Electrical Department

College of Engineering

University of Salahaddin

Subject: Engineering Analysis

Course Book – For 3rd Year

M. Sc. Basheer Abdulrahman Abdullah

Academic Year: 2022/2023

Course Book

1. Course name	**Engineering Analysis**
2. Lecturer in charge	**Basheer Abdulrahman Abdullah**
3. Department/College	**Electrical/College of Engineering**
4. Contact	**e-mail: basheer.akreyi@su.edu.krd** **Tel: (optional)**
5. Time (in hours) per week	**Theory: 4** **Practical: 0**
6. Office hours	**Sun and Wed 11:30 AM – 1:30 PM**
7. Course code	**0111**
8. Teacher's academic profile	**https://academics.su.edu.krd/basheer.akreyi**
9. Keywords	

10. Course overview:

Engineering analysis relies heavily on basic mathematics such as algebra, geometry, trigonometry, calculus, and statistics, and higher level mathematics such as linear algebra, differential equations, and complex variable, Fourier transform, Laplace transform, and Z-transform. Principles and laws from the physical sciences are key ingredients of engineering analysis.

Engineering analysis requires logical and systematic thinking about the engineering problem. The engineer must first be able to state the problem clearly, logically, and concisely. The engineer must understand the physical behaviour of the system being analysed and know which scientific principles to apply. He or she must recognize which mathematical tools to use and how to implement them by hand or on a computer. The engineer must be able to generate a solution that is consistent with die stated problem and any simplifying assumptions. The engineer must then ascertain that the solution is reasonable and contains no errors.

11. Course objective:

Objectives of this course acquaint students with modern mathematical engineering analysis and application in electrical engineering. Topics include Ordinary Differential Equations, Laplace transforms, the z-transforms, Fourier transforms and Fast Fourier transforms, Partial Differential Equations, and Function of Complex Variables.

The students should be able to model electrical circuits to mathematical models by any of transformation and analysis those mathematical models.

12. Student's obligation

The engineering analysis is semester-based course. Students are obligated to take two term exam and one final exam. Both term exams will be during the semester, and the final exam will be taken at the end of the semester. Beside of that, quizzes may be taken from time to time. The minimum requirement for a passing grade is 50%.

13. Forms of teaching

Computer-generated slide presentations can enhance the effectiveness of classroom lectures. As an instructor, I can emphasize main points and key announcements, and I can enhance my presentation with graphics. My presentations become more organized and flexible, and are easily updated or rearranged. From a student's perspective, class material is far more legible and interesting than hastily-scribbled notes on an overhead or chalkboard.

In this course I have also implemented the Moodle system which is a blended learning platform for schools that aim to simplify creating, distributing and grading assignments in a paperless way. This system will allow teacher and students to communicate online in an efficient way to support the students.

14. Assessment scheme

The grading of the course will be distributed as follow:

- First term exam 15%.
- Second term exam 15%.
- Quizzes and Homework plus student attendance/activities 10%.
- The average of the year will be 40%, and
- Final exam 60%

15. Student learning outcome:

The main outcome for the engineering analysis course is to give students the ability to analysis problems related to engineering. While majority of the course is related to mathematic, it gives the student to think on how to represent engineering related problems in a mathematical model, and use the mathematical tools that he/she will learn in this course such as the ability to compute Fourier series, Fourier transforms, Laplace transforms, and z-transform.

16. Course Reading List and References:

- Advanced Engineering Mathematics (9^{th} Edition) By Kreyszig
- Advanced Modern Engineering Mathematics (3^{rd} Edition) By Glyn James
- Advanced Engineering Mathematics (4^{th} Edition) By Dennis
- Advanced Engineering Mathematics (5^{th} Edition) By Peter
- Advanced Engineering Mathematics (2^{nd} Edition) By Greenberg

17. The Topics:	Lecturer's name
Chapter 1: Fourier Series This chapter will cover the following topics: • Fourier Series • Fourier Series of Even and Odd Functions • Full-Range and Half-Range Expansions • Complex Form of Fourier Series	Basheer Abdulrahman (4 Weeks)

Chapter 2: Fourier Transforms This chapter will cover the following topics: • Some Special Functions • Continuous Fourier transform • Discrete Fourier transform (DFT) • Fast Fourier transform (FFT)	Basheer Abdulrahman (4 Weeks)
Chapter 3: Laplace Transforms • Laplace Transform of basic functions using the definition • Transform of derivatives and integrals • Properties of Laplace Transform • Inverse Laplace Transform • Solution of linear differential equations using Laplace Transform • Circuit Applications	Basheer Abdulrahman (4 Weeks)
Chapter 4: The z-transforms This chapter will cover the following topics: • Definition and Direct Z-Transform • Properties of the Z-Transform • Inverse of the Z-Transform Methods • Rational Z-Transform function representation	Basheer Abdulrahman (3 Weeks)
18. Practical Topics (If there is any)	
None	None

19. Examinations:

Question Example:

Evaluate the Laplace transform of following functions using the definition

1) $f(t) = e^{-at}$

$$F(s) = \mathcal{L}\{f(t)\} = \int_0^{\infty} f(t)e^{-st}dt = \int_0^{\infty} e^{-at}e^{-st}dt$$

$$F(s) = \int_0^{\infty} e^{-(a+s)t}dt = \left[\frac{-e^{-(a+s)t}}{a+s}\right]_{t=0}^{t=\infty}$$

$$F(s) = \left[\frac{-e^{-(a+s)\infty}}{a+s} + \frac{e^{-(a+s)0}}{a+s}\right] = \frac{1}{a+s}$$

$$\mathcal{L}\{e^{-at}\} = \frac{1}{s+a}$$

2) $f(t) = \cos \omega t$

$$\mathcal{L}\{f(t)\} = \int_0^\infty \cos \omega t \, e^{-st} dt = \int_0^\infty \left[\frac{e^{j\omega t} + e^{-j\omega t}}{2}\right] e^{-st} dt$$

$$= \frac{1}{2}\left[\int_0^\infty e^{j\omega t} e^{-st} dt + \int_0^\infty e^{-j\omega t} e^{-st} dt\right]$$

$$= \frac{1}{2}\left[\mathcal{L}\{e^{j\omega t}\} + \mathcal{L}\{e^{-j\omega t}\}\right]$$

$$= \frac{1}{2}\left[\frac{1}{s - j\omega} + \frac{1}{s + j\omega}\right] = \frac{s}{s^2 + \omega^2}$$

$$\mathcal{L}\{\cos \omega t\} = \frac{s}{s^2 + \omega^2}$$

20. Extra notes:

None

21. Peer review **پێداچوونەوەی هاوەڵ**