Course Syllabus — Electrical Engineering Technology I - DC (AES1041)

Credit Hours: 2 Credit hours

Prerequisites: Mathematics Skills II (AES1012)

Co-requisites: Electrical Engineering Technology I Laboratory (AES1042)

QFE Level: 5

Knowledge: Comprehensive, specialized knowledge within a broad field of work or discipline, including an understanding of the underlying theoretical and abstract concepts with significant depth in some areas. A broad understanding of allied knowledge and theories in related fields of work or disciplines including related regulations, standards, codes, conventions and procedures. An understanding of information assembly, retrieval methods and logical problem-solving techniques from a range of sources. Recognition of sources of current knowledge and the integration of concepts from related fields. Literacy to comprehend and/or produce coherent texts covering complex relations from an array of information and contexts. Numeracy covering an array of mathematical procedures and representations and contexts.

Skills: Technical, creative and conceptual skills appropriate to solving a wide-range of problems associated with a field of work or discipline that include a comprehensive range of specialist cognitive and practical skills appropriate to diagnosing and implementing solutions to abstract, familiar and nonroutine problems within a field of work or discipline. Use of appropriate information retrieval methods and tools and techniques associated with the field of work or discipline. Comprehensive communication and information technology skills to present, explain and/or critique complex matters. Literacy skills to comprehend and/or produce, from array of information, coherent texts covering complex relations. Numeracy skills to select, apply, reflect and communicate an array of mathematical procedures and representations and contexts

Competence:

Autonomy and responsibility: Can take responsibility for coordinating the implementation of appropriate approaches to complex work procedures and processes, resources or learning, including leading teams within a technical or paraprofessional activity. Can exercise coordination and/or supervision in routine, familiar and some nonroutine work or learning contexts. Can coordinate technical, design processes in routine, familiar, nonroutine and an array of contexts with support available, if required. Can express an internalized, personal world view, in the context of an understanding of socio-cultural relationships.

Role in context: Can function with autonomy in technical and coordination contexts and support paraprofessional roles under guidance can function both independently and in a coordination role with multiple groups. Can take responsibility for coordinating the development of individuals and groups. Can review and develop the performance of self and others.

Self-development: Can evaluate own learning and identify learning needs in a familiar environment. Can take responsibility for and plan own learning within a managed and nonroutine environment. Can comprehend and observe ethical standards.

Course Description

This course covers basic electrical concepts and theory relating to DC circuit analysis including Ohm's law, Kirchhoff laws, resistive networks, equivalent circuits, capacitance and inductance. It also covers the DC motors, DC generators and batteries.

Instructors: TBD, TBD@adpoly.ac.ae

Schedule and Duration: 15 weeks plus examination week; lecture: 2 hours/week; tutorial: 1 hour/week; (2 Credit Hours)

Course Objectives

The overall course objective is to develop student basic knowledge in (i) basic dc theory and circuit analysis; (ii) voltage production methods; (iii) inductance and capacitance; and (iv) dc equipment.

Textbook

1. ACAD Basic Curriculum, Electrical Science, Chapters 1 to 7, General Physics Corporation, Elkridge, Maryland, 2003.
2. Edward Hughes, Electrical and Electronic Technology, revised by John Hiley, Keith Brown, and Ian McKenzie Smith. – 10th ed. (for reference purposes only)

Attendance

Sessions start on the hour. Students arriving after the session starts will be counted absent. Students will receive warnings and potential penalties from the Student Services Office or their sponsor if they reach 5%, 10%, and 15% absence. After 15% absence, students will receive a FA (fail due to absence) grade.

Academic Honesty Policy

Students must conduct their studies at AD Poly honestly, ethically, and in accordance with accepted standards of academic conduct. Any form of academic conduct which is contrary to these standards is academic misconduct, for which AD Poly may penalize the student.

Specifically, it is academic misconduct for a student to:

- Present copied, falsified, or improperly obtained data as if it were the result of laboratory work, field trips, or other investigatory work;
- Include in the student's individual work material which is the result of significant assistance from another person if that assistance was unacceptable according to the instructions or guidelines for that work;
- Cheat or attempt to cheat; or
- Plagiarize (knowingly presenting the work or property of another person as if it were one's own)

Abu Dhabi Polytechnic considers cheating or attempting to cheat a serious offense that will result in disciplinary action taken against involved individuals. Students caught cheating or attempting to cheat will earn an “F” grade in the course.

Course Learning Outcomes (CLOs)

Upon successful completion of the course a student should be able to:

CLO 1: Demonstrate an understanding of basic electricity theory and the basics of electric fields

CLO 2: Demonstrate an understanding of voltage production

CLO 3: Solve problems in basic DC theory and circuits including resistive networks, voltage dividers, current dividers and wye-delta conversions

CLO 4: Demonstrate knowledge of DC circuit inductance and capacitance

CLO 5: Demonstrate an understanding of DC generators

CLO 6: Demonstrate an understanding of DC motors

CLO 7: Demonstrate an understanding of batteries and current converters

Course Topics

CT 1: Electron theory; conductors and insulators; units of electrical measurement; and voltage, current, resistance and power. Simple uniform and non-uniform electric fields.

CT 2: Application of DC concepts and laws. Basic electrical circuits; DC theory and DC sources; electrical laws. Theory, construction and application of resistive electrical equipment (e.g. heaters). Ohm's Law, resistive networks, open and short circuits, voltage dividers, current dividers, Kirchhoff's Laws, mesh analysis, node analysis. Design of simple dc circuits to meet specified requirements (e.g. Wheatstone bridges, circuits including transducers)

CT 3: Basics of inductance and capacitance, construction of inductors and capacitors, types of capacitors, basic DC analysis of capacitors and inductors connected in series, parallel, and series-parallel. Time constants in RL and RC circuits. Charging and discharging in RC circuits

CT 4: Theory, construction and application of structural and auxiliary equipment. Generators, motors, and motor-generators.

CT 5: Principles of electrical generation and distribution. Electromagnetic induction. DC generators: Theory of operation, construction and types, operational considerations (e.g. internal losses)

CT 6: DC motors: Theory of operation, construction and types, operational considerations (e.g. starting resistance, internal losses)

CT 7: Batteries: Theory of operation. Lead-acid batteries: construction and operational considerations (e.g. battery state, charging and discharging, hazards).

Student Outcomes

The Higher Diploma in Nuclear Technology program student outcomes (SO) are taken from the 2019 ABET (Accreditation Board for Engineering and Technology) standard. Student Outcome 2 is from the associate degree standard and Student Outcomes 1, 3, 4, and 5 from the bachelor's degree standard.

SO1. An ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly defined engineering problems appropriate to the discipline;

SO2. An ability to design solutions for well-defined technical problems and assist with the engineering design of systems, components, or processes appropriate to the discipline;

SO3. An ability to apply written, oral, and graphical communication in broadly defined technical and non-technical environments; and an ability to identify and use appropriate technical literature;

SO4. An ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes; and

SO5. An ability to function effectively as a member as well as a leader on technical teams.

Table 1: Relation Course Topics (CTs) to Course Learning Outcomes (CLOs)

	CT1	CT2	CT3	CT4	CT5	CT6	CT7
CLO1	H						
CLO2					H		
CLO3		H					
CLO4			H				
CLO5				M	H		
CLO6				M		H	
CLO7							H

H: High, M: Moderate, L: Low

Table 2: Relation Course Learning Outcomes (CLOs) to Students Outcomes (SOs*)

	SO1	SO2	SO3	SO4	SO5
CLO1	H		L	M	
CLO2	H		L	M	
CLO3	H	M	L	M	
CLO4	H		L	M	
CLO5	H		L	M	
CLO6	H		L	M	
CLO7	H		L	M	

H: High, M: Moderate, L: Low
* SOs correspond to the ABET Student Outcomes (see above).

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Week-by-Week Teaching Plan

Week	Topic	Content	Textbook Reference
1-2	Basic quantities and terminology	Atomic structure, electric fields, voltage, current, resistance and power.	[1] GPC chapter 1
3-4	Voltage production	Magnetization. Magnetic fields. Magnetic flux and magnetic flux density. Electromagnetic induction. Lenz's law. Faraday's law.	[1] GPC chapter 2
5-6	Basic DC theory	DC circuit terminology. Ohm's law. Series and parallel resistive networks. Voltage and current dividers.	[1] GPC chapter 3 [2] Hambley's chapter 2
7	DC Circuit analysis.	Kirchhoff's laws. Mesh and node methods. Wye and Delta networks	[1] GPC chapter 3 [2] Hambley's chapter 2
8	Inductance	Inductors. Inductance. Self-induced emf. Inductors in series and in parallel. Time constant of RL circuits.	[1] GPC chapter 4 [2] Hambley's chapter 3
8-9	Midterm exam		
10	Capacitance	Capacitors. Capacitance. Capacitors in series and in parallel. Time constant of RC circuits.	[1] GPC chapter 3 [2] Hambley's chapter 2
11-12	DC generators	DC equipment terminology. Basic construction. Theory of operation. Internal losses. Types of dc generators.	[1] GPC chapter 5
13	DC motors	Magnetomotive force. Magnetic field intensity. Magnetic reluctance. Hysteresis. Basic motor construction. Theory of operation. Internal losses. Types of dc motors.	[1] GPC chapter 6
14-15	Batteries and current converters	Terminology. Battery theory. Battery operation. Types of batteries. Battery hazards. Diodes. Half-wave and full-wave rectifiers.	[1] GPC chapter 7
16	Final Examination	Comprehensive Examination	