

Petroleum Engineering Department

Diploma of Petroleum

Engineering Curriculum Document

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Curriculum Approved by:

ACK College Curriculum Committee



Foreword

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

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

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 PETROLEUM ENGINEERING

1. **Identify** the range of chemical principles and techniques relevant to petroleum engineering.
2. **Understand** the processes of physical and petroleum geology.
3. **Describe** the different geophysical techniques used in oil and gas exploration.
4. **Identify** hydrocarbon reservoir rock and fluid properties.
5. **Recognize** the equipment and operations used in drilling and well completion.
6. **Evaluate** the quality of hydrocarbon basins.
7. **Apply** the principles and techniques of reservoir engineering.
8. **Understand** the principles of upstream production.
9. **Identify** the different equipment used in surface production operations.
10. **Assist** in planning and designing production plant.
11. **Identify** the different equipment used in oil refining and petrochemical industries.
12. **Discuss** environmental issues in the oil and gas industry.

Units Distribution

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

Semester 1

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
15FMAT119	Applied Physics	NA	3	3	2
15FPTE110	Petroleum Engineering Technology: Ethics & Practices	NA	3	3	0
15FPTE111	Hydrocarbon Chemistry	NA	3	3	2

Semester 2

Unit Code	Unit name	Pre-Requisite	Credits	Delivery	
				Lect.	Lab.
15FMAT127	Engineering Mathematics II	15FMAT116	3	3	0
15FPTE120	Petroleum Engineering Materials	15FPTE111	3	3	2
15FPTE121	Health & Safety in the Workplace	15FPTE110	3	3	0
15FPTE122	Petroleum Geology	15FPTE110	3	3	2
15FPTE123	Fluid and Thermodynamics	15FMAT11615 FMAT119	3	3	2

Semester 3

Unit Code	Unit name	Pre-Requisite	Credits	Delivery	
				Lect.	Lab.
15FPTE210	Reservoir Rock and Fluid Properties	15FPTE122	3	3	2
15FPTE211	Drilling and Completion	15FPTE122	3	3	2
15FPTE212	Upstream Production	15FPTE123	3	3	0
15FPTE213	Environmental Issues in Oil and Gas Industry	15FPTE121	3	3	0
15FPTE214	Oil Refining	15FPTE120	3	3	2

Semester 4

Unit Code	Unit name	Pre-Requisite	Credits	Delivery	
				Lect.	Lab.
15FPTE220	Well Logging	15FPTE211	3	3	0
15FPTE221	Reservoir Engineering	15FPTE210	3	3	2
15FPTE222	Down Stream Production and Gas Processing	15FPTE212	3	3	0
15FPTE223	Instrumentation and Control	15FPTE214	3	3	2
15FPTE224	Equipment and Maintenance (PBL)	15FPTE211 15FPTE212 15FPTE214	3	3	0

Units Description

Semester (1)

1. 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

2. 15FMAT116 – Engineering Mathematics I [3CH, 3 Lec, 0 Lab]

This unit covers 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

3. 15FMAT119 – Applied Physics [3CH, 3 Lec, 0 Lab]

This unit introduces the principles of engineering physics and aims to develop a fundamental understanding of several broad areas of physics (mechanics, fluids, wave properties, properties of matter and heat) applied to engineering and technology. The unit provides practical experience in experimental and measurement techniques used to investigate these physical phenomena and develops related professional communication, information literacy and teamwork skills.

Prerequisite: None

4. 15FPTE110 – Petroleum Engineering Technology: Ethics and Practices [3CH, 3 Lec, 0 Lab]

The aim of the unit is to provide students with a broad overview of introduction to Petroleum Engineering in order that advanced units in subsequent years can be understood within a broader Petroleum Engineering context. This unit covers introduction to petroleum drilling, completions and production technologies, reservoir mechanics, fundamentals of rock and fluid properties, composition and PVT properties of petroleum fluids; basic physical and chemical properties of petroleum reservoir fluids related to

reservoir processes and production. It also provides an introduction to decision-making in petroleum business environment, and job responsibilities and roles.

Prerequisite: None

5. 15FPTE111 – Hydrocarbon Chemistry [3CH, 3 Lec, 2 Lab]

This unit is intended to introduce students to the study the principles of chemistry to oil and gas engineering situations including reaction equations; chemistry of petroleum products, the student will learn basic characteristics of matter, fundamental energy concepts, the principles of chemical nomenclature and stoichiometry and hydrocarbon chemistry.

Prerequisite: None

Semester (2)

6. 15FMAT127 – Engineering Mathematics II [3CH, 3 Lec, 0 Lab]

This unit covers 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

7. 15FPTE120 – Petroleum Engineering Materials [3CH, 3 Lec, 2 Lab]

This unit provides students with a systematic and coherent framework for understanding of materials for engineering applications. The unit discusses the various types, properties and classification of materials. It also covers the effects of environment on engineering materials and the principles of failure analysis. The justification of the selection and the factors that guide adoption of materials for particular purposes in the Oil and Gas Industry is covered.

Prerequisite: 15FPTE111

8. 15FPTE121 – Health and Safety in the Workplace [3CH, 3 Lec, 0 Lab]

This unit covers the purpose and procedures for investigating incidents and how the lessons learnt can be used to improve health and safety in Oil and Gas industry. Students will learn the hazards inherent in oil and gas arising from the extraction, storage and processing of raw materials and products.

Prerequisite: 15FPTE110

9. 15FPTE122 – Petroleum Geology [3CH, 3 Lec, 2 Lab]

This unit covers Physical Geology - earth processes and interior of the earth, geological time scale, types of rocks, rock identification and thin section practical in geology lab, petroleum system and Geochemistry - sedimentology and environmental deposition, sedimentary basins, structural geology, traps and seals, geochemistry related to petroleum, primary migration, secondary migration, and rock characterization, Geophysics - methods of petroleum exploration includes gravity method, magnetic method and seismic survey.

Prerequisite: 15FPTE110

10. 15FPTE123 – Fluid and Thermodynamics [3CH, 3 Lec, 2 Lab]

This unit covers the fundamental properties of fluids, analysis of pipe flow and analysis of buoyancy and stability of floating objects. It presents methods of analyzing fluid systems using the concept of a control volume combined with the conservation of mass and momentum equations. This unit also covers the basic principles of thermodynamics including first and second law of thermodynamics, latent and sensible heat, open and closed systems, and enthalpy.

Prerequisite: 15FMAT116 & 15FMAT119

Semester (3)

11. 15FPTE210 – Reservoir Rock and Fluid Properties [3CH, 3 Lec, 2 Lab]

This unit covers the fundamentals and principles of rock properties – Types of pore spaces, porosity, saturations, volumetric equations, land description, trapping mechanisms, pressure and temperature gradients, abnormally pressured reservoirs, Darcy's law for linear horizontal and tilted flow, radial flow for single phase liquids and gases, multiphase flow (relative permeability), capillary pressure and formation compressibility. This unit also covers fluid properties, particularly properties of fluids encountered in Petroleum Engineering, dealing with topics such as phase behavior, density, viscosity, interfacial tension, composition of oil and gas and brine system. Interpreting lab data for engineering applications is also covered, with discussion on PVT analysis, PVT cells, and types of experiments, such as flash, differential and separation, flash calculations with k-values and equation of state. Finally, some introduction to reservoir simulation software culminates this discussion.

Prerequisite: 15FPTE122

12. 15FPTE211 – Drilling & Completion [3CH, 3 Lec, 2 Lab]

This unit covers drilling technology, operation and equipment in the Offshore and Onshore area. The topics will include types and function of the rotary drilling rig, major components of drilling rig, drilling string components, functions and type of casing, cement operation, fishing tools and drilling fluid function and properties. This unit also

introduces the basic components of a completion that are tubing, packers perforation technologies and operation.

Prerequisite: 15FPTE122

13. 15FPTE212 – Upstream Production [3CH, 3 Lec, 0 Lab]

This unit covers an introduction to oil and gas production operations and equipment used in onshore and offshore production systems. It describes the basics of wellbore inflow and outflow, down hole completions and sand control management. It also discusses the fundamentals of stimulation and artificial lift equipment.

Prerequisite: 15FPTE123

14. 15FPTE213 – Environmental Issues in the Oil & Gas Industry [3CH, 3 Lec, 0 Lab]

This unit aims to present the main environmental impacts of the Oil and Gas Industry. It discusses different types of pollution (including air pollution, water pollution and other pollution sources), as well as the different accidents that may occur throughout the practice of the industry. The corresponding appropriate response and treatment to such incidents are also discussed.

Prerequisite: 15FPTE121

15. 15FPTE214 – Oil Refining [3CH, 3 Lec, 2 Lab]

This unit covers analysis of crude oil properties, processes employed in petroleum refining operation and equipment such as FCC, hydro-treating, distillation, heat exchanger, mixers, reactors, flare systems. It also covers the design of equipment used in oil refining and petrochemical industries along with drawing block diagram and process flow diagram (PFD).

Prerequisite: 15FPTE120

Semester (4)

16. 15FPTE220 – Well Logging [3CH, 3 Lec, 0 Lab]

This unit covers rig up, rig device, equipment used in well logging. petro-physical logs including open and cased-hole logs. Open-hole Logs: Gamma ray Log, SP Log, Resistivity Logs, Neutron – Density Logs, Sonics Log, Caliper Log, Cased-hole Logs: CBL and VDL, Quick look methods of well log interpretation and analysis: Saturation factor, cementation factor, shale content, Archie's 1st and 2nd Law, Wyllie's Time Equation.

Prerequisite: 15FPTE211

17. 15FPTE221 – Reservoir Engineering [3CH, 3 Lec, 2 Lab]

This unit covers a method of estimating hydrocarbon pore volume and recovery factor. Classification of oil reservoirs, reservoir performance prediction for solution gas drive, water drive, gravity drainage and combination drive reservoirs using material balance approach. Students will also gain some knowledge about well test analysis.

Prerequisite: 15FPTE210

18. 15FPTE222 – Downstream Production and Gas Processing [3CH, 3 Lec, 0 Lab]

This unit focuses on the downstream production operations for oil and natural gas. It covers the fundamentals of oil and gas processing including equipment, systems, instrumentation, operations, and related scientific principles. It also discusses the design and selection of surface facilities and explains the operational procedures for various oil and gas plant.

Prerequisite: 15FPTE212

19. 15FPTE223 – Instrumentation and Control [3CH, 3 Lec, 2 Lab]

This unit covers the key concepts in automatic control and instrumentation of petroleum process plants. The unit also provides an introduction to process control, transfer function; open and closed loop, feedback control, process measurements and process control will be presented in this unit. Commonly used sensing, transmission and final control elements are described and depicted in Piping and Instrumentation Diagrams.

Prerequisite: 15FPTE214

20. 15FPTE224 – Equipment & Maintenance (PBL) [3CH, 3 Lec, 0 Lab]

This Project Based Learning unit will outline operation principles and troubleshooting of equipment used in petroleum industry such as pumps, compressors, valves, storage tanks, and pipes. Maintenance fundamentals for petroleum equipment including equipment inspection and maintenance procedures according to the current industry standards will be covered in this unit.

Prerequisite: 15FPTE211 & 15FPTE212 & 15FPTE214

Assessment Framework

The assessment framework for the Diploma of Petroleum Engineering is based on the following principles:

1. An Academic semester at ACK is 16 weeks.
2. The number of teaching weeks in an academic semester at ACK is 13 weeks.

3. There is one week devoted to Midterm assessments “at week 8” and two weeks devoted for final assessments “weeks 15 and 16”.
4. The final semester exams will be spread over two weeks according to the departmental plans and schedule logistics.
5. Unit delivery approach (including conventional, PBL and workshop units)

Based on the above principles, the assessment framework will be as follows:

Conventional units:

Week #	Task	Grade weight distribution for a Unit with a lab	Grade weight distribution for a Unit without a lab
1			
2			
3			
4	Assessment tool #1	5	5
5			
6			
7			
8	Midterm Exam	30	40
9			
10			
11	Assessment tool #2	5	5
12			
13			
14	Labs	20	0
15&16	Final Exam	40	50
Total		100	100

Project Based Learning units:

Week #	Task	Grade weight distribution
1-14	Formative	0
14	Portfolio	100
Total		100



