

Electrical Engineering Department

Diploma of Electrical and Electronics Engineering

Curriculum Document

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Curriculum Approved by:

ACK College Curriculum Committee

Foreword

In this document, a curriculum for Diploma of Electrical and Electronics Engineering is explained. This diploma is designed to be offered by the Electrical Engineering Department of the School of Engineering at the Australian College of Kuwait – ACK.

The diploma program is a (60) Credit Hour (CH) program distributed among (4) academic semesters, (15) CH each. All units offered by this program are mandatory.

PROGRAM STUDENTS LEARNING OUTCOMES

GENERAL ENGINEERING LEARNING OUTCOMES

For the Engineering Diplomas, graduates will have the ability to:

- a. **Apply** science and engineering fundamentals and industry-standard hardware and software tools to solving problems.
- b. **Prepare** and **conduct** tests in the practice area, and **analyze** and **interpret** data.
- c. **Perform** tasks and procedures in a support role.
- d. **Read** and **produce** engineering drawings.
- e. **Understand** and **apply** relevant standards and codes of practice.
- f. **Identify** and **apply** engineering design principles of a standardized nature.
- g. **Appreciate** and **apply** the principles of health and safety in the workplace.
- h. **Recognize** the impact of engineering practice in global, economic, environmental and societal contexts.

TECHNICAL LEARNING OUTCOMES FOR ELECTRICAL AND ELECTRONICS ENGINEERING

1. **Troubleshoot** and **repair** faults in electronic, communications and power devices and systems.
2. **Apply** industry-standard instrumentation and measurement techniques.
3. **Define** and **classify** software solutions and programs for micro-processor-based systems.
4. **Explain** and **demonstrate** the fundamentals of radio frequency transmitter and receiver technologies and telephone and mobile systems.
5. **Implement** analog and digital electronic circuits.
6. **Apply** fundamentals of power systems analysis to generators, transmission lines and transformers.
7. **Apply** the fundamentals of electrical engineering and mechatronics to electrical engineering designs.
8. **Recognize** the concepts of feedback control systems and utilize them to *apply* automatic control, and component and stability analysis.
9. **Use** laboratory measuring equipment.

Units Distribution

The diploma of Electrical and Electronics Engineering includes (20) units, each equivalent to (3) Credit Hours (CH), distributed among four academic semesters as follows:

First Semester					
Unit Code	Unit name	Pre-requisite	Credits	Delivery	
				Lect.	Lab.
15FFSP110	English for Engineering	NA	3	3	0
15FMAT116	Engineering Mathematics I	NA	3	3	0
15FMAT112	Engineering Physics	NA	3	3	2
15FELE110	Electrical Engineering Technology: Ethics & Practices	NA	3	3	0
15FELE111	Electrical Circuit Analysis I	NA	3	3	2

Second Semester					
15FMAT127	Engineering Mathematics II	15FMAT116	3	3	0
15FELE120	Electrical Circuit Analysis II	15FELE111	3	3	2
15FELE121	Electromagnetism Fundamentals	15FMAT112	3	3	2
15FELE122	Instrumentation & Measurement	15FELE111	3	3	2
15FELE123	Introduction to Computer Programming	15FELE110	3	3	2

Third Semester					
15FELE210	Semiconductor Devices & Circuits	15FELE120	3	3	2
15FELE211	Electric Machines	15FELE121	3	3	2
15FELE212	Digital Logic	15FELE123	3	3	2
15FELE213	Communication Engineering I	15FMAT116 15FELE121	3	3	2
15FELE214	Power Systems	15FELE120	3	3	2

Fourth Semester					
15FELE220	Communication Engineering II	15FELE213	3	3	2
15FELE221	Principles of Mechatronics	15FELE211 15FELE212	3	3	2
15FELE222	Analog Electronics	15FELE210	3	3	2
15FELE223	Fundamentals of Control Systems	15FELE211	3	3	2
15FELE224	Engineering Project (PBL)	15FELE122 15FELE214	3	0	3

Units Description

15FFSP110 – English for Engineering [3CH, 3 Lec, 0 Lab]

English for Engineering is a one semester unit designed to meet the needs of students in the Engineering Department to research and write extensively. It aims to equip students with the necessary skills and strategies to research and source reliable academic and engineering articles and read these sources to effectively identify and synthesize relevant information and incorporate these ideas in a review report. Within the review report, students will be expected to critically analyze the pertinent issues appropriate to their chosen topic and support their research question while adhering to the academic requirements of text structure, format and referencing.

Prerequisite: None

15FMAT116 – Engineering Mathematics I [3CH, 3 Lec, 0 Lab]

This unit includes essential training in indices, standard form and engineering notations, algebra, solving simultaneous equations, solving quadratic equations, inequalities, logarithms, exponential functions, areas of common shapes, circles, volumes and surface areas of common solids, irregular areas and volumes and mean values of waveforms, introduction to trigonometry, trigonometric waveform, trigonometric identities and equations, complex numbers.

Prerequisite: None

15FMAT112 – Engineering Physics [3CH, 3 Lec, 2 Lab]

This unit discusses the fundamental interdisciplinary nature of science relating to forces, matter, electricity and magnetism. It provides the students with the required skills to integrate smoothly in the diploma of electrical engineering program. Topics to be covered in this unit are physical units and dimensions, vectors, unit conversions, motion, forces, momentum, work, energy, power, basics of magnetism, electric currents and voltages, waves and oscillations.

Prerequisite: None

15FELE110 – Electrical Engineering Technology: Ethics & Practices [3CH, 3 Lec, 0 Lab]

In this unit, students explore the role of engineers in ethically developing and maintaining sustainable socio-technical systems. They holistically investigate environmental, social, cultural and global impacts arising from use of renewable and non-renewable energy and resources. Students review electrical engineering projects to assess their sustainability and also review professional capabilities expected of engineering associates. They evaluate personal strengths and weaknesses and develop personal improvement plans. This unit also describes the performance outcomes, skills and knowledge required to

manage own performance and professional development. Particular emphasis is on setting and meeting priorities, analyzing information and using a range of strategies to develop further competence. The unit covers accessing, inputting and storing information used in manufacturing, engineering or related environments, using computing technology.

Prerequisite: None

15FELE111 – Electrical Circuit Analysis I [3CH, 3 Lec, 2 Lab]

This unit covers the fundamentals of simple DC electrical circuits as well as the technical skills to analyze, design and implement such simple circuits. It is packaged in such a way that students, having taken this unit, can build and analyze some practical, useful devices afterwards. Topics to be covered in this unit are electrical components, voltage and current sources, batteries and DC power generators, source transformation, series/parallel circuits, DC circuit analysis (Ohm's Law, Kirchhoff's Laws, etc.).

Prerequisite: None

15FMAT127 – Engineering Mathematics II [3CH, 3 Lec, 0 Lab]

This unit includes essential training in functions and their curves, introduction to differentiation, methods of differentiations, some application of differentiation, logarithmic differentiation, standard integration, integration using algebraic substitutions, area under and between the curves, volumes of solids revolution, vectors and the theory of matrices and determinants.

Prerequisite: 15FMAT116

15FELE120 – Electrical Circuit Analysis II [3CH, 3 Lec, 2 Lab]

This unit covers the fundamentals of simple AC electrical circuits as well as the technical skills to analyze, design and implement such simple circuits. It also introduces the students to the fundamental techniques used to solve complex electrical circuits. Topics to be covered in this unit are AC power generators, impedances, admittances, phasors, AC circuit analysis (Ohm's Law, Kirchhoff's Laws, etc.), AC power, superposition theorem, mesh and nodal analysis, Thevenin and Norton theorems.

Prerequisite: 15FELE111

15FELE121 – Electromagnetism Fundamentals [3CH, 3 Lec, 2 Lab]

This unit covers the basic fundamentals of Electrostatics, Magnetostatics and Electromagnetics and how those apply to communication and power systems. It also covers the basic concepts of wave propagation and the basic antenna designs. Topics to be covered in this unit are electric and magnetic fields, electric charges, electric and magnetic forces, Coulomb's Law, electromagnetic induction, Faraday's law, electromotive force, electromagnetic waves, free space propagation, wave guides basic concepts, basic antenna concepts (gain, power efficiency, dipoles, printed antennas, etc.).

Prerequisite: 15FMAT112

15FELE122 – Instrumentation & Measurement [3CH, 3 Lec, 2 Lab]

This unit covers industrial instrumentation as used for troubleshooting, process measurements and process control. The unit will discuss an overview of instrumentation principles, measurement terminology, differentiating between analog and digital, describe the instrumentation used for electronic testing. This unit covers the principles of operation of transducers used for industrial process measurement and control. The student explores technologies associated with data acquisition and analysis, and the measurement of physical parameters and their translation to electrical quantities including several common instrument transducers. The electronic signal-conditioning circuits required to convert the electrical changes in the transducers to signal which can be interpreted accurately by a microprocessor or embedded controller, are analyzed and designed.

Prerequisite: 15FELE111

15FELE123 – Introduction to Computer Programming [3CH, 3 Lec, 2 Lab]

This unit is for students with little or no programming experience. It provides students with an understanding of the role computation can play in solving basic problems. Basic concepts of computer programming are introduced starting with the notion of an algorithm. Emphasis is on developing the ability to write programs to solve practical computational problems. Topics covered in this unit are notions of low level and high level programming languages, algorithms, variables, structures, arrays, strings, files, input/output, pre-defined functions, user-defined functions. The unit will be based on C++ programming language.

Prerequisite: 15FELE110

15FELE210 – Semiconductor Devices and Circuits [3CH, 3 Lec, 2 Lab]

This unit covers the characteristics and applications of semiconductor devices and circuits including basic electrical components, and various diodes and transistors. Emphasis is placed on analysis, selection, biasing, and applications. Upon completion, students should be able to construct, analyze, verify, and troubleshoot analog circuits using appropriate techniques and test equipment. Topics to be covered in this unit are solid physics, semiconductors, characteristics and biasing of diodes and transistors, design and analysis of circuits using diodes, bipolar transistors, and field effect transistors, application of transistors as amplifiers and switches.

Prerequisite: 15FELE120

15FELE211 – Electric Machines [3CH, 3 Lec, 2 Lab]

This unit covers the design and operation principles of DC and AC machines, including single phase and 3-phase motors, generators and transformers. It also covers the applications of electric machines in typical industrial environment in terms of voltage, current, power ratings, torque and efficiency calculations.

Prerequisite: 15FELE121

15FELE212 – Digital Logic [3CH, 3 Lec, 2 Lab]

This unit covers the fundamentals and principles of digital logic. Topics covered in this unit are numbering systems, logic gates, combinational and sequential circuits, computer models (Von Newman and others), Boolean algebra, K-map, memory organization.

Prerequisite: 15FELE123

15FELE213 – Communication Engineering I [3CH, 3 Lec, 2 Lab]

This unit covers the basic fundamentals of Communication Systems. It introduces the students to the basic concepts of analog and digital communication systems. Topics to be covered in this unit are signal representation in time and frequency domains, frequency spectrum, bandwidth concepts, bandwidth limitations, communication systems classification, analogue modulation/demodulation techniques, digital modulation/demodulation techniques, concept of noise, noise elimination techniques.

Prerequisites: 15FMAT116 & 15FELE121

15FELE214 – Power Systems [3CH, 3 Lec, 2 Lab]

This unit presents the fundamentals of engineering techniques of power system analysis used in the power industry. Topics to be covered in this unit include: basic concepts of power systems, transformers, synchronous generators, transmission lines, admittance and impedance model of the electric power network, basic concepts of power system protection, and introduction to power system stability.

Prerequisite: 15FELE120

15FELE220 – Communication Engineering II [3CH, 3 Lec, 2 Lab]

This unit covers elaborated concepts of telephone and mobile communication systems. It provides the students with an understanding of common communication systems components as well as the differences between different mobile generations. Topics to be covered in this unit are Mobile Communication Evolution (PSTN, GSM, EDGE, 3G, 4G), propagation of mobile radio signals, and interference.

Prerequisite: 15FELE213

15FELE221 – Principles of Mechatronics [3CH, 3 Lec, 2 Lab]

Mechatronics is a multidisciplinary field of study concerned with the design, selection, analysis, and control of systems that combine mechanical elements with electronics components, including computers and or/microcontrollers. The unit focuses on essential topics in mechatronics including electronics, microcontrollers, data acquisition and interfacing, control software, sensors and actuators, and feedback control.

Prerequisites: 15FELE211 & 15FELE212

15FELE222 – Analog Electronics [3CH, 3 Lec, 2 Lab]

This unit covers a detailed analysis of BJT and FET biasing circuits and their stability considerations. This includes analysis of single and multistage amplifiers, amplifiers with different types of feedbacks, power amplifiers, tuned amplifiers and oscillators, linear integrated circuits, differential amplifiers and current mirrors, Operational Amplifiers design and circuits, active filters.

Prerequisite: 15FELE210

15FELE223 – Fundamentals of Control Systems [3CH, 3 Lec, 2 Lab]

This unit provides students with a basic coverage of feedback control systems. The topics cover the basic concepts of automatic control, the components of control systems, simple analytical tools, and stability analysis of systems. Students are also introduced to the use of Matlab/Simulink as a computer tool in control systems analysis.

Prerequisite: 15FELE211

15FELE224 – Engineering Project (PBL) [3CH, 0 Lec, 3 Lab]

This unit consists of a project which is done as a Project Based Learning (PBL) under the supervision of one (or more) academic staff. This project is to let the students show-case all of the skills they have learnt and are learning during their diploma program. In particular, the students will design, implement and evaluate a solution to an electrical engineering problem. The students will also present their solution through a final report, an oral presentation and a prototype demonstration.

Prerequisites: 15FELE122 & 15FELE214

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