Information Technology University
Department of Electrical Engineering

MT232: Differential Equations			
Course Code	MT232	**Semester**	3rd
Credit Hours	3	**Term**	Fall 2017
Instructor	Usama Bin Sikandar	**Pre-reqs**	Calculus and Analytic Geometry
E-mail	usama.sikandar@itu.edu.pk	**Department**	Electrical Engineering
Office	Room#9, 4th floor	**Discipline**	Mathematics
Instructor Office Hours	TBA	**Teaching Assistants**	Mohsin Ali, Amna Maqbool

Course Description:

This course explores how to solve linear first and second order linear differential equations, with a focus on linear dynamical systems modeling and their time evolution. Students will also be introduced to partial differential equations and Fourier methods towards the end of the course.

Course Outcomes/Objectives:

On the completion of the course, the student will be able to demonstrate the following:

- How to solve first order differential equations
- How to solve second order linear differential equations with constant coefficients
- Solve the differential equations and plot the solutions using MATLAB
- Sketch the solution of differential equation using phase plane analysis
- Knowledge of basic Fourier methods for the solutions of partial differential equations

Books:

Text Books:	1. *A first course in Differential Equations with modeling applications* (10th edition) by Dennis G. Zill. 2. *Fundamentals of Differential Equations*, by R. Kent Nagle, Edward B. Saff, and Arthur David Snider
Reference Books:	*Advanced Engineering Methods* (10th edition) by Erwin Kreyszig, Herbert Kreyszig and Edward Norminton.

Weekly Lecture Breakdown :

Week 1:	Introduction, Calculus review	Week 10:	Second order: variable coefficient
Week 2:	Mathematical modeling	Week 11:	Laplace transform
Week 3:	Phase portraits	Week 12:	Linear systems
Week 4:	First order: numerical, separable	Week 13:	Linear systems
Week 5:	First order: linear, Bernoulli	Week 14:	Modeling with PDEs
Week 6:	First order: exact	Week 15:	Heat equation
Week 7:	Second order: homogeneous	Week 16:	Wave equation
Week 8:	Second order: nonhomogeneous	Week 17:	Fourier series
Week 9:	**Mid-term exam**	Week 18:	**Final exam**

Chapter	Topics	Lectures
	Introduction	1
	Calculus Review ▪ Gradient ▪ Stationary points ▪ Graphs ▪ Functions	2
Zill, Ch 1	**Introduction to Differential Equations** ▪ Mathematical modeling ▪ Boundary-value problem ▪ Initial-value problem ▪ Methods of solving ▪ Uniqueness and existence theorem	2
Zill, Ch 2	**First order differential equations** ▪ Phase portraits ▪ Euler's approximation ▪ Separable equations ▪ Linear equations and integrating factor ▪ Bernoulli equation ▪ Exact equations	6
Kreyszig, Ch 2	**Second order linear equations** ▪ Constant-coefficient homogeneous ▪ Constant-coefficient nonhomogeneous ▪ Damping ratio and Quality factor ▪ Undetermined coefficients	4
Mid Term Exam		
	▪ Resonance and beats ▪ Frequency response ▪ Variation of parameters ▪ Cauchy-Euler ▪ Wronskian matrix	3
Zill, Ch 7	**Laplace Transform method** ▪ `Exponential type' functions ▪ Solving first and second order linear differential equations	2
Zill, Ch 8	**Linear Systems (2x2)** ▪ Homogeneous constant-coefficient ▪ Phase portraits ▪ `Complete' eigenvalues and `Defective' matrices ▪ Variation of parameters ▪ Reduction of order	4
Nagle, Ch 10	**Partial differential equations** ▪ Heat equation ▪ Wave equation ▪ Fourier series	6
Final Exam		

Course Assessment Distribution:	
Quizzes:	15 %
Assignments:	10 %
Mid-term Exam:	30 %
Final Exam:	45 %

Grading Policy:	
Quiz Policy:	At the end of each recitation, there will be a graded quiz. The question framed is to test the concepts involved in last two lectures. Grading for quizzes will generally be on a scale of 0 to 10. There will be a total of roughly 15-16 quizzes, 2 of which will be dropped. There will be no make-up quiz whatsoever. So, plan your leaves accordingly.
Assignment Policy:	In order to develop comprehensive understanding of the subject, assignments will be given. Assignments late by one day will be penalized by 20%. After that nothing will be accepted / graded. All assignments will count towards the total (No 'best-of' policy). The students are advised to do the assignment individually. Copying of assignments is highly discouraged and violations will be dealt with severely by referring any occurrences to the disciplinary committee. The problems in the assignment are meant to be challenging to give students confidence and extensive knowledge about the subject matter and enable them to prepare for the exams.
Plagiarism:	ITU maintains a zero-tolerance policy towards plagiarism. While collaboration in this course is highly encouraged, you must ensure that you do not claim other people's work/ ideas as your own. Plagiarism occurs when the words, ideas, assertions, theories, figures, images, programming codes of others are presented as your own work. You must cite and acknowledge all sources of information in your assignments. Failing to comply with the ITU plagiarism policy will lead to strict penalties including a failing grade in the course and referral to the disciplinary committee for a strict action, which may possibly lead to failing grades in all the courses of the semester.