meaning of first order differential equations • Separable equations	Chapter 2
Week 2	• Homogeneous equations • Exact equations • Linear differential equations	Chapter 2
Week 3	• Applications of Differential equations Growth and Decay Problems, Mixture Problems, Electric circuits problems, Half life Problems, Carbon Dating.	Chapter 2 & 3
Week 4	• Series circuits, second order and higher order linear homogeneous differential equations with constant coefficients. • Reduction of order	Chapter 3 & 4
Week 5	• Second and higher order non homogeneous linear differential equations with constant coefficients. • Sessional 1 Exam	Chapter 4
Week 6	• Method of Undetermined Coefficients • Variation of parameters	Chapter 4
Week 7	• Legendre and Bessel functions	Chapter 6
Week 8	• Cauchy-Euler differential equations • Series Solution of Differential Equations	Chapter 6
Week 9	• Series solution near an ordinary point • Series solution near a regular singular point	Chapter 6
Week 10	• Series solution near a regular singular point. • Sessional 2 exam.	Chapter 6
Week 11	• Homogeneous linear systems with constant coefficients elimination method. • Fundamental Matrices	Chapter 8
Week 12	• Complex Eigen values and repeated Eigen values	Chapter 8
Week 13	• Partial differential equations and their solutions. • Solution using method of separation of variables.	Chapter 12
Week 14	• Heat Equation, Wave equation and Laplace equation in one dimension	Chapter 12
Week 15	• Modelling Two dimensional Heat, Wave Equations, Laplace Equations,	Chapter 12

	• Revision of selected topics	
Week 16	Terminal Examination	Not Applicable

14 Course Assessment

The assessment of this module shall have following breakdown structure

First Sessional Test	10%
Second Sessional Test	15%
Quizzes/Assignments	25%
Terminal Examination	50%

The minimum pass marks for each course shall be 50%. Students obtaining less than 50% marks in any course shall be deemed to have failed in that course. The correspondence between letter grades, credit points, and percentage marks at CIIT shall be as follows:

Grades	Letter Grade	Credit Points	Percentage Marks
A	(Excellent)	4.0	90and above
A-		3.7	85-89
B+		3.3	80-84
B	(Good)	3.0	75-79
B-		2.7	70-74
C+		2.3	65-69
C	(Average)	2.0	60-64
C-		1.7	55-59
D	(Minimum passing)	1.3	50-54
F	(Failing)	0.0	Less than 50

Note: The marks to be assigned to students shall be in whole numbers and are not same as followed in the annual system of Lancaster University.

15 Assessment Schedule

Week 3	1st Assignment
Week 4	1st Quiz
Week 7	2nd Assignment
Week 8	2nd Quiz
Week 12	3rd Assignment
Week 13	3rd Quiz

16. Format of Assignment

This course indoctrinates the following format for all its assignments:

1. Paper Size: A4
2. Left Margin: 2 Inches
3. Right Margin: 1 Inch
4. Top Margin: 0.5 Inch
5. Bottom Margin: 0.5 Inch
6. Font: Times New Roman
7. Font Size:
    a. Main Heading 14
    b. Sub Heading 12
    c. Text 12
    d. Titles 16
8. Font Color: Black
9. Line Spacing: 1.5
10. Diagrams & Charts: Need not be colored

11. Title page must be designed as guided by resource person in class
12. Number of Pages: No Limit
13. Reference Style: APA (If applicable)

17.	**Text Book**	D. G. Zill, Differential Equations with Modeling Applications, 9th Ed.
18.	**Reference Books**	W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 7th Ed.

19. Plagiarism

Plagiarism involves the unacknowledged use of someone else's work, usually in coursework, and passing it off as if it were one's own. Many students who submit apparently plagiarised work probably do so inadvertently without realising it because of poorly developed study skills, including note taking, referencing and citations; this is poor academic practice rather than malpractice. Some students, particularly those from different cultures and educational systems, find UK academic referencing/acknowledgement systems and conventions awkward, and proof-reading is not always easy for dyslexic students and some visually-impaired students. Study skills education within programmes of study should minimise the number of students submitting poorly referenced work. However, some students plagiarise deliberately, with the intent to deceive. This intentional malpractice is a conscious, pre-mediated form of cheating and is regarded as a particularly serious breach of the core values of academic integrity. **The Dual Degree Prorgamme has zero tolerance for intentional plagiarism.**

Plagiarism can include the following:

1. collusion, where a piece of work prepared by a group is represented as if it were the student's own;
2. commission or use of work by the student which is not his/her own and representing it as if it were, e.g.:
    a. purchase of a paper from a commercial service, including internet sites, whether pre-written or specially prepared for the student concerned
    b. submission of a paper written by another person, either by a fellow student or a person who is not a member of the university;
3. duplication (of one's own work) of the same or almost identical work for more than one module;
4. the act of copying or paraphrasing a paper from a source text, whether in manuscript, printed or electronic form, without appropriate acknowledgement (this includes quoting directly from another source with a reference but without quotation marks);
5. submission of another student's work, whether with or without that student's knowledge or consent;
6. Directly quoting from model solutions/answers made available in previous years;
7. cheating in class tests, e.g.
    a. when a candidate communicates, or attempts to communicate, with a fellow candidate or individual who is neither an invigilator or member of staff
    b. copies, or attempts to copy from a fellow candidate
    c. attempts to introduce or consult during the examination any unauthorised printed or written material, or electronic calculating, information storage device, mobile phones or other communication device
    d. personates or allows himself or herself to be impersonated.
8. Fabrication of results occurs when a student claims to have carried out tests, experiments or observations that have not taken place or presents results not supported by the evidence with the object of obtaining an unfair advantage.

These definitions apply to work in whatever format it is presented, including written work, online submissions, groupwork and oral presentations.

20. Attendance Policy

Every student must attend 80% of the lectures/seminars delivered in this course and 80% of the practical/laboratory work prescribed for the respective courses. The students falling short of required percentage of attendance of lectures/seminars/practical/laboratory work, etc., shall not be allowed to appear in the terminal examination of this course and shall be treated as having failed this course.