



# Abu Dhabi Polytechnic

## HDNT Program Curriculum

July 2020

The purpose of this booklet is to provide information regarding the curriculum for the Higher Diploma in Nuclear Technology.

## Document Revision Form

*Document name: AEET – HDNT Curriculum*

Rev #	Date	Revised by and reason for revision	Approved by	Approval Date
Rev 0	23 July 2020	Initial document for Nawah by Dr. Anthony.		

## Table of Contents

<b>1. Academic Support Department .....</b>	<b>4</b>
1.1 Introduction .....	4
1.2 Department Mission .....	4
1.3 General Education .....	4
1.4 Philosophy of General Education at Abu Dhabi Polytechnic .....	4
1.5 Program Educational Objectives (PEOs) .....	6
1.6 Program Learning Outcomes (PLOs) .....	6
1.7 General Education Curriculum .....	7
1.8 Proposed Study Plan for First Year for All Programs (GRs Plan) .....	9
<b>2. Higher Diploma in Nuclear Technology .....</b>	<b>10</b>
2.1 Introduction .....	10
2.2 Program Accreditation and Delivery .....	10
2.3 Program Mission .....	10
2.4 Program Objectives (POs/PEOs) .....	10
2.5 Program Learning Outcomes (PLOs/SLOs) .....	11
2.6 Program Entry Requirements .....	11
2.7 Curriculum .....	12
2.8 Study Plan .....	14
2.9 Advanced Energy Engineering Technology Department Teaching Staff .....	16
<b>3. Course Descriptions .....</b>	<b>17</b>
3.1 Academic Support Department courses .....	17
14.1.1 Chemistry (CHEM) .....	17
14.1.2 Engineering Fundamentals (ENG) .....	17
14.1.3 English (ENGL) .....	18
14.1.4 Humanities (HUM) .....	18
14.1.5 Information Computer Technology (ICT) .....	19
14.1.6 Mathematics (MATH) .....	19
14.1.7 Physics (PHYS) .....	20
3.2 Advanced Energy Engineering Technology (AES) .....	20
<b>4. Course Syllabi .....</b>	<b>24</b>

## 1. Academic Support Department

### 1.1 Introduction

The Academic Support Department (ASD) was established in 2011 and was developed to meet ADPoly's mission of providing high quality academic support services and general education curriculum that solidifies students' knowledge and skills to enhance their academic performance in Applied Science and Engineering Technology in alignment with Abu Dhabi Economic Vision 2030.

### 1.2 Department Mission

The mission of the Academic Support Department is to provide high quality academic support services and tutoring that solidify knowledge, skills and enhance academic performance for science and engineering technology students at ADPoly. The ASD is committed to support students to achieve institutional educational goals and become a life-long-learners through offering variety of academic services, tutoring and learning resources.

### 1.3 General Education

The General Education Curriculum (GEC) is offered by ASD as a main role of the department. The GEC is offered in six main clusters: natural sciences (physics and chemistry), mathematics (precalculus, calculus and advance mathematics), fundamentals in engineering technology, humanities, English and technical communication skills, and skills for life (see figure 1). The GEC was developed based on the following parameters: program needs offered at ADPoly, Academic Accreditation Commission (CAA) standards, ABET standards, and national and international institutions' (i.e., other polytechnics) curriculum benchmarking. The general education courses are offered on a credit-hour system and they are divided into general education requirements and program-based general education courses.

### 1.4 Philosophy of General Education at Abu Dhabi Polytechnic

A top priority of Abu Dhabi Polytechnic is to make sure that undergraduate students receive a diverse and robust general education since enrollment to graduation. In the era of the Industrial Revolution 4.0 with increasing demands on professional expertise, general education plays a vital role in preparing graduates who can maneuver technological advancements as they occur.

The General Education program ensures that all undergraduate students, regardless of their academic major, receive a broad education entrenched in natural sciences, mathematics, fundamentals of engineering technology, humanities, communication skills, and innovation and entrepreneurship. It helps students to expand their knowledge and professional perception while studying Arabic language and Islamic culture, developing their Emirati national identity, learning how to be better communicators in English and striving for life-long self-efficacy.

The general education curriculum recognizes prior learning through a well-defined articulation plan for different high-school systems. Students can waive one or more semesters upon joining Abu Dhabi Polytechnic. Furthermore, the general education curriculum has been benched marked with national and international polytechnic and applied higher education institutions' curricula. Studying at Abu Dhabi Polytechnic gives students opportunities for transfer from other institutions, degree bridging, exchange programs, and continuation of their graduate studies. The general education curriculum meets institutional needs as well as those of accreditation bodies.

The general education represents a bedrock upon which detailed major-specific information is built. Students with a well-rounded general education are better informed and more likely to engage in meaningful activities to improve their own well-being as well as become positive contributors within their communities, professions, and country.

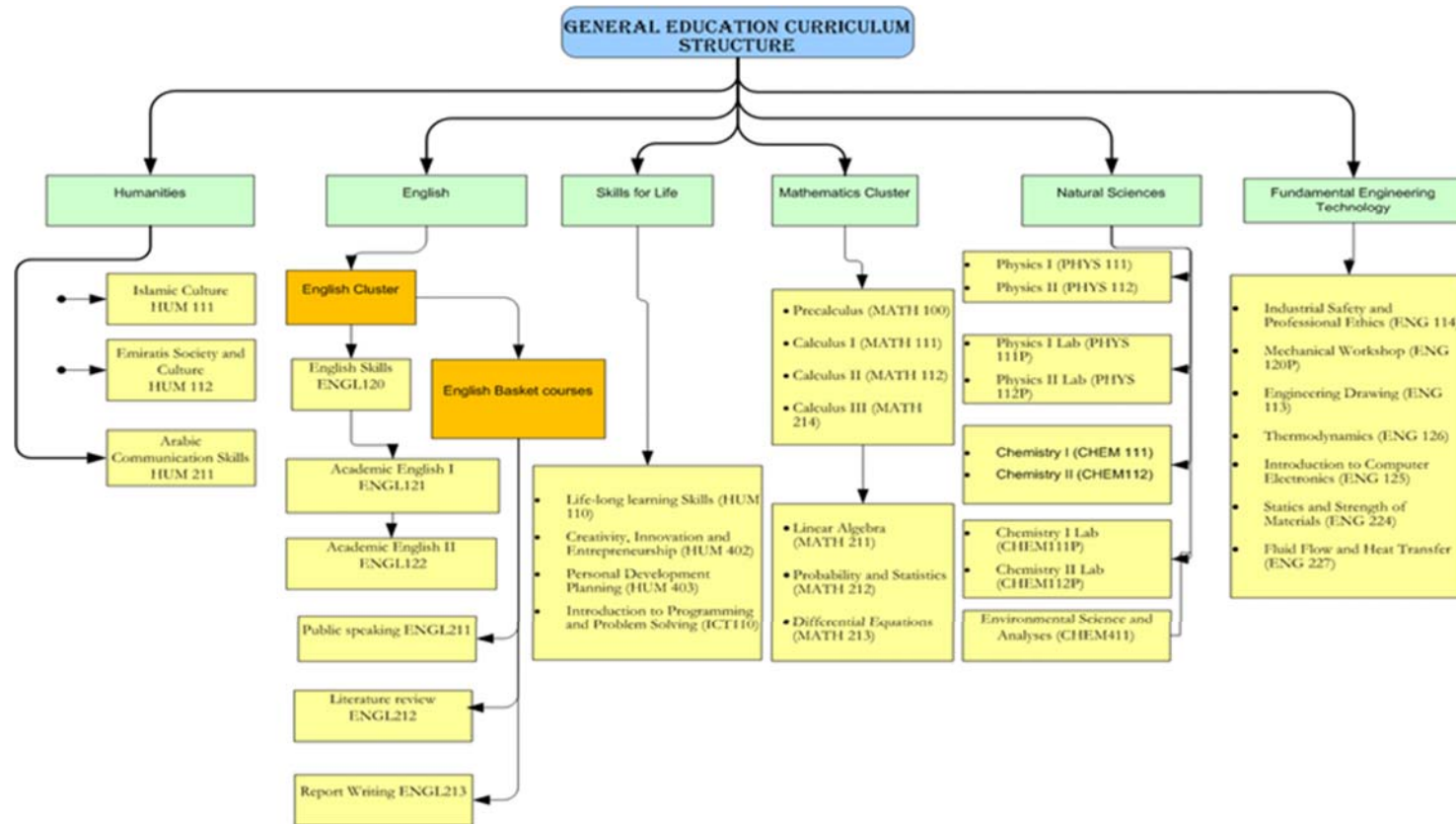


Figure 1: General Education Curriculum clusters

## 1.5 Program Educational Objectives (PEOs)

General education program is intended to provide the undergraduate curriculum with critical thinking skills; a broad understanding of the approaches to knowledge in humanities and social sciences, a common core of understanding among students in Islamic and multicultural studies, and a level of skill appropriate to higher education in science, mathematics, information literacy, the application of technology and communications silks.

These objectives are as follows:

- PEO1:** Provide students with knowledge and skill in science, mathematics, fundamentals of engineering technology, information literacy, and communication that will help them succeed in their studies, lives and careers.
- PEO2:** Provide students with critical thinking skills that promoting innovation, creativity and entrepreneurship.
- PEO3:** Provide students with a common core of understanding such as in Islamic culture and studies that enhancing their awareness of their role as a responsible citizens of UAE, who know and value their religion and culture, and also appreciate and participate in the multicultural diversity of the modern world.
- PEO4:** Create learning environment that produce competency in the use of resources and in research methodologies to promote life-long learning.
- PEO5:** Provide students with teamwork and leadership experiences while demonstrating effective communication skills and knowledge that will help them successfully guide the economic, social and cultural development of the UAE.

## 1.6 Program Learning Outcomes (PLOs)

The following list summarizes the Program Learning Outcomes for general education courses which are similar to ABET Student Outcomes 1-5 for engineering technology.

- PLO1:** 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;
- PLO2:** an ability to design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate to the discipline;
- PLO3:** 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;
- PLO4:** an ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes; and
- PLO5:** an ability to function effectively as a member as well as a leader on technical teams.

## 1.7 General Education Curriculum

The general education curriculum is divided in two main components:

1. General education requirements to be adhered to all areas of academic study (Table 1)
2. Program-based general education courses (Table 2)

**Table 1.** General education requirements to be adhered to all academic programs

General Education Requirements			28 Credit Hours	
Course Code	Course Title	Prerequisite(s)	Co-requisite	Credit Hours
MATH100	Precalculus			4
MATH111 <sup>a</sup>	Calculus I	MATH100		3
ICT110	Introduction to Programming & Problem Solving			3
ENGL120	English Skills			0
ENGL121	Academic English I	ENGL120		3
ENGL122	Academic English II	ENGL121		3
ENGL211	Public Speaking	ENGL122		1
ENGL212	Literature Review	ENGL122		1
ENGL213	Report Writing	ENGL122		1
HUM111	Islamic Culture			3
HUM112	Emirates Society & Culture			3
HUM211	Arabic Communication Skills			3
HUM402	Creativity, Innovation and Entrepreneurship	ENGL122		3

<sup>a</sup> Calculus I course is compulsory for all bachelor's degree programs and optional for Diploma/Higher Diploma

**Table 2.** Program-based general education courses

Program-based General Education Courses (depending on program study plan)				80 Credit Hours
Course Code	Course Title	Prerequisite(s)	Co-requisite	Credit Hours
PHYS111	Physics I		MATH111	3
PHYS111P	Physics I Lab		PHYS111	1
PHYS112	Physics II	PHYS111, MATH100		3
PHYS112P	Physics II Lab		PHYS112	1
CHEM111	Chemistry I			3
CHEM111P	Chemistry I Lab		CHEM111	1
CHEM112	Chemistry II	CHEM111		3
CHEM112P	Chemistry II Lab		CHEM112	1
CHEM411	Environmental Science and Analyses	CHEM111		3
MATH112	Calculus II	MATH111		3
MATH211	Linear Algebra	MATH100		3
MATH212	Probability and statistics	MATH111		3
MATH213	Differential Equations	MATH112		3
MATH214	Calculus III	MATH112		3
ENG113	Engineering Drawing			2
ENG114	Industrial Safety and Professional Ethics			2
ENG120P	Mechanical Workshop			1
ENG125	Introduction to Computer Electronics	ICT110		3
ENG126	Thermodynamics	MATH111, PHYS111, CHEM112		3
ENG224	Statics & Strength of Materials	MATH100, PHYS111		3
ENG227	Fluid Flow & Heat Transfer	ENG126		3
HUM110	Lifelong Learning Skills			3
HUM212	Applied Research and Development Skills			3
HUM401	Leadership Skills			3
HUM403	Personal Development Planning			2



## 1.8 Proposed Study Plan for First Year for All Programs (GRs Plan)

There are several general education courses proposed for freshman year (year 1). This general plan will vary from one program to another; students should refer to the study plan provided by their program.

1 <sup>st</sup> Year (Freshman)				
<b>Semester 1</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>	<b>Prerequisite(s)</b>
	MATH100	Precalculus	4	
	ENGL121	Academic English I	3	ENGL120
	ICT110	Introduction to Programming & Problem Solving	3	
	HUM111	Islamic Culture	3	
	ENG113	Industrial Safety & Prof. Ethics	2	
<b>Total Credit Hours</b>			<b>15</b>	
<b>Semester 2</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>	<b>Prerequisite(s)</b>
	CHEM111	Chemistry I	3	
	CHEM111P	Chemistry Lab I	1	
	PHYS111	Physics I	3	
	PHYS111P	Physics I Lab	1	
	MATH111	Calculus I	3	MATH100
	ENGL122	Academic English II	3	ENGL121
	ENG120P	Mechanical Workshop	1	
<b>Total Credit Hours</b>			<b>15</b>	
<b>Summer</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>	<b>Prerequisite(s)</b>
	PHYS112	Physics II	3	PHYS111
	PHYS112P	Physics II Lab	1	PHYS111P
	ENGL211	Public Speaking	1	ENGL122
	MATH112	Calculus II	3	MATH111
<b>Total Credit Hours</b>			<b>8</b>	

## 2. Higher Diploma in Nuclear Technology

### 2.1 Introduction

The Advanced Energy Engineering Technology Division offers the Higher Diploma in Nuclear Technology.

The HDNT program provides career-based technical education and training for the commercial nuclear power industry in the UAE. Students who successfully complete the program are prepared to enter the nuclear power plant workforce. The HDNT is unique in that it is integrated with the training program of the Nawah Energy Company and meets industrial standards based on Nawah's Systematic Approach to Training. Nuclear-based curriculum is taken from the industrial standard (ACAD 08-006 Nuclear Uniform Curriculum, April 2011) and National Qualification Authority (NQA) Vocational Education and Training Awards Council (VETAC) Qualification and National Occupational Skills Standards (NOSS) as submitted by the ENEC Q+NOSS Operators and Technicians Project (August 2014) and afterwards by Nawah. The nuclear-based curriculum satisfies the knowledge and skills components of the VETAC qualifications. Nawah is involved in admissions, financial support, and progression of all students in the HDNT program and Nawah keeps industrial training records (which were achieved during the HDNT program) in accordance with their regulatory and corporate requirements.

### 2.2 Program Accreditation and Delivery

The HDNT initial accreditation application was submitted in February 2011 and granted in February 2012. The HDNT renewal of accreditation application was submitted in October 2015 and again in March 2019. The CAA External Review Team visited ADPoly in February 2016 and again in December 2019. The completion of the HDNT final accreditation application was delayed from the 2015-2016 submission due to the restructuring of the ADPoly academic year and the transition of the HDNT On-the-Job Training to the Barakah Nuclear Power Plant.

Program Delivery	Duration	Language	Semester	Study location
Full Time	3 years	English	Fall, Winter and Summer	ADPoly Abu Dhabi campus and Barakah Nuclear Energy Plant

### 2.3 Program Mission

The mission of the HDNT program is to graduate technologists with an accredited academic degree of Higher Diploma in Nuclear Technology and industrial skills and competencies as a result of on-the-job training at the Barakah Nuclear Energy Plant.

### 2.4 Program Objectives (POs/PEOs)

The HDNT curriculum program educational goals were designed to assure graduates succeed in the early years of their career and to prepare graduates for their lifelong journey as nuclear technologists, professionals, leaders, and global citizens by:

- Goal I: Providing graduates with the knowledge, skills, and competencies required for the technical operation workforce at a commercial nuclear power plant in the UAE.

- Goal II: Preparing graduates for a career in the nuclear profession such that they understand the nature of their industry and advancement pathways.
- Goal III: Imparting to graduates communication, teamwork, and leadership skills in a technology-connected, supportive environment.
- Goal IV: Instilling graduates with an appreciation for professional and ethical responsibility and the value of the pursuit of knowledge for personal long-term development.

## 2.5 Program Learning Outcomes (PLOs/SLOs)

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:

1. 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;
2. 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;
3. 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;
4. An ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes; and
5. An ability to function effectively as a member as well as a leader on technical teams.

In addition, ABET requires for Nuclear Engineering Technology programs that the curriculum must provide graduates with instruction in the knowledge, techniques, skills, and use and maintenance of modern equipment in nuclear engineering technology. The following topics or activities are required:

- a. Nuclear systems and operations, and radiological safety, including:
  1. radiation protection procedures,
  2. current applicable rules and regulations, maintenance, control, performance, the human interface in operations, and quality assurance pertaining to the operation of nuclear systems; and
  3. the importance of the safe operation of nuclear systems;
- b. Problem solving using foundation mathematics and the fundamental principles, conservation laws, and rate processes of the physical sciences commonly encountered in segments of the nuclear industry served by the program; and
- c. Analyzing and interpreting laboratory analyses measuring nuclear and radiation processes.

## 2.6 Program Entry Requirements

In addition to ADPoly admissions requirements, students must sign a sponsorship contract with the Nawah Energy Company in order to gain entry into the Higher Diploma in Nuclear Technology program as explained in Section 7.3. The entry requirements of the Nawah Energy Company are more rigorous than the ADPoly general admissions requirements. Interested students should arrange with the ADPoly Student Services Office for an interview with the Nawah Energy Company.

## 2.7 Curriculum

Degree Requirements	Total Credit Hours: 110 Credit Hours
General Education Requirements	22
Program-based General Education courses	13
Program Major Requirements (compulsory)	75
Program Minor Requirements	0
Program Electives	0

General Education Requirements				22 Credit Hours
Course Code	Course Title	Prerequisite(s)	Corequisite	Credit Hours
MATH100	Precalculus			4
ICT110	Introduction to Programing & Problem Solving			3
ENGL121	Academic English I	IELTS =5.5 or EmSAT=1100 or ENGL120		3
ENGL122	Academic English II	ENGL121		3
ENGL211	Public Speaking	ENGL122		1
ENGL212	Literature Review	ENGL211		1
ENGL213	Report Writing	ENGL212		1
Select two of the following three Humanities courses:				
HUM111	Islamic Culture			3
HUM112	Emirates Society & Culture			3
HUM211	Arabic Communication Skills			3

Program-based General Education courses				13 Credit Hours
Course Code	Course Title	Prerequisite(s)	Corequisite	Credit Hours
CHEM111	Chemistry I			3
CHEM111P	Chemistry I Lab			1
PHYS111	Physics I			3
PHYS111P	Physics I Lab		PHYS111	1
ENG113	Engineering Drawing			2
ENG114	Industrial Safety & Professional Ethics			2
ENG120P	Mechanical Workshop			1

Program Major Requirements (compulsory)			62 Credit Hours
Course Code	Course Title	Prerequisite(s)	Credit Hours
AES731	Electrical Technology I for Nuclear Plant Ops	MATH100	2
AES731P	Electrical Technology I Lab		1
AES761	Applied Technical Chemistry	CHEM111	3
AES761P	Applied Technical Chemistry Lab		1
AES711	Introduction to Nuclear Technology	PHYS111	3
AES711P	Introduction to Nuclear Technology Lab		1
AES712	Nuclear Reactor Technology	AES711	4
AES722	Mechanical Technology I for NNP Operators	PHYS111	3
AES722P	Mechanical Technology I Lab		1
AES723	Mechanical Technology II for NNP Operators	AES722	2
AES732	Electrical Technology II for Nuclear Plant Ops	AES731	3
AES732P	Electrical Technology II Lab		1
AES741	Thermal Hydraulics for Nuclear Plant Ops	PHYS111	2
AES741P	Thermal Hydraulics for Nuclear Plant Ops Lab		1
AES751	Instrumentation and Control Technology	AES731	3
AES751P	Instrumentation and Control Technology Lab		1
AES771	OJT 1 NPP Familiarization and Systems	HOP approval	7
AES772	OJT 2 NPP Operation	HOP approval	3
AES773	OJT 3 Specialization Training Part A	HOP approval	12
AES774	OJT 3 Specialization Training Part B	AES773	4
AES786	Materials Science for Nuclear Plant Operators	AES711	2
AES786P	Materials Science for NPP Operators Lab		1
AES781	Nuclear Safety and Regulations	AES712	3
AES782	Rad Measurement and Protection	AES711 & AES731	3
AES782P	Rad Measurement and Protection Lab		1
AES784	Work-Based Learning	HOP approval	3
AES789	Capstone Project	HOP approval	4

## 2.8 Study Plan

1 <sup>st</sup> Year (Freshman)				
	Course Code	Course Title	Credit Hours	Prerequisite(s)
Semester 1	CHEM111	Chemistry I	3	
	CHEM111P	Chemistry I Lab	1	
	ENG114	Industrial Safety and Professional Ethics	2	
	ENG113	Engineering Drawing	2	
	ENGL121	Academic English I	3	IELTS =5.5 or EmSAT=1100 or ENGL120
	ICT110	Intro to Programming & Problem Solving	3	
	MATH100	Precalculus	4	
	<b>Total Credit Hours</b>			<b>18</b>
	Course Code	Course Title	Credit Hours	Prerequisite(s)
Semester 2	AES731	Electrical Technology I for Nuclear Plant Ops	2	MATH100
	AES731P	Electrical Technology I Lab	1	
	AES761	Applied Technical Chemistry	3	CHEM111 & CHEM111P
	AES761P	Applied Technical Chemistry Lab	1	
	ENG120P	Mechanical Workshop	1	
	ENGL122	Academic English II	3	ENGL121
	HUMXXX	Humanities Elective 1	3	
	PHYS111	Physics I	3	MATH100
	PHYS111P	Physics I Lab	1	
	<b>Total Credit Hours</b>			<b>18</b>
	Course Code	Course Title	Credit Hours	Prerequisite(s)
Summer	AES711	Introduction to Nuclear Technology	3	PHYS111 & PHYS111P
	AES711P	Introduction to Nuclear Technology Lab	1	
	AES722	Mechanical Technology I for NPP Operators	3	PHYS111 & PHYS111P
	AES722P	Mechanical Technology I for NPP Operators Lab	1	
	ENGL211	Public Speaking	1	ENGL122
<b>Total Credit Hours</b>			<b>9</b>	

2 <sup>nd</sup> Year (Sophomore)				
Semester 1	<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>	<b>Prerequisite(s)</b>
	AES723	Mechanical Technology II for NPP Operators	2	AES722 & AES722P
	AES732	Electrical Technology II for NPP Operators	3	AES731 & AES731P
	AES732P	Electrical Technology II for NPP Operators Lab	1	
	AES741	Thermal Hydraulics for NPP Operators	2	PHYS111 & PHYS111P
	AES741P	Thermal Hydraulics for NPP Operators Lab	1	
	AES751	Instrumentation and Control Technology	3	AES731 & AES731P
	AES751P	Instrumentation and Control Technology Lab	1	
	ENGL212	Literature Review	1	ENGL211
<b>Total Credit Hours</b>			<b>14</b>	
Semester 2	<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>	<b>Prerequisite(s)</b>
	AES712	Nuclear Reactor Technology	4	AES711 & AES7111P
	AES782	Rad Measurement and Protection	3	AES731, AES731P, AES711 & AES711P
	AES782P	Rad Measurement and Protection Lab	1	
	AES786	Materials Science for NPP Operators	2	AES711 & AES7111P
	AES786P	Materials Science for NPP Operators Lab	1	
	ENGL213	Report Writing	1	ENGL212
HUMXXX	Humanities Elective 2	3		
<b>Total Credit Hours</b>			<b>15</b>	
Summer	<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>	<b>Prerequisite(s)</b>
	AES781	Nuclear Safety and Regulations	3	AES712
	AES784	Work-Based Learning	3	HOP approval
<b>Total Credit Hours</b>			<b>6</b>	

3 <sup>rd</sup> Year (Junior)				
Semester 1	Course Code	Course Title	Credit Hours	Prerequisite(s)
	AES771	OJT 1 NPP Familiarization and Systems	7	HOP approval
	AES772	OJT 2 NPP Operation	3	HOP approval
Total Credit Hours			5	
Semester 2	Course Code	Course Title	Credit Hours	Prerequisite(s)
	AES773	OJT 3 Specialization Training Part A	12	AES772
Total Credit Hours			6	
Summer	Course Code	Course Title	Credit Hours	Prerequisite(s)
	AES774	OJT 3 Specialization Training Part B	4	AES773
	AES789	Capstone Project	4	HOP approval
Total Credit Hours			4	

## 2.9 Advanced Energy Engineering Technology Department Teaching Staff

Faculty Name	Position	Highest Degree	Conferring Institution
Anthony Hechanova	Professor, Department Head	Ph.D.	Massachusetts Institute of Technology, USA
Hong Kim	Professional Principal Instructor	Ph.D.	University of Iowa, USA
Evgeny Stankovskiy	Assistant Professor	Ph.D.	University of Nevada Las Vegas, USA
Hamza Ayyash	Instructor	Master	University of Paris, Sud, France
Tinashe Dhiwayo	Instructor	Master	North Carolina State University, USA
Malek Albadarneh	Teaching Assistant	Master	University of Birmingham, UK



### 3. Course Descriptions

Descriptions of some courses offered at ADPPoly (in particular those that support the Higher Diploma in Nuclear Technology program) are listed below. See the ADPPoly General [Catalog](#) on the ADPPoly website for the description of all courses currently offered by ADPPoly. The credit hours for each course is indicated after the course title. A credit hour is mainly based on the number of lecture hours per week and is less affected by the number of laboratory or on-the-job experience hours per week.

#### 3.1 Academic Support Department courses

##### 14.1.1 Chemistry (CHEM)

###### **CHEM-111 Chemistry I (3 CR)**

Chemistry I is 4 credit hours course package consisting of 3 credits for Chemistry I (Chem111) and 1 credit hour for Chemistry Lab (Chem111P). The Chemistry I course introduces the elementary principles of chemistry and enables students to develop their problem solving skills and understanding the basic fundamentals of chemistry including SI units, unit conversions, significant figures, and periodic table. Emphasizes on chemical reactions and the use of symbolic representation and nomenclature, the mole concept and its applications and molecular structure, stoichiometry and solution stoichiometry, gases law and ideal gas law, and atomic structure and periodicity, chemical bonding and orbital hybridization.

Lecture 3 hrs/wk, Tutorial 1 hr/wk.

Co-requisite: CHEM111P

###### **CHEM-111P Chemistry Lab I (1 CR)**

This Lab is an experimental course intended to complement Chemistry I and designed for students majoring in science and engineering technology. The purpose of the lab course is to explore the safety in chemical laboratories and the fundamental chemistry concepts experimentally, which are covered in the Chemistry I course. Students will conduct, analyse and interpret experiments on physical property, resolution of mixture, composition of element, empirical formula, stoichiometry, types of chemical reactions, gas laws and localized electron model. This course runs alongside with chemistry I and continued with chemistry II.

Lab 3 hrs/wk

Co-requisite: CHEM111

##### 14.1.2 Engineering Fundamentals (ENG)

###### **ENG-113 Engineering Drawings (2 CR)**

This course introduces the engineering drawing tools, schematic and engineering diagrams, and engineering operations. It provides the needed training to show typical drawing views and the proper way to show interior and exterior part details. This course relates lines and planes to orthographic projection to show the size and shape of objects. It includes application of principles and graphic elements of sectioning to show interior detail; and, the dimensioning techniques and symbol usage common to all drafting disciplines. Students will learn how to read, interpret and understand the various graphic symbols, components, systems, and abbreviations found on various engineering drawings categories; Fluid Power Diagrams and Schematics, Process and Instrumentation Diagram (P&ID) and loop diagrams, Electrical/Electronic diagrams and schematics.

Lecture 1 hr/wk, lab 2 hrs/wk

###### **ENG-114 Industrial Safety and Professional Ethics (2 CR)**

This course is a study of safety and health management in the workplace as it related to hazard identification and control, accident investigation and prevention, emergency planning and moral responsibilities to society. It introduces the students to profession, professional ethics, various moral issues and uses of ethical theories, and codes of ethics in professional engineering societies.

Lecture 2 hrs/wk

###### **ENG-120P Mechanical Workshop (1 CR)**

This course is a hands-on course covering mechanical shop safety procedures and use of manual and

automated mechanical machining processes. It provides the student with skills and knowledge of hand tools, drill presses, mills, lathes, welding and precision measuring instruments.

Lab 3 hrs/wk

### 14.1.3 English (ENGL)

Note: During the Academic Year 2019-2020, ADPoly revised its English curriculum. Some of the English courses listed below are either no longer offered, or will only be offered for a limited time during the transition from one catalog to another.

#### **ENGL-120 English Skills (0 CR)**

This course focuses on the development of fundamental English communication skills most needed for students preparing for further studies.

Lecture 3 hr/wk, Practical 2 hrs/wk

Pre-requisite: Placement exam; IELTS  $\geq 5.0$ /EmSAT  $\geq 1100$

#### **ENGL-121 Academic English I (3 CR)**

This course focuses on the development of intermediate English communication skills most needed for students preparing for further studies.

Lecture 3 hrs/wk, Practical 2 hrs/wk

Pre-requisite: Completion of ENGL120 English Skills; IELTS 6.0 (all bands  $\geq 5.5$ ); EmSAT  $\geq 1300$

#### **ENGL-122 Academic English II (3 CR)**

This course focuses on the development of high-intermediate English communication skills most needed for students preparing for further studies.

Lecture 3 hrs/wk, Practical: 2 hrs/wk

Pre-requisite: ENGL121 or IELTS (at least 6.5 with all bands  $\geq 6.0$ ) or EmSAT  $\geq 1500$

#### **ENGL-211 Public Speaking (1 CR)**

This course prepares students for situations where public speaking is required. Through a blended approach to learning, this course will help students practice and develop effective communication skills to compose and present speeches appropriate to various audiences, purposes and occasions. Topics will also include ethical responsibilities when speaking to others, overcoming fear, vocal aspects of speech delivery, nonverbal communications, and using appropriate visual aids.

Lecture 1 hr/wk, Online lecture 1 hr/wk, Tutorial 1 hr/wk

Pre-requisite: ENGL122

#### **ENGL-212 Literature Review (1 CR)**

Through a blended approach to learning, this course focuses on the skills that students need to locate, identify, and select relevant sources of literature to compile an annotated bibliography and a structured literature review.

Lecture 1 hr/wk, Online lecture 1 hr/wk, Tutorial 1 hr/wk

Pre-requisite: ENGL211

#### **ENGL-213 Report Writing (1 CR)**

This course enables learners to refine their writing skills in the genre of report writing through a blended learning approach. Students will learn about key principles of report writing through a mixture of online lectures and in-class tutorials and workshops.

Lecture 1 hr/wk, Online lecture 1 hr/wk, Tutorial 1 hr/wk

Pre-requisite: ENGL212

### 14.1.4 Humanities (HUM)

#### **HUM-111 Islamic Civilization (3 CR)**

This Islamic culture course deals with the foundation of Islam and its current challenges. Various lectures look at general Islamic regulations and the main issues related to Islamic civilization. Important intellectual issues in

religion, Sharia law, worship, ethics and contemporary ideologies are addressed while focusing primarily on aspects of Islamic civilization, its effects and contributions to knowledge and science which have had a clear impact on the rebirth and progress of mankind. The course highlights the problems and challenges facing humanity in general, and Arabic and Islamic nations in particular. Moreover, it discusses the issue of how Islamic nations keep pace with modernity, and how to live and communicate with other cultures in harmony.  
Lecture 3 hrs/wk

#### **HUM-112 Emirati Society and Culture (3 CR)**

This course is a study of human societies in general, and in particular the general features and main ingredients of the UAE society, geographic location, population development and composition, and economic and geographic aspects. It deals with family and tribal systems and the nature of governance in a tribal society. The nature of services provided to the community before and after the introduction of oil will be discussed, plus the role of cultural, educational and media institutions and the services they contribute to the community.

Students will also be provided with a comprehensive and integrated understanding of UAE society and various aspects of social and economic life, political and cultural rights, with particular reference to modern society-building since the establishment of the Union and foreseeing the future. This course aims to strengthen the sense of national belonging, loyalty and pride through consolidation of national culture and social concepts, by student participation in a research project during the semester covering all topics associated with the course..  
Lecture 3 hrs/wk

#### **HUM-211 Arabic Communication Skills (3 CR)**

The communication process of the Arabic language is essential in everyday life, and, based on it, we build our decisions on an individual, collective and international level. This course aims to develop students' capabilities in listening, reading, writing and speaking in their native language. It also helps students to gain linguistic abilities to communicate professionally and socially. In addition, it trains students in different communication skills to avoid common mistakes that can arise from miscommunication. Linguistic performance is developed through a solid and clear understanding of the meanings of different types of texts, which are relevant to the students' environment. Students will navigate through a variety of texts from the Quran, poetry, prose and short stories.  
Lecture 3 hrs/wk

#### **HUM-402 Creativity, Innovation, and Entrepreneurship (3 CR)**

Creativity, innovation, and entrepreneurship are essential skills in gaining a competitive advantage in today's global economic environment. Increasingly, organizations are seeking employees that are creative and have innovative and entrepreneurial know-how. Through real world examples and research from experts in the field, students will learn how to incorporate design thinking, entrepreneurship, and growth and leadership into the UAE's society and their own personal and professional development.

Lecture 3 hrs/wk

Pre-requisite: ENGL112 (Students in the 2<sup>nd</sup> year and higher are recommended to take this course—not 1<sup>st</sup> year students.)

### **14.1.5 Information Computer Technology (ICT)**

#### **ICT 110 Introduction to Programming and Problem Solving (3 CR)**

This introductory course in engineering problem solving and computer programming is for all undergraduate engineering students without prior programming experience in any language. The course covers the fundamentals of computer programming and its underlying principles using the Java programming language. Concepts and methods are illustrated by examples from various engineering disciplines. Useful numerical techniques and their applications to real world problems in science and engineering are also discussed. Weekly laboratory required.

Lecture: 2 hrs/week; tutorial: 2 hrs/week; Lab: 2 hrs/week

### **14.1.6 Mathematics (MATH)**

#### **MATH-100 Precalculus (4 CR)**

This course covers basic algebraic operations on numbers, exponents, roots and radicals, equations, inequalities, scientific notations, algebraic operations on expressions, solving formulas and literal equations. It

also covers geometry, functions and its graphs, trigonometry, radian measure, and oblique triangles, plotting trigonometric functions, solving system of linear equations and quadratics equations algebraically and graphically, matrix and its determinant, solving linear equations using the determinant (Cramer's rule), factoring and fractions, exponents and radicals, solving logarithmic and exponential equations.

Lecture 4 hrs/wk, Tutorial 1 hr /wk

### 14.1.7 Physics (PHYS)

#### PHYS-111 Physics I (3 CR)

This course enables students to develop their skills in understanding physical concepts. It helps students approach questions in a logical and systematic manner. This course covers a variety of topics in mechanics that are relevant for the degrees offered at the polytechnic.

Lecture 3 hrs/wk, Tutorial 1 hr/wk.

#### PHYS-111P Physics Lab I (1 CR)

This Lab is an experimental course intended to complement Physics I. The purpose of the lab course is to explore some of the main concepts experimentally, which are covered in the Physics I course. Students will conduct, analyze and interpret experiments on timing, motion, forces and energy, rotational motion, forces and rotational energy and analyze and prepare lab reports working either individually or in teams. This course is to run alongside Physics I.

Lab 3 hrs/wk.

## 3.2 Advanced Energy Engineering Technology (AES)

#### AES-711 Introduction to Nuclear Technology (3 CR)

This course covers the introduction to nuclear power technology, including nuclear technology history, current status, nuclear terminologies and radiation protection. This course also covers the fundamentals of atomic structure, mass defect, and binding energy; nuclear interactions and reactions; cross-sections; neutron activation; half-life determination; isotope identification methods; ionization; radiation interactions with matter; and, neutron interactions.

Lecture 3 hrs/wk, Tutorial 1 hr/wk. Prerequisite: PHYS-111. Corequisite: AES-711P.

#### AES-711P Introduction to Nuclear Technology Laboratory (1 CR)

The purpose of the laboratory course is to explore some of the main concepts experimentally, which are covered in the lectures of AES-711 Introduction to Nuclear Technology.

Laboratory 2 hrs/wk. Corequisite: AES-711.

#### AES-712 Nuclear Reactor Theory (4 CR)

This course provides basic concepts and theories associated with the theory of the fission process; control of fission process; neutron flux effects on reactor power; neutron leakage; fission products; neutron sources; reactivity coefficients; changes in reactor operational parameters; radiation from fission and from fission products; residual heat/decay heat. This course also covers the introduction to nuclear reactor operation, including nuclear reactor kinetics, reactor control, and power operation.

Lecture 4 hrs/wk, Tutorial 1 hr/wk. Prerequisite: AES-711.

#### AES-722 Mechanical Technology I for Nuclear Power Plant Operators (3 CR)

This course covers the operating principles and types of valves, pumps, heat exchangers, steam traps, filters and strainers, air compressors, and lubrication used in nuclear power plants.

Lecture 3 hrs/wk. Prerequisite: PHYS-111. Co-requisite: AES-722P.

#### AES-722P Mechanical Technology I Laboratory (1 CR)

This course contains the laboratory experiments that complement AES-722 Mechanical Technology I for Nuclear Power Plant Operators. The purposes of these laboratory experiments are to (1) apply the theoretical knowledge, (2) learn technical know-how related to the topics covered in the class and (3) learn to write a technical report.

The students demonstrate, conduct, and analyze experiments in a group, and write laboratory reports individually.

Laboratory/Tutorial 2 hrs/wk. Co-requisite: AES-722.

**AES-723 Mechanical Technology II for Nuclear Power Plant Operators (2 CR)**

This course covers the operating principles and types of refrigeration machines; heating, ventilation, and air conditioning systems; steam turbines; and, diesel engines.

Lecture 2 hrs/wk. Prerequisite: AES-722.

**AES-731 Electrical Technology I for Nuclear Power Plant Operators (2 CR)**

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 and DC generators.

Lecture 2 hrs/wk, Tutorial 1 hr/wk. Prerequisite: MATH-100. Corequisite: AES-731P.

**AES-731P Electrical Technology I for Nuclear Power Plant Operators Laboratory (1 CR)**

This is a lab course intended to be conducted concurrently with AES731 Electrical Technology I for NPP Operators. Students carry out practical procedures, conduct experiments, collect and analyze data relevant to DC circuits and DC machines.

Laboratory 2 hrs/wk. Corequisite: AES-731.

**AES-732 Electrical Technology II for Nuclear Power Plant Operators (3 CR)**

This course covers basic concepts relating to AC systems, including basic AC theory, AC reactive components, three phase power, AC machines, electrical power transmission and distribution, electrical test instruments and measuring devices and basic electronics.

Lecture 3 hrs/wk, Tutorial 1 hr/wk. Prerequisite: AES-731. Co-requisite: AES-732P.

**AES-732P Electrical Technology II Laboratory (1 CR)**

This is a laboratory course intended to be conducted concurrently with AES-732 Electrical Technology II for NPP Operators. Students carry out practical procedures, conduct experiments, collect and analyze data relevant to AC circuits, AC machines and electronic components.

Laboratory 2 hrs/wk. Corequisite: AES-732.

**AES-741 Thermal Science for Nuclear Power Plant Operators (2 CR)**

This course covers thermodynamics units, volumetric properties of pure fluids, important thermodynamics properties, mechanisms of heat transfer by conduction, convection, and radiation, heat exchanger design and sizing, fluid mechanics and fluid statics, application of thermodynamics to flow systems, in particular the Rankine cycle in nuclear power production in a pressurized water reactor.

Lecture 2 hrs/wk, Tutorial 1 hr/wk. Prerequisite: PHYS-111. Corequisite: AES-741P.

**AES-741P Thermal Science for Nuclear Power Plant Operators Laboratory (1 CR)**

This laboratory course and its experiments are intended to complement the Thermal Sciences for Nuclear Power Plant Operators course (AES-741). The purposes of these experiments are to (1) apply the theoretical knowledge, (2) learn technical know-how related to the topics covered in the class and (3) learn to write a technical report. The students demonstrate equipment familiarity, conduct experiments, analyze experimental results in a group, and write laboratory reports individually.

Laboratory 2 hrs/wk. Corequisite: AES-741.

**AES-751 Instrumentation and Control Technology (3 CR)**

This course provides knowledge and skills of fundamental instrumentation and control principles and concepts. It includes demonstrated knowledge of systems and components associated with process control, valve actuators and position indicators, miscellaneous sensors and detectors, chemistry instrumentation, and radiation detectors. It encompasses demonstrating an understanding of concepts of instrumentation and control, temperature sensors and detectors, pressure sensors and detectors, level sensors and detectors, flow sensors and detectors, and measurement.

Lecture 3 hrs/wk. Tutorial 1 hr/wk. Prerequisite: AES-731. Corequisite: AES-751P.

**AES-751P Instrumentation and Control Technology Laboratory (1 CR)**

The purpose of the course is to explore some of the main concepts experimentally, which are covered in the Instrumentation and Control Technology (AES-751) course. Students will conduct and analyze experiments on temperature, pressure, and flow, and describe their results in laboratory reports while working either individually or in teams. This course is to run concurrently with AES-741 Instrumentation and Control Technology. Laboratory 2 hrs/wk. Corequisite: AES-751.

**AES-761 Applied Technical Chemistry (3 CR)**

This course covers fundamental knowledge and skills of chemistry concepts required to solve problems in engineering and energy technology related environments. It includes demonstrating knowledge of water chemistry fundamentals, sources and types of impurities, control/removal of impurities, effects of impurities, the use of hydrogen gas in oxygen control, radical production and recombination, and radiochemistry. It also encompasses demonstrated understanding of solution chemistry, physical states, and nomenclature with a focus on water chemistry involving effects of impurities, ion exchange, water treatment, and corrosion. Lecture 3 hrs/wk, Tutorial 1 hr/wk. Prerequisite: CHEM-111. Corequisite: AES-761P.

**AES-761P Applied Technical Chemistry Laboratory (1 CR)**

The purpose of the course is to explore some of the main concepts experimentally, which are covered in the Applied Technical Chemistry (AES-761) course. Students will conduct and analyze experiments on acids and bases, titration of unknown acid, conductivity probe, pH probe, chemical cells, dissolved oxygen monitor (analyzer), turbidity detector, and describe their results in laboratory reports while working either individually or in teams. This course is to run concurrently with AES-761 Applied Technical Chemistry. Laboratory 2 hrs/wk. Corequisite: AES-761.

The following courses (AES-771 through AES-774) are provided by Nawah at the Barakah Nuclear Power Plant in the western region of Abu Dhabi. A total of 26 CR of OJT is required for the HDNT which consist of the following courses:

**AES-771 Nuclear Power Plant Systems and Operation**

**AES-772 Nuclear Power Plant Familiarization**

**AES-773 OJT Specialization Qualifications Part A**

**AES-774 OJT Specialization Qualifications Part B**

**AES-781 Nuclear Safety and Regulations (3 CR)**

This course covers basic concepts of a Design Basis Accident (DBA), severe accidents, accident analysis, principles and methods for assessing risk and reliability for Nuclear Power Plants. The course also covers several safety parameters and safety analysis of NPPs and safety improvement, international cooperation, and trends. The course also covers UAE's nuclear energy and safety laws, nuclear energy regulatory framework, applied technical standards and specifications for NPPs. Lecture 3 hrs/wk. Prerequisite: AES-712.

**AES-782 Radiation Measurement and Protection (3 CR)**

This course covers two main subjects: first to teach students how to measure radiation and understand the principle of radiation detection, and second to provide detailed radiological protection theory and techniques and develop student understanding and skills in radiation protection fundamentals needed to apply in the operation and maintenance of a nuclear power plant. Lecture 3 hrs/wk, Tutorial 1 hr/wk. Prerequisite: AES-731. Corequisite: AES-782P.

**AES-782P Radiation Measurement and Protection Laboratory (1 CR)**

This laboratory is an experimental course intended to complement AES-782 Radiation Measurement and Protection. Students will conduct, analyze and interpret experiments on counting, energy calibration, gamma spectra measurements, detector resolution, Compton scattering, Pair production and annihilation and absorption of gammas by different materials individually or in teams. This course is to run concurrently with Radiation Measurement and Protection (AES-782). Laboratory 2 hrs/wk. Corequisite: AES-782.

**AES-784 Work-based Learning (3 CR)**



This course provides refresher of knowledge, principles, and concepts of fundamental courses, such as Nuclear Reactor Technology, Electrical Technology I & II for NPP Operators, Mechanical Technology I for NPP Operators, Thermal Sciences for NPP Operators & Heat Transfer and Fluid Flow, Instrumentation and Control Technology, Applied Technical Chemistry, and Material Science for NPP Operators.

Lecture 3 hrs/wk. Registration for this course requires department head approval.

**AES-786 Materials Science for Nuclear Power Plant Operators (2 CR)**

This course covers the introduction to material problems in a nuclear power plant, including basic material properties, brittle fracture characteristics, radiation-induced property changes, and temperature effects such as heat up and cool down rate limits.

Lecture 2 hrs/wk. Tutorial 1 hr/wk. Prerequisite: AES-711. Corequisite: AES-786P.

**AES-786P Materials Science for Nuclear Power Plant Operators Laboratory (1 CR)**

This laboratory is an experimental course intended to complement AES-786 Materials Science for Nuclear Power Plant Operators course. The purpose of the course is to explore some of the main materials science concepts experimentally. Students will conduct and analyze experiments on stress strain behavior by tensile and compression tests, behavior of materials under torsion test, measurement of specimen toughness by impact test, hardness measurement, creep rate measurement, and describe their results in laboratory reports while working either individually or in teams.

Laboratory 2 hrs/wk. Corequisite: AES-786.

**AES-789 Capstone Project (4 CR)**

This is a blended-mode course which students take while doing their OJT. They work with a faculty supervisor to produce a detailed, factual report on a relevant area in the nuclear industry and present an oral report to at least two examiners.

Lecture/Tutorial 2 hrs/wk. Registration for this course requires department head approval.

## 4. Course Syllabi

The following appendices contain the course syllabi for the Higher Diploma in Nuclear Technology program for Academic Year 2019-2020.