

Ministry of Higher Education and Scientific Research

Supervision and Scientific Evaluation Department

Quality Assurance and Academic Accreditation Office

Electric Circuits - Course Description

The template provides a summary of the main course features and expected student learning outcomes.

1. Educational Institution	Shatt Al-Arab University
2. Department / Center	Department of Laser and Optoelectronics Engineering
3. Course Title /Code	Electric Circuit
4. Lecturer Name	Murtadha Muayad Naeem
5. Type of Teaching	Attendance
6. Academic Year /Term	Term
7. Total No. of Teaching Hours	175
8. Date of Preparing this Course Description	29/7/2025

1. Course Objectives

This comprehensive course provides a basic understanding of the principles of Electric Circuits.

The main objectives of this course are:

- To develop problem-solving skills and understanding of circuit theory through the application of techniques.

- To understand voltage, current, and power from a given circuit.

This course deals with the basic concept of electrical circuits.

- This is the basic subject for all electrical and electronic circuits.

- To understand Kirchhoff's current and voltage Laws problems.

- To perform mesh and Nodal analysis.

2. Course Output, Methodology, and Evaluation

(A) Cognitive Objectives

- Recognize how electricity works in electrical circuits.
- List the various terms associated with electrical circuits.
- Summarize what is meant by a basic electric circuit.
- Discuss the reaction and involvement of atoms in electric circuits.
- Describe electrical power, charge, and current.
- Define Ohm's law.
- Identify the basic circuit elements and their applications.
- Discuss the operations of sinusoids and phasors in an electric circuit.
- Discuss the various properties of resistors, capacitors, and inductors.
- Explain the two Kirchhoff's laws used in circuit analysis.
- Identify the capacitor and inductor phasor relationship with respect to voltage and current.

(B) Skill Objectives Related to the Program:

- **The skill objectives for Electric Circuits include** applying fundamental laws and analysis techniques to DC and AC circuits, including RL, RC, and RLC configurations. Students will analyze circuit behavior in both the time and frequency domains using phasors, complex impedance, and network reduction methods. They will also design and evaluate diode-based circuits for rectification, voltage regulation, and signal conditioning. Finally, students will determine equivalent circuits, assess power transfer efficiency, and interface circuits effectively with sensors and actuators.

(C) Methods of Teaching and Learning

- Delivering Pre-Prepared Lectures.
- Assigning Homework.
- Facilitating Group Discussions.

(D) Methods of Evaluation

- **Oral Tests:** Assessing students' understanding through verbal responses.
- **Monthly Tests:** Evaluating students' knowledge and progress on a monthly basis.
- **Daily Quizzes:** Regular quizzes to gauge students' grasp of material covered each day.
- **Regular Attendance:** Monitoring and evaluating students' consistent participation in classes.

(E) Sentimental and Value Objectives

- **Ethical Understanding:** Promoting respect, integrity, and social responsibility.
- **Attitudes and Values:** Fostering positive attitudes towards learning, collaboration, and ethical behavior.

(F) General and Qualitative Skills (other skills related to the ability of employment and personal development)

- Develop students' leadership skills.
- Improve students' proficiency in presenting technical information, writing reports, and explaining results.
- Develop students' technical skills through their participation in practical experiments related to laser principles.
- Encourage students to adapt to new technologies and methodologies related to laser principles.

3. Course Structure

Week	No of Hours	Required Learning Output	Title of Subject	Teaching Method	Evaluation
1		Introduction - Difference between Circuit Theory and Field Theory	Introduction	Lectures and discussions	Oral tests and questions
2		DC circuits – Current and voltage definitions, Passive sign convention and circuit elements, Combining resistive elements in series and parallel. Kirchhoff's laws and Ohm's law. Anatomy of a circuit, Network reduction, Introduction to mesh and nodal analysis	<u>Circuit Theory</u> DC circuits	Lectures and discussions	Oral tests and questions
3		AC circuits I – Time dependent signals, average and RMS values. Capacitance and inductance, energy	<u>Circuit Theory</u> AC circuits I	Lectures and discussions	Oral tests and questions

		storage elements, simple AC steady-state sinusoidal analysis.			
٤		AC Circuits II - Phasor diagrams, definition of complex impedance, AC circuit analysis with complex numbers.	<u>Circuit Theory</u> AC circuits II	Lectures and discussions	Oral tests and questions
٥		RL, RC and RLC circuits - Frequency response of RLC circuits, simple filter and band-pass circuits, resonance and Q-factor, use of Bode plots, use of differential equations and their solutions. Time response (natural and step responses). Introduction to second order circuits.	RL, RC and RLC circuits	Lectures and discussions	Oral tests and questions
٦		Resistive networks, voltage and current sources, Thevenin and Norton equivalent circuits, current and voltage division, input resistance, output resistance, coupling and decoupling capacitors, maximum power transfer, RMS and power dissipation, current limiting and over voltage protection	<u>Analogue Electronics</u> Fundamentals	Lectures and discussions	Oral tests and questions
٧		Revision problem classes		Lectures and discussions	Oral tests and questions
٨		Components and active devices – Components vs elements and circuit modeling, real and ideal elements. Introduction to sensors and actuators, self-generating vs modulating type	<u>Analogue Electronics</u> Components and active devices	Lectures and discussions	Oral tests and questions

		sensors, simple circuit interfacing			
9		Diodes and Diode circuits – Diode characteristics and equations, ideal vs real. Signal conditioning, clamping and clipping, rectification and peak detection, photodiodes, LEDs, Zener diodes, voltage stabilization, voltage reference, power supplies.	Analogue Electronics Diodes and Diode circuits	Lectures and discussions	Oral tests and questions

4. Lab Structure

Week	No of Hours	Materials Covered
1		Lab 1: Introduction to Agilent VEE and PSPICE
2		Lab 2: Thévenin's / Norton's Theorem and Kirchhoff's Laws
3		Lab 3: First-Order Transient Responses
4		Lab 4: Second-Order Transient Responses
5		Lab 5: Frequency Response of RC Circuits
6		Lab 6: Frequency Response of RLC Circuits
7		Lab 7: Filters

5. Learning and Teaching Resources

Textbooks	1. Fundamentals of Electric Circuits, C.K. Alexander and M.N.O Sadiku, McGraw-Hill Education 2. DC Electrical Circuit Analysis: A Practical Approach Copyright Year: 2020, dissidents
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6. Course Improvement Plan

Updating and expanding the curriculum content to include modern developments and applications related to laser principles.
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