Eastern Mediterranean University



Faculty of Engineering

Department of Electrical and Electronic Engineering

**EENG 224 - Circuit Theory II**

**Year and Semester : 2, Spring**

**Credit Hour : (4, 1) 4**

#### Engineering Science Credit: 3

#### Engineering Design Credit: 1

**Pre/Co-requisite(s) : EENG 223 Circuit Theory I**

**Academic Term : FALL Semester 2022-2023**

**Catalog Description:**

Sinusoidal sources and phasors. AC steady-state analysis. AC steady-state power. Three-phase circuits. The Laplace Transforms. Circuit analysis in the s-domain. Frequency response. Mutual inductances and transformers. Two-port circuits.

**Prerequisite by Topic:**

The course is a continuation of the previous circuit course EENG223 Circuit Theory I.

**Instructor:**

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| **Asst. Prof. Dr. Alper Doganalp** |
| Office Phone: 630 1600  Office: CT205, School of Computing and Technology (SCT) |
| E-mail: [alper.doganalp@emu.edu.tr](mailto:alper.doganalp@emu.edu.tr) |

**Lab Assistants: TBA**

**Course Web Pages:** <https://staff.emu.edu.tr/alperdoganalp/en/teaching/eeng224>

Or <http://faraday.ee.emu.edu.tr/eeng224>

**Textbook:**

C. K. Alexander, M. N. O. Sadiku, *Fundamentals of* *Electric Circuits* (4th Edition), McGraw-Hill, Inc, 2009

**References:**

1. C. K. Alexander, M. N. O. Sadiku, *Problem Solving Made Almost Easy* McGraw-Hill, Inc, USA, 2003.

2. D. E. Johnson, J. R. Johnson, J. L. Hilburn, *Electric Circuit Analysis* (3rd Edition), Prentice-Hall, USA, 1997.

**Course Objectives:**

The basic objective of this course is to introduce students to the fundamental theory and mathematics for the analysis of Alternating Current (AC) electrical circuits, frequency response and transfer function of circuits. Through the material presented in this course, students will learn:

* the fundamental principles in electric circuit theory and be able to extend these principles into a way of thinking for problem solving in mathematics. science and engineering
* to analyze analog circuits that includes energy storage elements in the time and frequency domains, both theoretically and experimentally
* ways in which electrical engineering shapes and benefits society
* to improve the oral, graphical and written communication skills
* how to learn and work effectively both individually and in groups
* to evaluate the personal learning process and understanding of the concepts and skills from class.

**COURSE OUTLINE AND ORGANIZATION**

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| **Week No.** | **Hours** | **Description** |
| 1-2 | 8 | **1) Sinusoids and Phasors:**  Sinusoidal sources and the sinusoidal response. Complex excitations and the phasor concept. Use of the impedance and admittance concepts to solve the sinusoidal responses. Kirchoff’s Laws in the frequency domain and impedance combinations **(Chp. 9)**. |
| 3-4 | 8 | **2) Sinusoidal Steady-State Analysis:**  Nodal and mesh analysis for phasor circuits. Sinusoidal steady-state analysis using other techniques such as Superposition, Source Transformation and Thevenin, Norton equivalent circuits **(Chp. 10)**. |
| 5-6 | 8 | **3) AC Power Analysis:**  Instantaneous and average power concepts and the effective or the RMS value. Maximum Power Transfer for impedance circuits. Complex, active, reactive power and power factor concepts for phasor circuits, power factor correction **(Chp. 11)**. |
| 7-10 | 6 | **4) Three-Phase Circuits:**  Balanced three-phase voltages. Three-phase connection types such as balanced Y-Y, Y-Δ and Δ-Δ connections. Power in the balanced circuits. Unbalanced three-phase systems  **(Chp. 12)**. |
| 8-9 |  | Midterm Exam Week |
| 10--11 | 6 | **5) Magnetically Coupled Circuits:**  Mutual inductance and energy in a coupled circuit. Analysis of linear transformer circuits. The ideal transformer, reflected impedance and equivalent reflected transformer circuits, autotransformer circuits **(Chp. 13)**. |
| 12-13 | 8 | **6) Frequency Response:**  Transfer function, decibel scale, Bode plots of magnitude and phase of the transfer function. The series and parallel resonance circuits. Frequency response of filters, passive and active filter circuits. Filter design using magnitude and frequency scaling **(Chp. 14)**. |
| 14 | 4 | **7) The Laplace Transform and Circuit Analysis in the s-Domain:** The Laplace transform, inverse Laplace transform and transform properties. Application of the Laplace transform to electric circuits and the transfer function **(Chp. 15)**. |
| 15-16 |  | FINAL EXAMS |

**Laboratory Work:** Laboratory sessions are organized in parallel to theoretical study. Students perform different experiments each week and submit reports for evaluation.

# **GRADING POLICY**

Homework and/or quizzes 15%

Laboratory 15%

Midterm Exam 30%

Final Examination 40%

Laboratory performance: A passing mark is required for receiving a letter grade of D or above.

NG Grade: Failure to qualify for assessment for more than 50% of the total mark through not sitting exams, not attending labs, or not submitting assignments, may result in a letter grade of NG.

**MAKE-UP POLICE**

The make-up exam for the midterm or for the final is administrated by the department.

**ACADEMIC HONESTY - PLAGIARISM**

Cheating is copying from others or providing information, written or oral, to others. Plagiarism is copying without acknowledgement from others’ work. According to university by-laws cheating and plagiarism are serious offences punishable with disciplinary action ranging from simple failure from the exam or project, to more serious action (letter of official warning suspension from the university for up to one semester). Disciplinary action is written in student records and may appear in student transcripts.