University of Cyprus

Engineering School

A Curriculum for a Master program in Petroleum Engineering

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The Homer-Ferrington semi-submersible rig that drilled for Noble Energy Ltd the first exploration well in Aphrodite block of Cyprus in 2011.

The Master in Petroleum Engineering

Introduction

The Master in Petroleum Engineering (M.Eng) degree will be administered academically by the Hydrocarbon Committee and granted by the Engineering School of the University of Cyprus.

The program as planned will admit initially up to 30 students a year. A full time student will be able to complete the course work and the final project program in 12 months. The program will be based on a core courses and it will contain some electives. Though the program is designed to be complete on the subjects, as it develops with the recruiting of local faculty and the number of students increase, more courses will be added based on industry demands and the requirements of regulatory and administrative bodies.

Program objectives

The main objective of the Master in Petroleum Engineering (M.Eng) program is to build and accelerate the development of national workforces for recruitment by the local authorities, national subsidiaries and international operating companies in the upstream oil and gas industry. The program will address, in particular, the growing needs of deepwater exploration and development that have raised the complexity of technical challenges in geosciences and petroleum engineering and have increased the difficulty of hydrocarbon exploitation. Knowing that the development of competencies and key capabilities in petroleum engineering remains the biggest hurdle in workforce management in oil and gas industry, this program provides the first step which is the education in the relevant subjects.

The study program proposed herein will be named Master in Petroleum Engineering and will focus on the needs of the upstream oil and gas industry. It will cover the following major areas:

1. Petroleum Geology and Applied Geophysics
2. Drilling and Completion Engineering
3. Reservoir Characterization, Management and Production
4. Production, transportation and storage facilities

The necessary courses which cover the above areas are listed below.

Admission to the program

The program is designed with prerequisite knowledge obtained by graduates with a B.Sc. in Engineering (such as Civil, Mechanical, Chemical, Environmental and others). Candidates from other fields will be expected to take prerequisites courses before admission to the Master in Petroleum Engineering program. Prerequisite subjects are considered those taught in the courses of applied mathematics, computational methods, solid mechanics and fluid mechanics.

Applicants must demonstrate competitive academic standards and top grades in English language. All program students must be able to demonstrate their abilities in English. For a quick reference to the level of English knowledge, equates to a C-grade at English GCSE or an IELTS score of 6.5, or for a Test of English as a foreign language (ETS TOEFL®) a minimum score of 550 (paper based), 213 (computer based) or 80 (internet-based) will be required. The candidates must apply officially for admission to the program by the specified date. There is only one admission period for every academic year, in September. The applications are evaluated by the Hydrocarbon Committee of the Engineering School and approved by the Engineering Council. The selection of the students is based on the following criteria: On the quality and academic record and achievements of the applicant in undergraduate and postgraduate studies and the promise for a professional and academic career in petroleum engineering. If the candidates do not fulfill the above criteria the Engineering School reserves the right to admit fewer students than the announced positions.

List of courses

The majority of the courses is mandatory and serves as the currently required core of the program. The students must attend 7 mandatory courses and to choose 2 elective courses from the list of elective courses. A student with first degree in petroleum engineering might choose to attend a 3rd elective course instead of the PET 501 which is on the introduction to the petroleum engineering. Deviation from the recommended lists will be allowed provided approval is granted by the academic director of the program.

Course No.	Course Title	ECTS
	Mandatory	
PET 501	Introduction to petroleum engineering	8
PET 511	Petroleum geology	8
PET 513	Formation evaluation	8
PET 521	Drilling operations	8
PET 522	Well and subsea completions and production facilities	8
PET 531	Reservoir engineering	8
PET 532	Natural gas production engineering	8
PET 551	Project in hydrocarbon exploration and production	16
PET 552	Seminars related to petroleum engineering	2
	Electives (two courses)	
PET 502	Hydrocarbon law & economics	8
PET 503	Health, Safety and Environmental assessment and control in petroleum operations	8
PET 512	Applied geophysics: seismic Interpretation	8
PET 541	Petroleum geomechanics	8

A sample program of Master in Petroleum Engineering

Following the University of Cyprus and the European Common Transfer System existing guidelines, the program will require the completion of 90 ECTS, of which 72 ECTS will be devoted to coursework, 2 ECTS to scientific seminars and 16 ECTS to a final project. In the ECTS system, for one semester with 13 weeks teaching period and 1 week of study preparation for exams for an 8 ECTS course the work breaks down as follows: lecture hours 3X13=39, homework preparation 12 X 14 = 168 hours.

Therefore, the total student load for this course is 39+168=207 hours and an ECTS unit is typically awarded for 25-30 hours workload for a student. On this basis, for each course of the program Master in Petroleum Engineering 8 ECTS were allocated.

The student will decide the appropriate combination of elective courses in consultation with the program's director. The following table presents a typical program of study which can be completed in a calendar year given that the student will follow a full-time program including the summer months. Some of the courses will be offered by visiting instructors from abroad with industrial experience. Therefore, it might be necessary those courses to be offered in an intensive lecture program of one or more full weeks. The students will be notified on time on the detail class schedule.

Term	Period		Course		ECTS
Prep. Period	August		Prerequisite Subjects		
1	Sep-Oct	PET 501	Introduction to Petroleum Engineering		8
		PET 511	Petroleum Geology		8
2	Nov-Dec	PET 521	Drilling Operations		8
		Elective	PET 512	Applied geophysics: seismic interpretation	8
			PET 502	Hydrocarbon law & economics	
		PET 561	Fall Semester Seminars in Petroleum Engineering		1
3	Jan-Feb	PET 513	Formation Evaluation		8
		PET 522	Well and subsea completions and production facilities		8
4	Mar-Apr	PET 531	Reservoir Engineering		8
		Elective	PET 541	Petroleum Geomechanics	8
			PET 503	Health, Safety, Environmental assessment and control in petroleum operations	
		PET 562	Spring Semester Seminars in Petroleum Engineering		1
5-6	May-Aug	PET 532	Natural Gas Production Engineering		8
		PET 551	Project in hydrocarbon exploration and production		16

Course descriptions

It is reasonable to expect some changes in the program and courses description with an overall objective to improve the program. After the number, name and description of each course, there might be an indication of any prerequisite course that a student needs to attend successfully before registering to the course.

PET 501 Introduction to petroleum engineering (8 ECTS)

Overview of petroleum engineering, Oil and Gas industry, Petroleum origin and migration, nature of oil and gas reservoirs, petroleum exploration, drilling, formation evaluation, completion and production, reservoir engineering methods of oil resource estimation and optimization, surface facilities, enhanced oil recovery.

PET 502 Hydrocarbon law & economics (8 ECTS)

History and evolution of oil and gas law, Cyprus Hydrocarbon Law, regulatory agencies, production sharing agreements, joint operating agreements, unitization agreements, basics of contract law and marketing, case studies.

Fiscal systems, cash flow and economic indicators, upstream petroleum economics, midstream and downstream petroleum economics, managing and mitigating uncertainty and risk, sensitivities, simulations and decision analysis, valuing petroleum assets, portfolios and companies

PET 503 Health, Safety & Environmental assessment and control in petroleum operations (8 ECTS)

Impact of drilling, completion and production operations, environmental transport of petroleum wastes, planning for health, safety & environmental protection, waste treatment methods, waste disposal methods, remediation of contaminated sites, environmental regulations, sensitive habitats, emission control, Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA).

PET 511 Petroleum geology (8 ECTS)

Basics of petroleum geology, geological time, plate tectonics, structural types and stratigraphies, rock type characteristics and identification, age determination, paleontology, engineering geology. Basin analysis, prospect generation based on a model system, source rocks, oil generation and maturation, migration of fluids, trapped structures and seal. Seismic and log correlation, risk assessment, analysis, modeling and simulation.

PET 512 Applied geophysics: processing, imaging and interpretation (8 ECTS)

Principles of geophysics: Potential and imaging techniques, gravitational, electromagnetic and seismic data acquisition including instrumentation for land and marine surveys.
Processing of seismic reflection data: Wave equation, Fourier analysis, deconvolution, velocity analysis and statics correction, stacking, migration.
Advanced topics: full-waveform inversion and seismic anisotropy.
Seismic interpretation: Stratigraphic and structural systems. Marine sedimentological systems, sedimentary sequences, and unconformities in time and space, time evolution of buried channels. Identification of faulting systems, faults reactivation. BSR and gas hydrates, sedimentary structure of continental margins, transform basins. Practical training in 2D and 3D seismic data.

PET 513 Formation evaluation (8 ECTS)

Introduction to formation evaluation methods. Determination of rock and fluid properties, evaluation of petroleum-bearing formations, core and cutting analysis, mud logging, wireline logging, measurement while drilling (MWD), drill stem test (DST) and wireline formation testing, RFT, MDT.

PET 521 Drilling operations (8 ECTS)

Introduction to drilling engineering and operations, budgeting, equipment, rig design, drilling risers, wellheads and blow-out prevention (BOP), string design, drilling bits, drilling hydraulics, fluid systems, drilling fluids, casing design, pore pressure and fracture pressure prediction, mud-density, basic well control, horizontal drilling, multilateral drilling, drilling measurements. Deep water platforms, floating drilling vessels, types of motion, station keeping, motion compensation, special problems in floating drilling, shallow water flows, drilling deep water, high pressure risers, deep water casing design and running procedures, deep water cementing, deep water well control.

PET 522 Well and subsea completions and production facilities (8 ECTS)

Well completions: inflow and outflow performance, production analysis of subsurface systems, well completion methods and procedures, perforating techniques, formation damage, flow restrictions, fracturing process, sand control methods, producing bottom hole pressure (BHP), tubing selection, design, and installation, single and multi-phase flow in piping, gas lift, electrical submersible pump (ESP), hydraulic pumping, cavity pumping (PCP), plunger lift.

Subsea completions and production facilities: offshore production, design and building blocks of subsea engineering, different types of subsea completions, flow assurance, subsea production systems and equipment, production control systems, costs of subsea equipment, operations, maintenance and integrity of subsea systems, advanced and new subsea technologies, Most Efficient Rate (MER), choke design, productions systems, gas and oil measurement, control systems, safety systems, production systems, optimization of operations. Design and codes, construction, corrosion, maintenance, regulations, decommissioning

PET 531 Reservoir engineering (8 ECTS)

Material balance concepts, phase behavior, fluid saturations, compressibility, wettability and capillary, permeability and relative permeability, porosity, Darcy's law, pressure drop, diffusivity, flow regimes, steady-state, pseudo-steady-state and transient flow, radial flow, well models, skin factors

Reservoir types, reservoir drive mechanisms, reserves determination, deterministic (volumetric & material balance) and probabilistic techniques, production forecast using decline analysis empirical methods, non-conventional gas reservoirs, well test design, planning and analysis, reservoir damage, fluid coning and water influx, secondary and tertiary recovery, schemes. Planning, predicting oil recovery and performance, reservoir monitoring, horizontal well application, enhanced oil recovery, water-flooding

PET 532 Natural gas production engineering (8 ECTS)

Gas reservoirs, properties of natural gases, PVT modeling, gas-wellbore performance, gas well test, gas-wellhead choke performance, deliverability of gas wells, horizontal wells, smart wells. Gas condensates, liquid separation process of natural gases, vertical lift, separation equipment, gas processing and treatment, CO2 and H2S removal, fractionation and adsorption, dehydration processes of natural gases, gas-metering techniques. Transportation and storage of natural gases,

pipelines and compressed natural gas (CNG), compression and cooling of natural gases, thermodynamics of LNG processes, heat transfer, pumps, refrigeration, fractionation/ distillation, LNG liquefaction technologies. Gas to liquids (GTL), economics analysis of production.

PET 541 Petroleum geomechanics (8 ECTS)

Elasticity and plasticity theories and rock failure mechanisms, acoustic wave propagations in rocks, mechanical properties from laboratory tests and field data, stresses around wellbore and failure mechanisms. Applications: wellbore stability, sand prediction, fracturing, reservoir compaction, casing collapse, subsidence, CO2 geological storage.

PET 551 Project in hydrocarbon exploration and production (16 ECTS)

The objective of the project is to integrate the topics studied in the courses. Groups of about 8-10 students are provided with field data available to the contractor before the field development decision. The team will describe the exploration and development of the prospect, followed by a production plan. The team must create the plan of the infrastructure to produce, transport and market the hydrocarbons.

During the project period students will attend a series of technical lectures on major work processes and technical decisions involved in exploration, development and operation of hydrocarbon fields. The lectures will review the life cycle of a field from prospect identification, exploration and production access rights and license, discovery, appraisal, commerciality decision, planning and design, project development, commissioning and production startup, production plateau period, production decline, production shutdown, field abandonment and facilities decommissioning.

The project students will have access to state-of-the-art computer hardware and industry standard software. The total project deliverables will include a written report with references to the geology, field development engineering, production processes and project economic. The student will be exposed to a range of transferable skills such as teamwork, presentation and negotiation. The assessment will be based on the written report and to group presentation.

PET 561 Fall semester seminars in petroleum engineering (1 ECTS)

The students register in the program must attend a number of seminars given by academic and professional experts in the field related to exploration and exploitation of hydrocarbons in the fall semester

PET 562 Spring semester seminar in petroleum engineering (1 ECTS)

The students registered in the program must attend a number of seminars given by academic and professional experts in the field related to exploration and exploitation of hydrocarbons in the spring semester

Information

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