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
Term   : **Summer 2022**

Instructor	: Dr. Preetom Nag
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	   North South University

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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.
Course Objectives	1. To classify the different types of differential equations and find the appropriate analytical tools and techniques for finding the solutions of the first order and the second order ordinary differential equations. 2. To create and analyze mathematical models using the first order and the second order ordinary differential equations. 3. To demonstrate students' understanding of how physical phenomena are modeled by system of differential equations and investigate the solution methods. 4. To develop the ability to apply Fourier series and Fourier Integrals to significant applied problems.
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

Course Learning Outcomes (continued)	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.

Mapping of Course 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.	**C2, C3, P2**	Lecture, Discussion	Class work, Quiz, Assignment, Midterm Exam, 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

Marks Distribution :

Attendance-	10%
Regular Quizzes (Best 3 from 4)	15%
Mid-Term	30%
Final Exam-	35%
Assignment	10%
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 : Midterm exam TBA
Course Final **Exam** According to NSU Schedule.

Instruction

(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** by any chance. In case of Mid-term- or Final exam, exceptional cases*(unfortunate physical inability, accidents, serious illness) may be considered conditionally (**through an application approved by the Department Chairman**). Please note the retake exam questions are generally a bit tricky and critical compare to the regular exam questions.

(c) A late present means you come to the class within 15 minutes the class starts. You are automatically **absent after 15 minutes delay** and not allowed to the class room.

(d) If you are a **probation student/retake student**, I would like to have you in 24 classes (minimum **20 class present is must**)

Lesson Plan:

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

XI	**Systems of ODEs** System of ODEs: Homogeneous system	Lecture, assignment	Formative-Assessment, Quiz 3	CO-4
XII	**Systems of ODEs** Nonhomogeneous Linear Systems of ODEs.	Lecture, assignment	Quiz 3	CO-4
XIII	**Systems of ODEs** Nonhomogeneous Linear Systems of ODEs.	Lecture, assignment	Formative-Assessment, Quiz 3 Final Exam	CO-4
XIV	**Laplace Transformation** Laplace Transformation and its inverse.	Lecture, assignment	Formative-Assessment,	CO-3
XV	**Laplace Transformation** linearity and shifting, Laplace transformations of derivatives and integrals,	Lecture, assignment	Formative-Assessment	CO-3
XVI	**Laplace Transformation** Initial Value Problems, unit step function, delta function and t-shifting.	Lecture **Assignment-3**	Formative-Assessment	CO-3 CO-2
XVII	**Fourier Series and Fourier Functions** Periodic function and Fourier Series, Fourier coefficients and applications. Even and odd functions.	Lecture, Assignment	Quiz 4 Exam	CO-5
XVIII	**Fourier Series and Fourier Functions** Fourier coefficients and applications. Even and odd functions, Half range expression	Lecture, Assignment	Quiz 4 Final Exam	CO-5
XIX	**Fourier Series and Fourier Functions** Fourier integrals and transforms	Lecture, assignment	Quiz 4 Final Exam	CO-5
XX	**Series Solutions of ODEs** Power series method-about ordinary point	Lecture, Assignment	Quiz 5 Final exam	CO-3
XXI	**Series Solutions of ODEs** Power series method-about singular point	Lecture, Assignment	Quiz 5 Final exam	CO-3
XXII	**Series Solutions of ODEs** Power series method-about singular point	Lecture, **Assignment-3**	Quiz 5 Final exam	CO-3
XXIII	**Preparation for final Exam**	Explaining, Demonstrating	Final exam	
XXIV	**Preparation class for Final Exam**			

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Classroom Rules of Conduct

1. Electronic devices e.g**. cell phone**, **laptop, notepad, iPad, iPod, mp3, etc.** are strictly prohibited in the class.

2. It is imperative that the students maintain absolute discipline in class. Students are also expected to arrive on time for the class, as frequent late attendance will not be accepted.

3. **Academic Integrity Policy:** Department of Mathematics and Physics does not tolerate academic dishonesty by its students. At minimum, students must not be involved in cheating, copyright infringement, submitting the same work in multiple courses, significant collaboration with other individuals outside of sanctioned group activities, and

fabrications.

Students are advised that violations of the Student Integrity Code will be treated seriously, with special attention given to repeated offences.

Please Refer to NSU Student Handbook, Sections: "Disciplinary Actions" and "Procedures and Guidelines".

Exams & Make Up Policy

Five quizzes will be taken (best **Three** will be considered). **NO makeup for quizzes and NO Formative assessment will be taken under any circumstances.** If a student misses the Midterm exam and/or Final exam due to the circumstances beyond their control (official valid documents are required) and informed beforehand (if possible), reasonable arrangement may be considered with a penalty of 20% marks. **The right to reserve all these conditions goes to the instructor**. There will be **no extra question** in the Midterm. One extra question will be allowed in Final exam. Please note the retake exam questions are generally a bit tricky and critical compare to the regular exam questions.

Students will get the opportunity to see/recheck their midterm and Final exam scripts.

Attendance Policy

Students are required and expected to attend all classes regularly and on time and participate in class discussions. No student will be permitted to enter class after 15 minutes the class starts. North South University mandates to fail students who are absent 25% or more from their classes, even if such absences are excusable. It is the responsibility of the student to become aware of other course-related announcements missed during an absence.

Please Refer to NSU Student Handbook, Section: "Study Principles and Policies"

Communication Policy

All communications should take place using the instructor's **email**. Announcements in class will override any statement made here or in any other handouts. It is the student's responsibility to be aware of any announcements made in classes.

Appropriate Use Policy

All members of the North South University community must use electronic communications in a responsible manner. The University may restrict the use of its computers and network systems for electronic communications subject to violations of university policies/codes or local laws or national laws. Also, the university reserves the right to limit access to its networks through university-owned or other computers, and to remove or limit access to

Students Complaints Policy

Students at North South University have the right to pursue complaints related to faculty,

staff, and other students following the rules and instructions stated in the students' handbook. The nature of the complaints may be either academic or non-academic. For more information about the policy and processes related to this policy, you may refer to the students' handbook.

Students with Special Needs

North South University will provide educational opportunities that ensure fair, appropriate and reasonable accommodation to students who have disabilities/special needs that may affect their ability to participate in course activities or meet course requirements. Students with disabilities are encouraged to contact their instructors to ensure that their needs are met. The University through its Special Need section will exert all efforts to accommodate special needs.

Special Needs Section
Telephones: +88-02-**5566 8200 ext-1220**
Location: **Room # 413/A, Admin Building** (4th floor).