M.Sc. Program in Petroleum Engineering

Petroleum engineering involves the application of earth sciences and physical sciences to the evaluation and exploitation of natural hydrocarbon resources. In the practical field, the development of reservoirs under increasingly adverse conditions poses new engineering problems. This requires skilled engineers capable of producing engineered solutions to current problems.

It is clear that the future exploitation of oil reservoirs in Saudi Arabia, for a secondary and tertiary crop of oil, requires intensive research over a long period. This calls for a steady output of highly trained petroleum engineering graduates.

The graduate courses are planned to emphasize the type of subject matter that addresses the petroleum production problems in Saudi Arabia. Additional courses may be added as the program progress. These include future courses on drilling, natural gas storage and utilization, and well logging. The program maintains a balance between the basic state–of–the–art technology and the particular needs of Saudi Arabia.

Requirements for Admission to the Master of Science Degree Program

1- Applicants for the Master's degree must hold the Bachelor of Science (B.Sc.) degree from King Saud University or an equivalent degree from another accredited university with the minimum grade of "Very Good". Applicants with overall ratings of “Good” can be conditionally accepted.

2- It is possible to accept students holding Bachelor of Science degree in other engineering branches. In this case, the department may require additional undergraduate courses that applicants must take and pass their exams from the first time with a minimum grade of “Good” and overall average grade of "Very Good".

Faculty Members

Professors:

Hamada, A.M.	Production Engineering
Al-Blehed, M.S.	Petroleum Economy & Energy
Ahmed, M. Kh.	Reservoir Engineering

Associate Professors:

Al-Awad, M.N.	Drilling Engineering & Rock Mechanics
Abdel Fattah , k h .m	Reservoir Engineering
Al-Homaidhi , E . S	Formation Evaluation Engineering
Desouky , S . E	Reservoir Engineering

Assistant Professors:

Al-Saddique, M.A.	Reservoir Engineering
Amro, M.M	Reservoir Engineering
Al-Sughayer, A.A.	Reservoir Engineering
Shokir , E . M .	Drilling Engineering
Gawish , A . A .	Reservoir Engineering
Hossain , M . M .	Drilling Engineering

Course Work Requirements:

The M.Sc. degree program in Petroleum Engineering contains the following three areas of specialization:

1- Petroleum Reservoir Engineering
2- Petroleum Production Engineering
3- Oil Well Drilling Engineering

The course work is divided according to the following:

1- The student takes 10 specialized mandatory units, which are common for all three areas of specialization as shown in Table 1.

2- The student takes 6 units of mathematics designated by the Department Council, for each accepted group of students, from the mathematical courses in Table 2.

3- The student takes 9 units in the area of his specialization determined by the Department Council, for each accepted group of students, from the group of specialized area courses in Table 3.

In addition, a thesis based on a research related to problems in the oil industry

Table 1. Mandatory Common Courses

Code No.	Course Title	Units
PE 510	Theory of Fluid Flow through Porous Media	3
PE 520	Advanced Drilling Engineering	3
PE 530	Advanced Petroleum Production Engineering	3
PE 546	Graduate Seminar	1

Table 2. Mathematics Courses

Code No.	Course Title	Units
MATH 503	Probability and Mathematical Statistics	3
MATH 505	Numerical Linear Algebra	3
MATH 506	Ordinary and Partial Differential Equations	3
MATH 507	Advanced Operations Research	3

Table 3. Specialized Courses

Path 1 - Petroleum Reservoir Engineering:

Code No.	Course Title	Units
PE 512	Water flooding	3
PE 513	Tertiary Oil Recovery	3
PE 515	Reservoir Simulator Development	3
PE 516	Advanced Natural Gas Technology	3
PE 518	Advanced Well Test Analysis	3
PE 543	Advanced Petroleum Economics	3
PE 545	Advanced Topics In Petroleum Engineering	3

Path 2 - Petroleum Production Engineering:

Code No.	Course Title	Units
PE 516	Advanced Natural Gas Technology	3
PE 531	Advanced Well Stimulation Technology	3
PE 532	Multiphase Fluid Flow In Conduits	3
PE 542	Reservoir Evaluation	3
PE 543	Advanced Petroleum Economics	3
PE 545	Advanced Topics In Petroleum Engineering	3

Path 3 - Oil Well Drilling Engineering:

Code No.	Course Title	Units
PE 521	Advanced Drilling Fluids Engineering	3
PE 531	Advanced Well Stimulation Technology	3
PE 541	Oil Exploration	3
PE 543	Advanced Petroleum Economics	3
PE 544	Rock Mechanics	3
PE 545	Advanced Topics In Petroleum Engineering	3

Brief Description of M.Sc. Courses

PE 510 Theory of Fluid Flow Through Porous Media 3(3,0)

Development of basic equations of fluid flow in Cartesian and polar coordinate systems for single phase and multiphase flow. Continuity equation, energy equation, and Darcy's law. Diffusivity equation for compressible and incompressible flow. Applications of fluid flow equations to various oil recovery processes. Solutions of the diffusivity equation and applications to transient analysis. Introduction to reservoir simulation.

PE 512 Water flooding 3(3,0)

Buckley-Leveret theory. Well patterns. Sweep efficiency and conformance. Cross flow. Approximate design methods. Surface equipment. Water treatment. Selective plugging and profile control.

PE 513 Tertiary Oil Recovery 3(3,0)

Chemical flooding methods, using surfactants, polymer, carbon dioxide, caustic, etc. Theories of oil entrapment and mobilization. Basic equations, theories and models. State-of-the art and field experience. Economics.

PE 515 Development of Reservoir Mathematical Models 3(3,0)

Finite difference schemes. Time and distance discretization. Stability criteria. Applications to petroleum reservoir flow equations: IMPES and simultaneous solution. Development of multi-dimensional, multi-phase reservoir simulator.

PE 516 Advanced Natural Gas Technology 3(3,0)

Phase relations of natural gas systems (ternary diagrams). Mathematical representation of phase behaviour. Gas analysis by spectrometry and chromatography. Design of gas pipelines. Advanced technology of underground storage of natural gas.

PE 518 Advanced Well Test Analysis 3(3,0)

The diffusivity equation, line source solution and applications, van Everdingen and Hurst solution, effect of skin and well bore storage, finite reservoirs and shape factors, use of pressure derivatives in well test analysis, pulse testing, the use of nonlinear regression in well test analysis, well testing

in horizontal wells. Prerequisite: PE 510

PE 520 Advanced Oil well Drilling Engineering 3(3,0)

Drilling problems, blowout control, loss circulation, solids controlled equipment, prediction of fissures and vugs pressure, directional drilling, horizontal drilling, complete well planning, corrosion problems in drilling engineering.

PE 521 Advanced Drilling Fluids 3(3,0)

Equipment and procedures for evaluating drilling fluids performance, clay mineralogy and colloid chemistry of drilling fluids, rheology of drilling fluids, filtration properties of drilling fluids, surface chemistry of drilling fluids, drilling problems related to drilling fluids, completion, work over and packer fluids.

PE 530 Advanced Production Engineering 3(3,0)

Inflow performance relationships, reservoir considerations, in well completions, completion and work over fluids, vertical flow by intermittent slugs, problems in well analysis, surface and separation facilities for oil, water and gas, choice of optimal production system.

PE 531 Advanced Well Stimulation 3(3,0)

Theories of hydraulic fracturing, mechanics of fracturing, and rheology of fracturing fluids. Acid treatment. Models of matrix acidizing. Evaluation of stimulation operations.

PE 532 Multiphase Fluid Flow in Conduits 3(3,0)

Introduction. Mathematical and physical bases for pressure loss calculations in multiphase flow. Vertical multiphase flow. Horizontal multiphase flow. Multiphase flow in inclined pipes, and in directionally drilled wells.

PE 541 Petroleum Exploration 3(3,0)

Land and marine gravity, and land and airborne magnetometer surveys. Interpretation. Modern methods of seismic surveying and of data interpretation. Seismic maps and sections. Remote sensing.

PE 542 Petroleum Property Evaluation 3(3,0)

Elements of evaluation and economic systems governing value. Reservoir tools and their use to determine value. Geological input to evaluation. Principles of risk and uncertainty.

PE 543 Advanced Petroleum Economics 3(3,0)

Exhaustible and renewable energy sources, international oil and gas market, oil and gas supply and demand, oil and gas prices, energy modeling and forecasting, competition and switching between fuels, the role of strategic oil inventory, risk analysis and uncertainty.

PE 544 Rock Mechanics 3(3,0)

Analysis of stress and infinitesimal strain, friction, elasticity and strength of rock. Linear elasticity. Laboratory testing. Fluid pressures and flow in rocks. Behavior of ductile materials. Further problems in elasticity. Crack phenomena and the mechanisms of fracture. The stage of stress underground. Strain waves.

PE 545 Advanced Topics in Petroleum Engineering 3(3,0)

The department will select a newly developing area in petroleum engineering for offering.

PE 546 Graduate Seminar 1(0,2)

Each participating student will present one of the subjects in petroleum engineering and discussion will be initiated from the participating students, faculty members and audience.