North South University
Department of Mathematics and Physics

MAT350: Engineering Mathematics

Course Name : **Engineering Mathematics**
Course Code : MAT 350
Credit Hours : 3 Credits
Pre-requisite : MAT 250
Semester : **Fall 2018**

Course Short Description:
This course is intended for Engineering students who require a working knowledge of differential equations; included are techniques and applications of ordinary differential equations in engineering problems with some elements of scientific computing.

Instructor :

Department of Mathematics and Physics
North South University

Office :
Email: :
Office Time :

Course Learning Outcomes: Upon successful completion of this course, students will be able to:

(CO-1) Classify the type of a given differential equation and find the appropriate analytical techniques for finding the solutions of the first order and the second order ordinary differential equations.

(CO-2) Formulate and analyze mathematical models using the first order and the second order ordinary differential equations.

(CO-3) Solve linear differential equations using different tools, like the Laplace transform technique, power series method; and identify their applications.

(CO-4) Demonstrate their understanding of how physical phenomena are modeled by system of differential equations and investigate the solution methods.

(CO-5) Develop the ability to apply Fourier series and Fourier Integrals to significant applied problems.

Bloom's Mapping with course learning outcomes:

#	Course Outcomes (CO)	Bloom's taxonomy domain/level (**C**: *Cognitive* **P**: *Psychomotor* **A**: *Affective*)	Delivery methods and activities	Assessment tools
CO-1	Classify the type of a given differential equation and find the appropriate analytical techniques for finding the solutions of the first order and the second order ordinary differential equations.	**C2**	Lecture, Video Discussion	Quiz, Assignment
CO-2	Apply and analyze mathematical models using the first order and the second order ordinary differential equations.	**C3, C4, P2**	Lecture, in-class group discussion, Videos	Concept clarification, Midterm exam, Assignment
CO-3	Solve linear differential equations using different tools, like the Laplace transform technique, power series method; and identify their applications.	**C3,C4, P2**	Lecture, Discussion	Class work, Quiz, Assignment, Final Exam
CO-4	Demonstrate their understanding of how physical phenomena are modeled by system of differential equations and investigate the solution methods.	**C4, P2**	Lecture, Video, Discussion	Concept, Demonstration, Quiz, Assignment, Final Exam
CO-5	Develop the ability to apply Fourier series and Fourier Integrals to significant applied problems.	**C2, C3, P2**	Lecture Video Demonstration	Assignment, Final Exam

Course Content:

1. **First Order Ordinary Differential Equations:**
   Introduction to Ordinary Differential Equations (ODEs), mathematical modeling with ODEs, Separable and Exact ODE, Linear ODE, Bernoulli equation.

2. **Second-Order and Higherorder ODEs:**
   Homogeneous Linear ODEs of Second Order, Homogeneous Linear ODEs with Constant Coefficients, Euler–Cauchy Equations, Existence and Uniqueness of Solutions. Wronskian, Non-homogeneous ODEs, Homogeneous Linear ODEs, Linear independence, Wornskian.Homogeneous Linear ODEs with Constant Coefficients, Nonhomogeneous Linear ODEs.Modeling and Applications
3. **Systems of ODE**
   System of ODEs, Phase plane method, Nonhomogeneous Linear Systems of ODEs.
4. **Series Solutions of ODEs**
   Power series method, Extended Power Series Method, Bessel's Equation.Bessel Functions and general solution.
5. **Laplace Transformation**
   Laplace Transformation and its inverse, linearity and shifting, Laplace transformations of derivatives and integrals, Initial Value Problems, unit step function, delta function and t-shifting.

6. **Fourier Series and Fourier Functions**
   Periodic function and Fourier Series, Fourier coefficients and applications. Even and odd functions, Half range expression, Fourier integrals and transforms.

Course Calendar : Supplement sheet (see last page)

Marks Distribution:

Attendance-	5%
Regular Quizzes (3 quizzes)	15%
Mid-Term-I	20%
Mid-Term-II	20%
Final Exam-	35%
Assignment/Class performance/	5%
Total	**100%**

Text Books: 1. A First Course in Differential Equations with Modeling and Applications, (10th Edition), Author-Dennis G. Zill.
2. Advanced Engineering Mathematics (10th Edition)- Author: Erwin Kreyszig

Grading Policies: As per NSU Grading Policy

Important dates:

First midterm	TBA
Second midterm	TBA
Course Final	TBA

Rules and Restrictions:

(a) Submit the assignments in recommended date. **No late submission will be accepted**. Make a photocopy of your assignment before submission.
(b) There is **no scope to retake a quiz**. In case of Mid-term- or Final exam, exceptional cases*(unfortunate physical inability, accidents, serious illness) may be considered conditionally (with a **penalty of 20% reduced marks**) with proper justification.
(c) A late present means you come to the class within 10 minutes the class starts. You are automatically **absent after 10 minutes delay** and not allowed in the class.
(d) Three consecutive absents need an official clarification.

(e) If you are a **probation student/retake**, I would like to have you in 24 classes (**20 present is Must)**
(f) As per your need add.

********** **Thank You** **********

Lesson Plan

Class	Topics	Learning Activities	Assessment	Learning Outcome
I	**<u>First Order Ordinary Differential Equations:</u>** Introduction to Ordinary Differential Equations (ODEs), mathematical modeling with ODEs,	Lecture	Discussions Mid term-I	CO-1
II	**First Order ODEs- Separable ODEs** Separable ODEs with modeling and applications.	Individual Assignment	Quiz 1	CO-1
III	**First Order ODEs- Exact ODEs** Separable and Exact ODEs with modeling and applications.	Lecture Group Discussion	Discussions Quiz 1 Mid term-I	CO-1
IV	**First Order Linear ODE:** Linear ODE and Bernoulli equations with modeling and applications.	Lecture	Quiz 1 Mid term-I	CO-1
V	**Second-Order Linear ODEs:** Homogeneous Linear ODEs of Second Order: Types and Solution methods.	Lecture	Mid term-I	CO-1
VI	**Second-Order Linear ODEs:** Homogeneous Linear ODEs with Constant Coefficients: Superposition principle and inverse operator method.	Lecture Assignment	Mid term-I	CO-1
VII	**Second-Order Linear ODEs:** Homogeneous Linear ODEs with Constant Coefficients: Shift exponents and variation of parameters method	Lecture	Mid term-I	CO-1
VIII	**Second-Order Linear ODEs: Modelling** Modelling: Mass–Spring System without/with damper	Lecture Assignment	Mid term-I	CO-2
IX	**Second-Order Linear ODEs: Modelling** Modelling: Mass–Spring System without/with damper	Lecture Assignment	Mid term-I	CO-2
X	**Mid Term Exam-I**			
XI	**Non-homogeneous ODEs:** Cauchy Euler Equation and Variation of paremeters	Lecture	Quiz 2 Mid term-II	CO-1
XII	**Systems of ODEs** System of ODEs: Homogeneous system	Lecture assignment	Quiz 2 Mid term – II **Final Exam**	CO-4

XIII	**Systems of ODEs** Nonhomogeneous Linear Systems of ODEs.	Lecture assignment	Mid term – II **Final Exam**	CO-4
XIV	**Laplace Transformation** Laplace Transformation and its inverse.	Lecture assignment	Mid term - II	CO-3
XV	**Laplace Transformation** linearity and shifting, Laplace transformations of derivatives and integrals,	Lecture assignment	Mid term - II	CO-3
XVI	**Laplace Transformation** Initial Value Problems, unit step function, delta function and t-shifting.	Lecture assignment	Mid term - II	CO-3
XVII	**Mid Term II**			
XVIII	**Fourier Series and Fourier Functions** Periodic function and Fourier Series, Fourier coefficients and applications. Even and odd functions.	Lecture assignment	Quiz 3 Final Exam	CO-5
XIX	**Fourier Series and Fourier Functions** Fourier coefficients and applications. Even and odd functions, Half range expression	Lecture assignment	Quiz 3 Final Exam	CO-5
XX	**Fourier Series and Fourier Functions** Fourier integrals and transforms		Quiz 3 Final Exam	CO-5
XXI	**Series Solutions of ODEs** Power series method-about ordinary point	Lecture assignment	Final exam	CO-3
XXII	**Series Solutions of ODEs** Power series method-about singular point	Lecture assignment	Final exam	CO-3
XXIII	**Revision and Discussion Class**	Discussion, Explain, Lecture	Final exam	
XXIV	**Final Exam**			