Master of Science in Petroleum Engineering and Geosciences
Program code: 200015

INTRODUCTION

The Colleges of Engineering and Petroleum, and the College of Science offer a joint Master's degree program in **Petroleum Engineering and Geosciences**. The aim of the program is to produce world-class graduates that can be an asset to the region at large, and to provide the industry with students that are prepared for long-life learning, capable of being productive contributors for the oil and gas industry, capable of working well in teams, and aware of the environment. The program features thesis and non-thesis options.

PROGRAM REQUIREMENTS

33 (33) TOTAL COURSE CREDITS

18 (24) COMPULSORY SUBDISCIPLINE COURSES (3 credits each)

A thesis-track student is required to take 9 credits from each subdiscipline, while a project-track student is required to take 12 credits from each subdiscipline.

A- Petroleum Engineering

2090-511 Geo-Statistics
2090-512 Formation Evaluation
2090-514 Petroleum Economic Evaluation
Equivalent to 0650-545 Economic Evaluation of Petroleum Reservoirs
2090-542 Reservoir Modeling
Equivalent to 0650-521 Advanced Reservoir Simulation

B- Earth and Environmental Sciences

2090-530 Subsurface Geophysical Methods
2090-533 Basin Analysis and Relation to Petroleum Exploration
2090-535 Advanced Stratigraphy
Equivalent to 0460-539 Advanced Stratigraphy
2090-539 Carbonate Sediments and Evaporites
Equivalent to 0460-535 Carbonate Sediments and Evaporates

6 (6) ELECTIVES COURSES (3 credits each)

2090-541 Core Analysis
2090-543 Environmental Aspects of Oil Field Operations
2090-550 Advanced Well Stimulation
2090-552 Terrigenous Clastic Depositional Systems
2090-553 Geophysical Methods in Petroleum Geosciences
2090-560 Characterization of Naturally Fractured Reservoirs
Equivalent to 0650-547 Characterization of Naturally Fractured Reservoirs

2090-562 Advanced Well Logging
2090-591 Special Topics in Petroleum Engineering and Geosciences

9 (3) COMPULSORY COURSES

2090-592	Seminar	(0)
2090-593	Project (Non-thesis option)	(3)
2090-597	Thesis	(0)
2090-598	Thesis	(0)
2000-599	Thesis	(9)

COURSE DESCRIPTION

2090-511: GEOSTATISTICS
CR: 3

Review of Probability and Statistics, Data Correlation/Regression, Variogram and Variogram Modeling, Linear Regression, Kriging-Cokriging Variations, Conditional Simulation, Sequential Simulation, Simulated Annealing, Uncertainty Assessment, Integration of Seismic and Well Data, Scales and Resolution, Sequential Simulation with Block Krigging, Bayesian Approach, Geostatistical Inversion, Modeling Facies Variations, Lithofacies Characterization, Object-Based Modeling, Indicator Methods.

2090-512: FORMATION EVALUATION
CR: 3

Formation Evaluation using Core analysis, Formation Evaluation using Open Well Logs, Well testing, Noise logging, Temperature Surveys, Radioactive tracer logging, Spinner-flowmeter logging, Formation Damage caused by Asphaltene deposition, Wax deposition, Inorganic scale deposition, Fines migration and Clay Swelling.

2090-514: PETROLEUM ECONOMIC EVALUATION
CR: 3

Economics of the upstream sector in all its aspects: reserves, players (international oil companies, national oil companies, and service companies), investments, costs and benchmarking, certainty economics applied to petroleum projects cash flow including taxation, application of uncertainty analysis and the use of statistical and probabilistic properties of reservoir description, standard methods of investment analysis when risk has to be coped with.

2090-530: SUBSURFACE GEOPHYSICAL METHODS
CR: 3

Advanced geophysical methods including seismic and well logging. Review of the principles of seismic exploration procedures. Relation of seismic reflections to significant geological features, seismic facies. Stratigraphic interpretation of seismic facies and unconformities. Review of principal of well logging techniques and types (SR, GR, resistivity, Neutron and density, dipmeter, etc..). Log correlation. Integration of geophysical data in subsurface mapping (structure maps, faults, isopach map). Cross-sections, fence diagrams.

2090-533: BASIN ANALYSIS AND RELATION TO PETROLEUM EXPLORATION
CR: 3

Basin evolution. Hydrocarbon occurrence. Plate tectonic interactions, sedimentary column and rock types and their conductivities, thermal effects on the basins. Type of basins and related to petroleum potential: divergent rifted type basins, subduction orogenic convergent type basins. Basin subsidence rate. Case study: Arabian-Iranian Basin.

2090-535: ADVANCED STRATIGRAPHY
CR: 3

Scope of stratigraphy. Analysis and classification of sedimentary basins (architecture, geometry and tectonic evolution). Basic well-log analysis. Advanced methods in stratigraphic analysis with particular emphasis on statistical methods (cluster and trend surface analysis and other multivariate

techniques). Magnetic and seismic stratigraphy. Data collection, reduction and interpretation. Case study from Kuwait and Arabian Gulf Region.

2090-539: CARBONATE SEDIMENTS AND EVAPORITES
CR: 3

Skeletal and non-skeletal components of carbonate sediments and their mineralogical stability in marine environments for formation of the major carbonate particles type (e.g. oolites, pisolites, stromatolites, peloids, grapestones and micrites). Diagenetic alteration. Factors controlling deposition and formation of Recent dolomite. Element distribution in carbonates and its relationships to activity of organisms. Carbonate cements. Sabkhas and evaporate generation. Thermodynamic treatment of the carbonate and evaporate system. Techniques used in carbonate and evaporate mineralogy (e.g. petrographic, staining, XRD and SEM, AA).

2090-541: CORE ANALYSIS
CR: 3

Error Analysis, Porosity Determination, Permeability Determination, Retort Techniques for Saturations Determinations, Special Core Analysis: Core Preservation Techniques, CT Imaging and Application to Core Analysis, Capillary Pressure Measurement Techniques, Electrical Resistivity Measurements, Measurement at Overburden Pressure, Wettability, Relative Permeability Measurement Techniques, Rock Wettability Evaluation Techniques.

2090-542: RESERVOIR MODELING
CR: 3

Steps involved in the development and application of numerical reservoir simulator models to primary and secondary recovery processes in reservoir engineering. Model Formulation, General Material Balances, Single Phase Flow, Overall Program Structure, Finite Difference Approximations, Boundary and Initial Conditions, Well Model, Anisotropy, Truncation Error, Grid Selection, Stability Analysis, Non-linear Problems, Multiphase Flow Models, IMPES Solution, Simultaneous Solution, Stability of Multiphase Flow PDEs, Reservoir Framework, Relative Permeability, Transmissibility in Multiphase Flow, Effective Relative Permeability, Capillary-Gravity Equilibrium, Model Initialization, Reservoir Characterization.

2090-543: ENVIRONMENTAL ASPECTS OF OIL FIELD OPERATIONS
CR: 3

Administrative Aspects, Consequences of Petroleum-Derived Pollution in the Terrestrial Environment, Consequences of Petroleum-Derived Pollution in the Marine Environment, Production Operations and the Environment, Underground Waste-Water Disposal, Offshore Operations and the Environment, Ocean Transportation, Offshore Contingency Plans for Containment and cleanup, Behavior of Petroleum on the Sea Surface and the Effect of Weathering, Sampling, Instrumentation, Analysis and Interpretation for Oil and Effluents, Pollution Control Instrumentation.

2090-550 ADVANCED WELL STIMULATION
CR: 3
PR: 2090-512

Diagnosis of formation damage, rate decline analysis, types of formation damage, water injection problems, stimulation methods, candidate selection and planning of stimulation operations.

2090-552: TERRIGENOUS CLASTIC DEPOSITIONAL SYSTEMS
CR: 3

Examination of modern marine and non-marine depositional environments dominated by terrigenous sediments; processes, characteristics and relationships that dominate in these settings, emphasis on characteristic styles of fluvial, deltaic, shore-zone, shelf and slope depositional systems, and on responses of sediment to the processes that operate in these environments. Criteria for recognizing these environments and processes in ancient terrigenous sequences will be reviewed.

2090-553: GEOPHYSICAL METHODS IN PETROLELUM GEOSCIENCES
CR: 3

Principles and applications of field geophysical techniques, the geophysical methods used to asses the configuration and physical properties of the Earth's subsurface, as well as, to explore for natural resources. The course emphasizes the recording, reduction, presentation of gravity, magnetic, electric, seismic and electromagnetic data.

2090-560: CHARACTERIZATION OF NATURALLY FRACTURED RESERVOIRS
CR: 3

Origin of fractures, classification of fractures, petrophysical properties of fractured reservoirs, well testing in fractured reservoir, detection and identification of fractured reservoirs, modeling fractured reservoirs.

2090-562 ADVANCED WELL LOGGING
CR:3
PR: 2090-512

Evaluating formations for hydrocarbon shows using NMR logging and routine logs in low resistivity/low contrast pay zones, tight sandstone and carbonate rocks, and heavy oil reservoirs. A particular emphasis is reserved for fluid typing, lithology identification, permeability evaluation, and shaly sand analysis.

2090-591: SPECIAL TOPICS IN PETROLEUM ENGINEERING AND GEOSCIENCES
CR: 3

An upper division of graduate technical elective, treating topics in Petroleum Engineering and Geology. Topics of this course are mostly not covered in the other courses. The topics are chosen at the discretion of the Graduate Program Committee.

2090-592: SEMINAR
CR: 0

2090-593: PROJECT
CR: 3

The student undertakes an independent project on a research topic of theoretical and/or experimental focus under the supervision of a faculty member listed in the supervisory list of the College of Graduate Studies. The objective is to provide the student with an opportunity to integrate and apply the knowledge gained throughout the course of study in a practical problem. The student must document the project in a scientific report following standard research writing guidelines and give a public presentation to the project examination committee.

2090-597 Thesis
CR:0

2090-598 Thesis
CR:0

2000-599 Thesis
CR:9