



Civil Engineering Department

College of Engineering

Salahaddin University -Erbil

Subject: Engineering Analysis 1

Course Book: Year 3

Lecturer's name: : Sazan Nariman Abdulhamid

Academic Year: 2020-2021

Course Book

1. Course name	Engineering Analysis 1
2. Lecturer in charge	Sazan Nariman
3. Department/ College	Civil/Engineering
4. Contact	e-mail: sazan.abdulhamid@su.edu.krd
5. Time (in hours) per week	Theory : 2 hr Tutorial : 1 hr
6. Office hours	1 hr/ day
7. Course code	CE305
8. Teacher's academic profile	<p>I am a lecturer in the Civil Engineering Department - College of Engineering - Salahaddin University. I received my MSc in Geotechnical Engineering from the University of Duhok in 2007. I am interested in researching on different topics such as Soil improvement with Geosynthetic, Stone columns, and piles.</p> <p>Based on my previous experience and skills gained during my study at Salahaddin University, I was successful in passing all required knowledge to my student and encourage them to undertake more researches to obtain excess scores in addition to their scores in addition to their scores obtained in the session examines.</p> <p>I have been a lecturer in different courses such as Soil Mechanics and Engineering drawing. I am also supervised several Engineering projects such as cantilever retaining wall, reinforced earth retaining wall of undergraduate students; in addition, I teach Engineering Analysis from 2016 till now.</p>
9. Keywords	Ordinary differential equations

10. Course overview:

Engineering analysis is vital tool for practicing engineering professionals in performing their duties, creations, decision making and problem solving.

"Scientists DISCOVER what it was, while

Engineers create "what it was not" in DESIGN to satisfy human needs.

It is distinguishing true engineering design from "tinkering". In this course, students are guided through an example engineering analysis. Then they perform a similar analysis on the design solutions they brainstormed in the previous activity in this unit. At activity conclusion, students should be able to defend one most-promising possible solution to their design challenge.

Engineering analysis is the internal guidance of a project. It can be described as the breaking down of an object, system, problem or issue into its basic elements to get at its essential features and their relationships to each other and to external elements. It is an important part of the engineering design loop that occurs many times during the completion of real-life engineering product or system design. Often, a thorough and varied analysis of a design prior to implementation leads to increased safety and efficiency in using the product.

11. Course objective:

The objective of the course, is to introduce fundamental mathematical concepts and their practical applications primarily to third-year civil engineering students.

The main idea behind this subject is the development of the student's ability to use mathematics with understanding to solve engineering problems. Recognizing the increasing importance of mathematical modelling in engineering practice, many of the worked examples and exercises incorporate mathematical models that are designed both to provide relevance and to reinforce the role of mathematics in various branches of engineering, which are seen as essential if engineers are to tackle the increasingly complex systems that are being called upon to analyse and design. The importance of numerical methods in problem solving is also recognized, and its treatment is integrated with the analytical work and it will be taken into account if the time permits

12. Student's obligation

To ensure that every student derives the maximum benefit from their learning experience, and to further ensure that every student enhances the learning environment for others, the students have an obligation to:

1. Attend lectures. Regular attendance is necessary to maintain pace with lectures and the progress of the class.
2. Submit classroom activities, quizzes, assignments on time as expected.
3. Maintain acceptable levels of academic progress through finding out their level.

13. Forms of teaching

Power points presentation will be used to illustrate the details of the subject, as well as providing the students with complete sets of printed lectures, and using the whiteboard to explain the details of the **Engineering Analysis**

Classroom discussions will be done by a focus on sharing the students in the course of explanation by raising a direct question to a single student or a group of students to simplify the problems. Besides, **quizzes** are required at the end of each subject to let the chance for practicing questions and problems.

14. Assessment scheme:

The method to evaluate the student understanding and reacts are to carry out two main semester exam, quizzes, assignments and class tutorial. So the final grade will be based upon the following criteria:

- ❖ Monthly Exam (30 %)
- ❖ Activities (mostly quizzes, classroom activities, assignments) (10 %)
- ❖ Final Exam (60 %)

15. Student learning outcome:

The main idea behind this subject is the development of the student's ability to use mathematics with understanding to solve engineering problems. Recognizing the increasing importance of mathematical modelling in engineering practice, many of the worked examples and exercises incorporate mathematical models that are designed both to provide relevance and to reinforce the role of mathematics in civil of engineering, which are seen as essential if engineers are to tackle the increasingly complex systems that are being called upon to analyse and design, such as application of (Drainage of tank,.....)

The importance of numerical methods in problem-solving is also recognized, and its treatment is integrated with the analytical work, and it will be taken into account if the time permits.

16. Course Reading List and References:

- **Required textbook:**

Advanced Engineering Mathematics"

by Erwin Kreyszcic, 9th edition, 2006, John Wiley & Sons.

- **Recommended references:**

1. "Advanced Engineering Mathematics" by Peter V. O'Neil, 1st edition, 2007, Thomson.
2. "Advanced Modern Engineering Mathematics" by Glyn James, 3rd edition, 2004, Pearson- Prentice hall.
3. "Mathematical Methods for Engineers and Scientists" by K. T. Tang, 1st edition, 2007, Springer.
4. "Higher Engineering Mathematics" by John Bird, 5th edition, 2006, Elsevier.
5. "Advanced Engineering Mathematics", by C. Ray Wylie and Louis C. Barrett, 1995.
6. "Advanced Engineering Mathematics", by Dennis G. Zill and Michael R. Cullen , 2006
7. "Advanced Engineering Mathematics", by K. A. Stroud and Dexter J. Booth, 2003.
8. "Advanced Engineering Mathematics", 2nd Edition by Michael Greenberg-1998.
9. "Theory and problems of differential Equations", by FRANK AYRESI.
10. "Engineering Mathematics", by John Bird, Fourth Edition, 2003.
11. "Handbook of Mathematics for Scientists and Engineer" by Andrei Polyanin and Alexander V. Manzhirov, 2007.

17. The Topics:

Course Content

Ordinary Differential Equations

In mathematics, an ordinary differential equation (ODE) is a differential equation containing one or more functions of one independent variable and its derivatives. The term ordinary is used in contrast with the term partial differential equation concerning more than one independent variable.

Linear differential equations, which have solutions that can be added and multiplied by coefficients, are well-defined and understood, and exact closed-form solutions are obtained. By contrast, ODEs that lack additive solutions are nonlinear, and solving them is far more intricate, as one can rarely represent them by elementary functions in closed form: Instead, exact and analytic solutions of ODEs are in series or integral form.

Course Program

Week No.	Description
Week 1-2	<ul style="list-style-type: none"> ❖ Course Book and General Introduction on First order ordinary differential equations ❖ Separable differential equations
Week 3	<ul style="list-style-type: none"> ❖ Homogeneous ordinary differential equations
Week 4	<ul style="list-style-type: none"> ❖ Exact ordinary differential equations
Week 5	<ul style="list-style-type: none"> ❖ Linear ordinary differential equations
Week 6	<ul style="list-style-type: none"> ❖ General applications <p>Two quizzes will be done covering first-order differential equations</p>
Week 7	<ul style="list-style-type: none"> ❖ Second Order differential equations - Homogeneous linear ordinary differential equations with constant coefficients
Week 8	<ul style="list-style-type: none"> ❖ Non homogeneous differential equations with undetermined coefficient
Week 9	<ul style="list-style-type: none"> ❖ Non homogeneous differential equations with (method of variation of parameter) and (Euler and Legendre's equations)
Week 10	<ul style="list-style-type: none"> ❖ Applications of second order DEs <p>A quiz will be done covering second order differential equations</p>
Week 11,12	<ul style="list-style-type: none"> ❖ Higher order non-homogeneous ordinary linear differential equations with constant coefficients <p>A quiz will be done covering higher order differential equations</p>

Sample of Exam Sheet

Q1: Solve the following differential equations;

$$1) \frac{dy}{dx} = \frac{xy + 2y - x - 2}{xy - 3y + x - 3}$$

$$2) \left[\frac{2}{\sqrt{1-x^2}} + y \cdot \cos xy \right] dx + [x \cdot \cos xy - y^{-1/3}] dy = 0$$

$$3) y' = 6(y - 2.5) \tanh 1.5x$$

$$4) y'' + y = \sin^2 t$$

$$5) y^{(4)} - y^{(3)} - 3y^{(2)} - 5y' - 2 = 12te^t$$

$$6) (\tan x - \sin x \cdot \sin y) dx + \cos x \cdot \cos y \cdot dy = 0$$

Q2: Write down the form of a particular solution by undetermined coefficient (do not find the constant for the equation);

$$y'' - 4y' + 4y = t^3 + 1 + 2te^{2t} - \sin 2t$$

Q3: Determine the lateral displacement of a hinged-hinged column of length (L) subjected to an axial load (P)

and a uniform lateral distributed load (W) using $\frac{d^2 y}{dx^2} = -\frac{M}{EI}$

Peer review

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