Course Syllabus — Engineering Symbols and Diagrams (AES-1001)

Credit Hours: 2 Credit hours

Prerequisites: None

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 non-routine 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 para-professional activity. Can exercise coordination and/or supervision in routine, familiar and some non-routine work or learning contexts. Can coordinate technical, design processes in routine, familiar, non-routine 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 non-routine environment. Can comprehend and observe ethical standards.

Course Description

This course covers knowledge and skills of engineering drawings, diagrams, and schematics that are used in various industries. It includes using and interpreting engineering schematics drawings in engineering work and allied fields of work and creating sketches to communicate information. It encompasses recognizing and using schematics, drawings and diagrams and their relationship to other technical drawing types; conventions and standards, abbreviations and symbols; legal status

and parts; relationship to model-based definition; systems of dimensioning and tolerancing; common features; and use in various media.

Instructors: Dr. Anthony Hechanova, anthony.hechanova@adpoly.ac.ae (course coordinator)

Schedule and Duration: 15 weeks plus final examination week. 2 hours lecture/week.

Course Objectives

The overall objective of this course is to develop student understanding of fundamental engineering drawings and to interpret schematics and mechanical diagrams.

Text Book

1. DOE Fundamentals Handbook Engineering Symbology, Prints, and Drawings, Volume 1, FSC-6910, DOE-HDBK-1016/1-93, U.S. Department of Energy, Washington DC, United States, 1993
2. DOE Fundamentals Handbook Engineering Symbology, Prints, and Drawings, Volume 2, FSC-6910, DOE-HDBK-1016/2-93, U.S. Department of Energy, Washington DC, United States, 1993
3. ANSI/ISA-5.1-2009, Instrumentation Symbols and Identification (*for reference only*)

Attendance:

Students arriving late by even 1 minute will be recorded as absent. Students will receive a warning from the Student Services Office if they reach 5% absence. They will receive a second warning and 500 AED stipend deduction upon reaching 10% absence. At 15% absence, students will receive a FA (fail due to absence) grade in their transcript, an SMS message, a 1000 AED stipend deduction, and a requirement to retake the course at its next offering.

Academic Honesty Policy:

Students must conduct their studies at ADPoly 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 ADPoly may penalize a 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
- 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 engineering drawings, sketches and material lists.

CLO 2: Demonstrate understanding of basic fluid power diagrams and schematics.

CLO 3: Demonstrate understanding of basic process and instrumentation diagram (P&ID) and loop diagrams.

CLO 4: Demonstrate understanding of basic electrical diagrams and schematics.

CLO 5: Demonstrate understanding of basic electronic diagrams and schematics.

CLO 6: Demonstrate understanding of basic logic circuits and diagrams.

CLO 7: Demonstrate understanding of foundation engineering fabrication, construction, and architectural drawings.

CLO 8: Produce sketches and a basic drawings of the engineering fields.

Course Topics:

CT 1: Introduction to Engineering Print Reading and standards. The definition and the purpose of engineering drawings, the five major areas of an engineering drawing, the most common drawing categories and the standards and conventions used with technical drawings.

CT 2: Fluid Power Diagrams and Schematics. Fluid Power Definitions (hydraulic & pneumatic systems), Main hydraulic & pneumatic power components are introduced. The common graphic symbols and conventions used on hydraulic & pneumatic schematics are reviewed. Several examples of how to read and interpret hydraulic & pneumatic schematics are provided.

CT 3: Process and Instrumentation Diagram (P&ID) and Loop Diagrams: This module introduces ANSI/ISA-5.1 standard Instrumentation Symbols and Identification, reviews the common graphic symbols and conventions used on P&IDs and loop diagrams; and provides several examples of how to read and interpret a P&IDs and loop diagrams.

CT 4: Electrical Diagrams and Schematics: This module reviews the major symbols and conventions used on electrical schematics and single line drawings and provide several examples of reading and interpreting electrical diagrams.

CT 5: Electronic Diagrams and Schematics: This module will identify the graphic symbols used on engineering electronic circuits, diagrams, and schematics, and provide several examples of reading and interpreting electronic diagrams and schematics.

CT 6: Logic Circuits and Diagrams: This module identifies the graphic symbols used on logic diagrams. It explains how logic gates are used to represent a component's control circuits.

CT 7: Engineering Fabrication, Construction, and Architectural Drawings: Reading and interpreting basic dimensional and tolerances & fits symbology, and basic fabrication, construction and architectural symbology.

ABET Student Outcomes:

The Higher Diploma in Nuclear Technology program student outcomes are taken from the ABET (Accreditation Board for Engineering and Technology, Inc.) 2019 Student Outcome 2 for associate

degree programs and Student Outcomes 1, 3, 4, and 5 for baccalaureate degree programs. These are the following learned capabilities:

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	H	H	H	H	H	M
CLO2	M	H	M				
CLO3	M	L	H				
CLO4	M			H	M	L	
CLO5	M			M	H	L	
CLO6	M			L	L	H	
CLO7	H						H
CLO8	M	M	L	M	M	M	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	H	H		
CLO2	H	M	M		
CLO3	H	M	M		
CLO4	H	M	M		
CLO5	H	M	M		
CLO6	H	M	M		
CLO7	H	M	M		
CLO8	M	H	H		
Average	H	M	M		

H: High, M: Moderate, L: Low

* SOs correspond to the ABET Student Outcomes (see above). SO4 and SO5 will be "H" for the lab part of this course.

Assessments: Weekly quizzes, weekly assignments, midterm examination, and final examination

Grading policy:

Quizzes	15%
Practical assignments	20%
Midterm examination	25%
Final examination	40%
Total	100%

Week-by-Week Teaching Plan

Week	Topic	Content	Page
1-2	Introduction to Engineering Print Reading and standards	Definition of engineering drawing and its purpose, anatomy of a drawing, title block, drawing scale, grid system, revision block, changes, notes and legends.	1. DOE, V1, Module 1 2. Course presentation
2-3	Introduction to Engineering Print Reading and standards	Types of drawings, views and perspectives. Fluid Power, Process and Instrumentation Diagram (P&ID) and loop diagrams, electrical single lines, electronic diagrams, logic diagrams, fabrication, construction, and architectural drawings. Standards and conventions used in technical drawings.	1. DOE, V1, Module 1 2. Course presentation
4-5	Fluid Power Diagrams and Schematics	Hydraulics versus pneumatics systems. Graphic symbols for hydraulic and pneumatic main components, diagrams, and schematics.	1. DOE, V1, Module 2 2. Course presentation
5-6	Process and Instrumentation Diagram (P&ID) and Loop Diagrams	Graphic symbols used Process and Instrumentation Diagram (P&ID) and loop diagrams for different types of instrumentations, signal transmission lines, valves & actuators and system components.	1. DOE, V1, Module 2 2. ANSI/ISA-5.1-2009, Instrumentation Symbols and Identification 3. Course presentation
6-7	Electrical single line and Diagrams	Graphic symbols for electrical components and single line diagrams and schematics.	1. DOE, V1, Module 3 2. Course presentation
8	Midterm	Modules 1, 2 & 3	1. DOE, V1, Module 1, 2 & 3 2. ANSI/ISA-5.1-2009, Instrumentation Symbols and Identification 3. Course presentation
9-11	Electronic Diagrams and Schematics	Graphic symbols for engineering electronic block diagrams, circuits, and schematics.	1. DOE, V2, Module 4 2. Course presentation
11-13	Logic Circuits and Diagrams	Logic gates and their graphic symbols and truth table	1. DOE, V2, Module 5 2. Course presentation

5-6	Engineering Fabrication, Construction, and Architectural Drawings	Dimensioning and tolerances. Symbology, rules, and conventions, Reading dimensioning and tolerance	1. DOE, V2, Module 6 2. Course presentation
16	Final Exam	Modules 1, 2, 3, 4, 5, and 6	1. DOE, V1 & 2, Modules 1, 2, 3, 4, 5, and 6 2. ANSI/ISA-5.1-2009, Instrumentation Symbols and Identification 3. Course presentations