FACULTY OF ENGINEERING (FE)

Graduation Requirements

To receive a Bachelor of Engineering Degree in any of the engineering programs a student must satisfactorily complete 150 credit hours with an overall minimum grade point average (GPA) of 2.0. Additionally s/he must attain at least a "C" average in specific courses set by each program. The following table summarizes the number of credits required for each Bachelor granting program in the FE.

Program	Common Requirements			Program Requirements			Total Credit Hours
	General Education	Basic Sciences / Mathematics	General Engineering	Major Core	Free Engineering and Major Technical Electives	Internship & FYP*	
CVLE	20	26	14	73	12	5	150
COME	20	26	12	75	12	5	150
COMP	20	26	12	75	12	5	150
POWE	20	26	16	71	12	5	150
BIME	20	26	7	80	12	5	150
INME	20	26	15	72	12	5	150
MCHE	20	26	15	72	12	5	150
PTRE	20	30	15	68	12	5	150
CHME	20	39	15	59	12	5	150
CVLE: Civil Engineering COME: Communications and Electronics Engineering COMP: Computer Engineering POWE: Electrical Power and Machines Engineering BIME: Biomedical Engineering INME: Industrial Engineering MCHE: Mechanical Engineering PTRE: Petroleum Engineering CHME: Chemical Engineering							
*FYP: Final Year Project							

Common Requirements

The following are the descriptions of the curricular components that are common to all programs offered in the Faculty of Engineering.

I. General Education

Student working for a BE degree in an engineering program must complete a total of 20 credit hours of general education (university and faculty) requirements distributed as follows:

I.A. General Education Core (12 credits)

This curricular component includes 6 courses comprising 12 credits; 3 courses (total of 5 credits) are University Requirements (UR) and 4 courses (total of 7 credits) are Faculty requirements (FR) as listed in the following table:

Course	Title	Credits	Prerequisite
University Requirement			
ARAB 001	Arabic Language	2	
BLAW 001	Human Rights	1	
ENGL 001	English Language	2	
Faculty Requirement			
ENGL 211	Advanced Writing	2	ENGL 001
ENGL 300	Speech Communications	2	ENGL 211

MGMT 002	Entrepreneurship I	2	
ENGR 001	Engineering Ethics	1	Finish ≥ 90 Crs

Descriptions of the General Education core courses are given below.

ARAB 001 Arabic Language (2Crs.: 2Lec,0Lab): تقديم إطار عام للغة العربية لغير المتخصصين، وتتناول الموضوعات التالية: العربية بين لغات العالم، النظام الصوتي، النظام الصرفي، النظام النحوي والنظام الكتابي، كما تتناول العربية والتعريب، والعربية والحاسوب، ثم كيف تكتب مقالاً علمياً.

BLAW 001 Human Rights (1Cr.: 1Lec,0Lab): This course aims at introducing students to the principles of human rights and its foundations. The importance of human rights in our societies, not only from a theoretical point of view but rather more from a practical one, is highlighted. Special attention is given to certain global themes on human rights, which touch on critical topics related to our society. It also covers the following topics: Human rights, key values of human rights and other values, characteristics of human rights, history of human rights, some problematic cases, the evolution of human rights, the implementation of human rights and NGOs, human rights in Lebanon, children, citizenship, democracy, discrimination and xenophobia, education, and gender equality. Lectures are in English.

ENGL 001 English Language (2Crs.: 2Lec,0Lab): A general course that enhances the language skills and provides coverage of basic grammar, vocabulary, reading, and writing for foundation students. It deals with basic competence in reading, through exercises on getting main ideas, guessing meaning from context, understanding details, predicting and inferencing. Writing development from paragraph to composition, proceeding through writing is the focus of the course. Writing and reading build vocabulary through exercises and dictionary use and clause exercises. The latter develop grammar where the use of nouns, verbs, adjectives, and adverbs, transition signals, the reconstructing of sentences and main and subordinating clauses is practiced.

ENGL 211 Advanced Writing (2Crs.: 2Lec,0Lab): Students write essays on different topics related to argumentation or presentation of concepts and ideas in an organized manner. This is in addition to descriptive, narrative, reflective, and creative writing. Topics chosen are related to the students' culture diagram as well as current affairs. The ability of students to write academically and classify and organize ideas is stressed. ***Pre-req.: ENGL 001.***

ENGL 300 Speech Communications (2Crs.: 2Lec,0Lab): Basic oral communication principles and theories; body, intonation, and stress language considerations; speaker-listener relationship; speech topic, context and audience; planning, preparing and delivering of platform speeches; showcase and spotlight ideas; group interactions; projects and formal presentations. ***Pre-req.: ENGL 211.***

MGMT 002 Entrepreneurship I (2Crs.: 2Lec, 0Lab): An introductory course designed around the development of business plan. The course examines how to formulate business ideas, select a location, select a legal form of organization, locate financing source, assess the market, and develop a human resources management system.

ENGR 001 Engineering Ethics (1Crs.: 1Lec, 0Lab): Ethical issues in the practice of engineering, corporate responsibility; personal rights; honesty, ethical aspects of safety, risk and liability and conflicts of interest; environmental issues and sustainability; codes of ethics; emphasis on developing the capacity for independent ethical analysis of real cases. ***Pre-req.*: earned 90 crs.**

I.B. General Education Electives (8 credits)

This component encompasses 8 Credits of General Elective courses selected from the University Elective Courses listed in the University Section of this catalog.

II. Basic Sciences and Mathematics Courses

The Basic Sciences and Mathematics component for all engineering majors except the PTRE program consists of 26 credits (27 credits for the PTRE program and 36 credits for the CHEM program) distributed as follows:

Course	Title	Credits	Prerequisite
CHEM 241	Principles of Chemistry	3	
CHEM 207/CHEM 405	Environmental Chemistry/Solid State Chemistry	2	
MATH 281	Linear Algebra	3	
MATH 282	Calculus	3	
MATH 283	Differential Equations	3	MATH 281, 192
MATH 284	Numerical Analysis	3	MATH 283
MATH 381	Probability and Statistics	3	MATH 282
PHYS 281	Electricity and Magnetism	3	

PHYS 282	Materials Properties and Heat	3	

Instead of the CHEM 207/CHEM405 and the CHEM 241 courses, the PTRE program requires the following three 9-credits chemistry courses instead:

- CHEM 281: Principles of Chemistry I (3 Credits)
- CHEM 282: Principles of Chemistry II (3 Credits)
- CHEM 331: Organic Chemistry (3 Credits)

Instead of the CHEM 207/CHEM405 and the CHEM 241 courses, the CHME program requires the following six 18-credits chemistry courses instead:

- CHEM 248: Physical Chemistry I (3 Credits)
- CHEM 281: Principles of Chemistry I (3 Credits)
- CHEM 282: Principles of Chemistry II (3 Credits)
- CHEM 331: Organic Chemistry (3 Credits)
- CHEM 345: Inorganic Chemistry (3 Credits)
- CHEM 358: Surface and Colloid Chemistry (3 Credits)

Descriptions of the required mathematics and basic sciences courses are given below.

CHEM 207 Environmental Chemistry (2Crs.: 2Lec,0Lab): Chemistry of ozone layer in the atmosphere; particulate matter and control of air pollution; global warming; waste management, treatment and disposal; mass-energy transfer; risk, dose response and human exposure assessment; hazard identification; risk characterization; water resources and pollutants; BOD and waste water.

CHEM 241 – PRINCIPLES OF CHEMISTRY (3Cr.:3 Lec): A study of the fundamental concepts of chemistry including matter and measurement, atoms, molecules, ions, moles, nomenclature, atomic and molecular weights. Stoichiometry. Chemical reactions, quantitative calculations. Periodic table, atomic structure, periodic properties of the elements, chemical bonding, molecular structure. The gaseous, liquid, and solid states of matter. Properties of solutions, aqueous reactions and solution stoichiometry. Thermochemistry, chemical thermodynamics, chemical kinetics, chemical equilibrium, acids, bases and ionic equilibria, and nuclear chemistry.

CHEM 248 Physical Chemistry I (3Crs.:3Lec): The course covers principles and applications of the first and second laws of thermodynamics. Third Law of Thermodynamics, entropy and free energy changes in chemical reactions, Thermodynamic of solutions. Phase equilibria in heterogenous systems. Phase rule and its application in one, two and three component systems. Pre-req.: CHEM 282.

CHEM 281 Principles of Chemistry I (3Crs.: 3Lec,0Lab): Introduction to the basic concepts and principles of chemistry including: Atoms, molecules, mole concept, chemical reactions and calculations, stoichiometry. Periodic table and properties of the elements, nomenclature. Theories of atomic structure, atomic spectra. Theories of chemical bonding. Covalent bonding and molecular structure: molecular geometry, VSEPR theory, valence bond theory, hybrid orbital and molecular orbital theory.

CHEM 282 Principles of Chemistry II (3Crs.: 3Lec,0Lab): Topics discussed are the three physical states of matter (gases, liquids and solids). Properties of solutions. Chemical equilibrium. Ionic equilibria. Rates of chemical reactions. Introduction to the basic chemical thermodynamics and thermo-chemistry. ***Pre-req.:CHEM281.***

CHEM 331 Organic Chemistry (3Crs.:2Lec,2Lab): Introduction to organic chemistry. A new mechanistic approach to the study of the chemical reactions and a survey of hydrocarbons, alcohols and ethers. Detailed study of aromatic compounds, aldehydes, ketones, carboxylic acids and their derivatives, and amines. The course also introduces students to spectroscopic identification of organic compounds. Applied experiments related to the above topics. ***Pre-req.: CHEM281.***

CHEM 345 – Inorganic Chemistry I (3Crs.:3Lec,0Lab): Brönsted and Lewis acid and base. Chemistry of main group elements. Basic concepts of coordination compounds: nomenclature, bonding, structure, stability, magnetic properties, stereochemistry. Crystal and ligand field theories. ***Pre-req.: CHEM 282.***

CHEM 358 Surface And Colloid Chemistry (3Crs.:3Lec): Basic terms in surface and colloid chemistry, the kinetic properties of disperse systems, interfacial phenomena, the optical and electrical properties of colloids, the preparation and stability of colloids, properties of gels, emulsion, foams and aerosol. ***Pre-req.: CHEM248***

CHEM 405 Solid State Chemistry (2Crs.:

2Lec,0Lab): Bonding in solids; crystal structures; x-ray diffraction; electron models; band theory; crystal defects; electrical, thermal, optical and magnetic properties of solid state materials from a chemical perspective; fabrication techniques and modern applications.

MATH 281 Linear Algebra(3Crs.: 3Lec,0Lab): Partial fractions; binomial theorem; roots of polynomial equations; convergence of series; Matrices: Determinants, rank, eigen values, eigenvectors, block decomposition, axes transformation solution of linear system of equations; introduction to complex analysis; conic sections; engineering applications.

MATH 282 Calculus (3Crs.: 3Lec,0Lab): Hyperbolic functions; implicit and logarithmic differentiation; derivatives of higher order functions; Leibniz theorem; mean value theorem; partial differentiation and applications; Taylor expansion; methods of integration; improper integrals; multiple Integrals; engineering applications.

MATH 283 Differential Equations (3Crs.: 3Lec,0Lab): First- and second-order differential equations with constant and variable coefficients; simultaneous system of differential equations; series solution; Introduction to partial differential equations; Fourier series; Laplace transforms; shifting theorems; convolution theorem; engineering applications. ***Pre-req.: MATH 281, MATH 282.***

MATH 284Numerical Analysis (3Crs.: 3Lec, 0Lab): Curve fitting; function approximation; iterative method for finding roots; solution of systems of linear equations; numerical differentiation and integrations; numerical solution for ordinary differential equations (first order, simultaneous system, second order); special functions; numerical analysis software; engineering applications. ***Pre-req.: MATH 283.***

MATH 381 Probability And Statistics (3Crs.: 3Lec, 0Lab): Probability space, conditional probability and independence, and probability theorems; Random variables, and density functions, joint probability; expectation, variance and covariance, moments and moment generating functions: Discrete and continuous distributions; statistical measures: mean, mode, variance, standard deviation; statistical distribution: t-distribution, chi- distribution; sampling theory; Theory of estimation, confidence intervals; probability and statistical software. ***Pre-req.: MATH 282.***

PHYS 281 Electricity and Magnetism (3Crs.: 3Lec, 0Lab):

Electric charges and Coulomb's Law; Electric field and potential of various charge distributions; electric dipoles; Gauss's Law in electricity; Capacitance and Dielectrics; Electric conduction current; Resistance and Temperature; Magnetic field of a solenoid; Gauss's Law in Magnetism; Electromotive force; Electromagnetic induction; Faraday's law; Self induction and inductance.

PHYS 282 Material Properties and Heat (3Crs.: 2Lec,2Lab): Properties of materials: units, dimensions, experimental errors, circular motion of rigid bodies, moment of inertia, compound pendulum, elasticity of materials, Hook's law, relations between stresses and strains, elastic energy, torsion, gravitation and gravity, satellite motion, pressure measurements, flow of ideal fluids, streamlines and equation of continuity, Bernoulli's equation and its applications, viscosity of fluids, flow in capillary tubes; Heat: heat and temperature, temperature measurements, specific heat and latent heat, heat transfer by conduction, heat convection, heat transfer by radiation and black body radiation.

III. General Engineering

The general engineering component includes 15 credits (12 credits for the ECE programs) distributed as follows:

Course	Title	Credits	Prerequisite
COMP 208	Programming I	3	
CVLE 210	Statics*	3	
INME 221	Engineering Economy	3	
MCHE 201	Engineering Drawings and Graphics*	3	
MCHE 213	Dynamics**	3	

*Not included in the curriculum of ECE programs, replaced by INME 423 Project Planning and Management (3 credits)

COMP 208 Programming I (3Crs.: 2Lec,2Lab): Computer fundamentals. Computer system components: hardware and software. Problem solving and flowcharts/pseudocode. High level programming: data types, structured programming constructs, input and output, expressions and assignments, selection, repetition, arrays.

CVLE 210 Statics (3Crs.: 3Lec,0Lab): Force vectors (analytical and graphical methods), free-body diagrams; equilibrium of particles and rigid bodies in

two and three dimensions; structural elements and supports; plane and space trusses; axial, shear, and moment diagrams of beams; Cable-supported structures. Friction; center of gravity and centroid; moment of inertia. Applications.

INME 221 Engineering Economy (3Crs.: 3Lec,0Lab): Basics principles and techniques of economic analysis of engineering project, time value of money, cost allocation and estimation, evaluation of engineering projects and investments, depreciation, inflation, bond and loan financing, after tax cash flow analysis, sensitivity analysis, selection among mutually exclusive alternatives using present worth, annual worth, internal rate of return, benefit-cost.

MCHE 201 Engineering Drawing and Graphics (3Crs.: 1Lec,4Lab): Constructional Geometry-constructing tangents. Plane curves and polygons. Orthographic drawing and theory of sketching shapes and surface identification. Orthographic projection of views. Sectional views and conventions. Pictorial drawing. Applications of Auto-CAD software for 2D drawings.

MCHE213 Dynamics (3Crs.: 3Lec,0Lab): Dynamics of a particle, system of particles, and planar rigid bodies using Newton's law of motion. Work and energy principle, impulse and momentum principle. Free-body diagram and concept of equilibrium. Inertia properties of rigid bodies.

Program Requirements

Requirements for the Bachelor of Engineering degree are program-specific. They encompass three categories: Major specific core courses, major specific elective courses, and engineering courses chosen from outside the major. The program requirements for the bachelor degrees in the different engineering majors are given hereafter. Details and titles of relevant courses are included in the Student's Study Plan (SSP) that is distributed to all engineering students.

DEPARTMENT OF CHEMICAL AND PETROLEUM ENGINEERING

Acting Chairperson	Dr. Rami Harkouss
Assistant Professors	Dr. Rami Harkouss
Full-time Instructors	Eng Hussein Ghorayeb
	Eng. Shareef El-Mustafa

Petroleum Engineering Program

Mission

The Chemical and Petroleum Engineering Department is devoted to educating exemplary petroleum engineers by instituting best learning practices that drives knowledge, build skills and competencies, and inspire the learner to define a purpose, develop a passion to forever learn, cultivate a sense of responsibility toward the profession, society and the environment, and attain the ability to confront challenges, and in so doing contribute to the advancement of the community, immediate and beyond.

Objectives

The educational objectives of the Petroleum Engineering (PE) program are determined to support career advancement of the graduates and as they pursue their career goals, the graduates will:

1. Be competent to handle complex petroleum engineering tasks requiring multifaceted skills.
2. Be recognized for their ability to pursue innovative solutions through creative integration of best practices.
3. Demonstrate career advancement and exhibit the habits and personal attributes to handle management and leadership roles.
4. Exhibit commitment to the wellbeing of the community and the environment in pursuant of relevant solutions.

Learning Outcomes

Upon completion of the program graduates shall be able to:

a. an ability to apply knowledge of mathematics, science, and engineering
b. an ability to design and conduct experiments, as well as to analyze and interpret data
c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d. an ability to function on multidisciplinary teams
e. an ability to identify, formulate, and solve engineering problems
f. an understanding of professional and ethical responsibility
g. an ability to communicate effectively
h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i. a recognition of the need for, and an ability to engage in life-long learning
j. a knowledge of contemporary issues
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Degree Requirements

The undergraduate curriculum for the degree of Bachelor of Engineering in Petroleum Engineering consists of 150 credit-hours of course work + ICDL, where the standard duration of study is 6 semesters.

Career Opportunities

Petroleum engineers attain a broad spectrum of skills sought by almost every relevant profession. Industries, enterprises, and service providers requiring petroleum engineering skills include: oil and gas production, refining and distribution, excavation, process, consulting, environmental institutions, and government. Most importantly, you can imagine something that never was and make it a reality! There is so much work to be done to guarantee the future of mankind and petroleum engineers can tap the possibilities through the spirit of innovation and entrepreneurism.

Program Overview

The **Student's Study Plan** is given to every student upon his/her enrollment. The PTRE curriculum consists of the following components:

I. Common Requirements	**Credits**
General Education Requirements	20
Basic Sciences and Mathematics	30
General Engineering topics	15
II. PE Program-Specific Requirements	**Credits**
A. Petroleum Engineering Core	59
B. Engineering topics from outside the major	9
C. Petroleum Engineering Technical Electives	12
D. Final Year Project	4
E. Internship	1

I. Common Requirements

The list of the Common Requirement courses and their descriptions are presented in the introductory pages of the Faculty of Engineering section in this catalog.

II. PTRE Program-Specific Requirements

A. Petroleum Engineering Core Courses

The Petroleum Engineering core courses are listed in the table below.

Course	Title	Credits	Pre-requisites
GEOL201	Physical Geology	3	
GEOL205	Geophysical Techniques	3	PHYS281
GEOL206	Principles of petroleum geology	3	GEOL201, MCHE201
GEOL401	Geology of Lebanon and Levantine Region	3	GEOL206
PTRE201	Introduction to Petroleum Engineering	3	
PTRE202	Reservoir Rock Properties	3	PTRE201
PTRE206	Petroleum Drilling Systems	3	PTRE201
PTRE301	Reservoir Fluids	3	PTRE202, MCHE339
PTRE303	Well Logging	3	GEOL206
PTRE306	Petroleum Geo-mechanics	3	MCHE319
PTRE308	Petroleum Production Technology	3	PTRE206
PTRE405	Well Testing	3	PTRE301
PTRE409	Reservoir Simulation	3	PTRE301, MATH284, COMP208
PTRE410	Reservoir Characterization	3	PTRE202, PTRE303
PTRE412	Drilling Technology	3	PTRE206
PTRE414	Gas Production Engineering	3	PTRE308 MCHE329
PTRE500	Research Methodology	2	ENGL300
PTRE511	Petroleum Refining Operations	3	CHEM331
PTRE512	Environment and Safety	3	PTRE306
PTRE513	Reservoir Engineering	3	PTRE301

Description of Core Courses

GEOL 201 PHYSICAL GEOLOGY (3Crs.:2Lec,2Lab): An introduction to the composition and structure of the earth from the atomic scale of minerals to the global scale of plate tectonics. Topics include the composition of minerals and rock, volcanism, earth structures, earthquakes, erosion and surface processes, geologic time, geologic hazards, and plate tectonics. In this course, attention will focus on the rocks, landscapes, surface erosional and depositional features, the agents that form them and scenic areas of Lebanon and Levantine region.

GEOL205 GEOPHYSICAL TECHNIQUES (3Crs.:2Lec,2Lab): Introduction to geophysics; Principles of exploration seismology and field procedures; Seismic reflection: how an image of the subsurface is generated and how to interpret it. The theory, instrumentation and field procedure of the magnetic techniques The reduction and interpretation of magnetic data. The theory, instrumentation and field

procedure of the gravity technique. The reduction and interpretation of gravity data.
Pre-req.: PHYS281.

GEOL 206 PRINCIPLES OF PETROLEUM GEOLOGY (3Crs.:2Lec,2Lab): Geological characteristics of the Earth, sedimentary rock fill of depositional basins, fundamental principles of petroleum geology, different settings in which accumulations of conventional oil and gas are found, Fundamentals source rock, reservoir, and trap studies; well log and seismic interpretation, petroleum geochemistry, and mapping. Migration pathways and reservoir traps, procedures adopted for assessing resources and reserves. ***Pre-req.: GEOL201, MCHE201***

GEOL 401 GEOLOGY OF LEBANON AND LEVANTINE REGION (3Crs.:3Lec,0Lab): The main features of Lebanon, the landscape, folds, faults, igneous features, rock types in Lebanon, fossils of Lebanon, minerals of Lebanon, Lebanon in its regional plate tectonic setting, resources of Lebanon, geologic hazards of Lebanon, the subsurface geology of Lebanon, The geology of Levantine region in regional scale. ***Pre-req.: GEOL206.***

PTRE 201 INTRODUCTION TO PETROLEUM ENGINEERING (3Crs.:3Lec,0Lab): Overview and history of the petroleum industry and petroleum engineering; Petroleum reserves, production and consumption statistics of the world; Structure of the petroleum industry; Composition, origin, migration and accumulation of petroleum; Oil traps. Petroleum exploration methods; Nature of oil and gas wells; Drilling History; Types of drilling rigs; Drilling equipment's; Introduction to drilling fluids; Special problems in Drilling; Cost; Data acquisition during drilling; Reservoir properties; Reservoir pressure and evaluation; properties and behaviors of reservoir fluids; Oil and gas production; The production system, Methods of oil production; Fundamentals of oil refining.

PTRE 202 RESERVOIR ROCK PROPERTIES (3Crs.:2Lec,2Lab): Understanding the basic properties of reservoir rocks and how they relate to the storage and production of oil and gas. Important concepts such as heterogeneity, capillary pressure, relative permeability, resistivity are included as part of the course. ***Pre-req.:.*** PTRE201

PTRE 206 PETROLEUM DRILLING SYSTEMS (3Crs.:3Lec,0Lab): Introduction to petroleum drilling systems, including fundamental petroleum engineering concepts, quantities and unit systems, drilling rig components, drilling fluids, pressure loss calculations, casing and well cementing. ***Pre-req:*** **PTRE201**

PTRE 301 RESERVOIR FLUIDS (3Crs.:2Lec,2Lab): Organic chemistry applied to Petroleum Engineering, Thermodynamics behavior of naturally occurring hydrocarbon mixtures; Evaluation and correlation of physical properties of petroleum reservoir fluids, including laboratory and empirical methods. Equations of State, Phase equilibria, and properties, Pressure Volume Temperature Analysis (PVT). ***Pre-req.:PTRE*****202*, MCHE339***

PTRE 303 WELL LOGGING (3Crs.:3Lec,0Lab): Basic formation evaluation concepts, borehole environment, principles of resistivity, radiation, thermal and elastic wave measurements and measuring tools, applications to formation evaluation using commercial software package. Lithology plots. Saturation, irreducible saturation and permeability studies from well logs. Shale sand analysis. Complex reservoir analysis. Wire-line Formation Testing. Integration of core, log, well test and seismic data evaluation. Cementing quality monitoring. Gun perforating. Production Monitoring. ***Pre-req.: GEOL206***

PTRE 306 PETROLEUM GEOMECHANICS (3Crs.:3Lec,0Lab): Introduction to applications of Geomechanics in oil and gas industry; stress/strain: estimation, transformation and Mohr circle representation; rock behavior under stress; rock index properties; rock mechanics lab tests; in-situ stresses and effective stresses; calculation of induced stresses around a wellbore using Kirsh's equations; mud weigh windows determination to mitigate wellbore failures; hydraulic fracturing. ***Pre-req.: MCHE319.***

PTRE 308 PETROLEUM PRODUCTION TECHNOLOGY (3Crs.:3Lec,0Lab): Overview of oil and gas properties. Engineering design of oil and gas processing equipment. Well completion design, reservoir deliverability and well flow performance concepts, tubing design and selection, completion equipment, artificial lift, production optimization, well stimulation. ***Pre-req.: PTRE206***

PTRE 405 WELL TESTING (3Crs.:3Lec,0Lab): Flow in porous media, pseudo-state, steady-state, unsteady-state flow, well testing methods used to determine well and reservoir parameters (DST, Build-Up, Drawdown tests...); Type curve analysis, Models for well testing, Evaluation of well performance by Saphir Simulation. ***Pre-req.: PTRE*****301**

PTRE 410 RESERVOIR CHARACTERIZATION (3Crs.:2Lec,2Lab): Definition of petroleum reservoir

heterogeneity using conventional methods and possible improvements to these methods. Reservoir rock properties and their spatial variations; estimation of reserves; introduction to theory and application of geostatistics to reservoir characterization; presentation of fundamental geostatistical concepts including: variogram analysis, estimation variance, kriging and stochastic simulations. Impact of geologic structure on oil recovery methods. Review of basic statistical concepts and methods. Reservoir rock and fluid property evaluation by statistical methods. Scale-up and simulator data Preparation. Emerging methods in petroleum reservoir characterization. ***Pre-req.: PTRE202, PTRE303.***

PTRE 409 RESERVOIR SIMULATION (3Crs.:2Lec,2Lab): Solution of production and reservoir engineering problems using state-of-the-art commercial reservoir simulation software, using data commonly available in industry. Emphasis on reservoir description, reservoir model design and calibration, production forecasting and optimization, economic analysis and decision making under uncertainty. ***Pre-req.: PTRE301, MATH284, COMP208.***

PTRE 412 DRILLING TECHNOLOGY (3Crs.:2Lec,2Lab): Well planning Design, trajectory design, Rig systems and Rig components and their functions; Types of formation pressures; Drilling Fluid Technology including laboratory experiments and empirical methods; Casing and primary cementing equipment; Hole conditions; Fishing tools; Directional and Horizontal Drilling and applications; ERD; Calculations to build sections; Kicks and blow outs; Well control methods. ***Pre-req.: PTRE*206**

PTRE 414 GAS PRODUCTION ENGINEERING (3Crs.:3Lec,0Lab): Vapor-liquid equilibrium, natural gas flow in wellbores and pipelines, networks, gas well unloading and solutions, metering, compressor design, special topics. ***Pre-req.: PTRE308, MCHE*329**.

PTRE 499 INTERNSHIP (1Cr) This is a professional training which should not be less than four weeks. The training is followed by a presentation session where the students are supposed to present what they have learned. ***Pre-req.: PTRE500***
Refer to the department policy for further details.

PTRE 500 RESEARCH METHODOLOGY (2Crs.:2Lec,0Lab): Steps for conducting a successful research: formulating a research problem, conceptualizing a research design, constructing an instrument for data collection, writing a research proposal, collecting data, processing & displaying data, writing a research report. ***Pre-req.: ENGL300***

PTRE 501 FINAL YEAR PROJECT I (1Cr) / PTRE 502 FINAL YEAR PROJECT II (3Crs) After completing 120 credits of course work, the student becomes eligible to sign up for the Final Year Project (FYP) that extends over two semesters; beginning in Fall-semester and ending in the following Spring-semester. The FYP experience requires students to work in teams to complete a specific project, submit a technical report, and give a presentation on a significant, relevant, and comprehensive engineering problem. The FYP is intended to stimulate student creativity and critical thinking, and build skills in formulating, designing, developing, building, communicating, and managing engineering projects. The project aims to provide students with a transitional experience from the academic world to the professional world. ***Pre-req.: PTRE500***
Refer to the Final Year Project Policy for more details.

PTRE 511 PETROLEUM REFINING OPERATIONS (3Crs.:3Lec,0Lab): Refining and associated downstream processing technologies, Refinery Products and Test methods, Refinery Units, Atmospheric and Vacuum distillation; Fluid Catalytic Cracking, Hydro-treating and Catalytic Reforming processes. ***Pre-req.: CHEM331***

PTRE 513 RESERVOIR ENGINEERING (3Crs.:3Lec,0Lab): Determination of reserves; material balance methods; aquifer models; fractional flow and frontal advance; displacement, pattern and vertical sweep efficiencies in waterfloods; enhanced oil recovery processes; design of optimal recovery processes; introduction and performance analysis of unconventional reservoirs. ***Pre-req.:PTRE*301**.

PTRE 512 ENVIRONMENT AND SAFETY (3Crs.:3Lec,0Lab): Environmental control technology for oilfield processes, crude oil and petroleum product terminals; storage tanks; EHS guidelines; wastewater treatment and disposal, chemical hazards; EHS for offshore oil and gas development; Golden rules to prevent accidents. ***Pre-req.: PTRE306***

B. Engineering topics from outside the major

This part of the PTRE curriculum includes 9-credits courses offered by other engineering programs. These courses are listed in the table below.

Course	Title	Credits	Pre-/Co-requisites
MCHE 319	Mechanics of Materials for PE	3	Pre: CVLE 210
MCHE329	Thermodynamics for PE	3	Pre: PHYS 282
MCHE339	Fluid mechanics for PE	3	Pre: PHYS 282

Descriptions of this group of courses are given below.

MCHE 319 MECHANICS OF MATERIALS for PE (3Crs.:3Lec,0Lab): Introduction to the mechanics of deformable bodies considering linear material response. Load-stress, stress-strain, and strain-displacement relations. Tension/compression of rods and trusses, torsion of shafts, bending in beams, bucking of columns, and pressure vessels. Analysis of combined loading. Mohr circle analysis. Stress-strain transformations. Statically indeterminate structures. ***Pre-req.: CVLE210.***

MCHE 329 THERMODYNAMICS for PE (3Crs.:3Lec,0Lab): Introduction and basic concepts. Properties of pure substances. Energy analysis of closed systems. Mass and energy analysis of control volumes. Second law of Thermodynamics. Entropy, gas power cycle, vapor power cycle, vapor refrigeration cycle, real gas, Gas-vapor mixtures and air conditioning. ***Pre-req.: PHYS*282**

MCHE 339 FLUID MECHANICS for PE (3Crs.:3Lec,0Lab): Fluid static, Forces on immersed surfaces,, buoyancy and stability of floating bodies, Fluid kinematics, fluid masses subjected to acceleration, vortex motion, hydrodynamics, momentum equation, Euler's and Bernouilli equations, fluid flow in pipelines, PI-Theorem. ***Pre-req.: PHYS*282.**

C. Petroleum Engineering Technical Electives

The PTRE curriculum includes four 3-credit hour courses as technical electives. The courses are chosen from the courses listed in the table below with their descriptions given thereafter.

Elective Courses			
Course	**Title**	**Credits**	**Pre- requisites**
PTRE413	Natural Gas Engineering	3	PTRE308
PTRE415	Fire Control Engineering	3	PTRE412
PTRE417	Hydrocarbon Phase Behavior	3	MCHE329
PTRE419	Petroleum Economy, Risk & Management	3	MATH381
PTRE 503	Crude Oil Processing	3	CHEM331
PTRE506	Process Instrumentation and Control	3	POWE212, MATH284
GEOL203	Sedimentary Rocks	3	GEOL202
GEOL314	Marine Geology	3	GEOL201
GEOL316	Carbonate Sedimentology	3	GEOL201
GEOL318	Petroleum Geology of Middle East	3	GEOL401, GEOL205
GEOL504	Seismic (3D) Stratigraphy and Interpretation	3	GEOL205
GEOL506	Structural Geology and Tectonics	3	PTRE303
GEOL507	Seismic Exploration	3	GEOL202
GEOL508	Fund. of Seismic Acquisition, Processing & Interpretation	3	GEOL507
GEOL509	Basin Evolution and Hydrocarbon Resources	3	GEOL206
CMPS322	Digital Image Processing for Petroleum Engineering	3	COMP208

Description of Technical Elective Courses

CMPS 322 DIGITAL IMAGE PROCESSING FOR PETROLEUM ENGINEERING (3Crs.:2Lec,2Lab): Introduction; image sensing and acquisition; some basic gray level transformations for oil slick image enhancement; image contrast enhancement using histogram processing for oil slick; image smoothing using spatial filters; image sharpening using Spatial filters; point, line and edge detection for oil slick; optimal global and adaptive thresholdings for oil slick Image Segmentation. ***Pre-req.: COMP208***

GEOL 203 SEDIMENTARY ROCKS (3Crs.:3Lec,0Lab): Provides a general introduction to sedimentary rocks, sedimentary processes, and the depositional environments in which these rocks form. The course covers classification and knowledge of sedimentary rocks, sedimentary processes and environments, and the relationship of sedimentary rocks and plate tectonics. Laboratories focus on the identification of sedimentary rocks and structures in hand specimen. ***Pre-req.: GEOL202.***

GEOL 314 MARINE GEOLOGY (3Crs.:3Lec,0Lab): Introduction to marine geology, a brief review of the formation of the ocean basins is presented, followed by a detailed study of the ocean margins. Sedimentary processes operating in the fluvial, estuarine, near shore and continental-shelf regions will be discussed, as well as sea-level history. ***Pre-req.:-GEOL201.***

GEOL 316 CARBONATE SEDIMENTOLOGY (3Crs.:3Lec,0Lab): Discussion of the origins, classification, and criteria of recognition of carbonate accumulations from different depositional environments. ***Pre-req.: GEOL201.***

GEOL 318 PETROLEUM GEOLOGY OF MIDDLE EAST (3Crs.:3Lec,0Lab): Provides an integrated tectonic, stratigraphic, paleogeographic, and structural framework for the region to evaluate known and frontier petroleum areas. ***Pre-req.: GEOL401, GEOL205.***

GEOL 504 SEISMIC STRATIGRAPHY AND INTERPRETATION (3D SEISMIC) (3Crs.:3Lec,0Lab): The stratigraphic significance of seismic reflectors –Identification of depositional sequences – Age determination of depositional sequences – Recognition and analysis of the seismic facies present in terms of reflector geometry, continuity and amplitude and mapping their distribution- Interpretations of relative changes of sea-levels. Hands-on exercises provide practice in: identifying examples of reflection terminations (onlap, downlap, toplap), identifying depositional sequence boundaries on seismic sections on the basis of reflector terminations, determining the age of seismic sequences, identifying different seismic facies on seismic sections, and constructing chronostratigraphic summary chart from suitable seismic sections or geological cross-sections. ***Pre-req.: GEOL205***.

GEOL 506 STRUCTURE GEOLOGY & TECTONICS (3Crs.:3Lec,0Lab): Fundamental concepts, principles and methods in global tectonics and structural geology. The course covers global plate tectonics and analytical methods in plate kinematics, including an understanding of tectonic motions on a sphere. The structure and geodynamics of the mantle are examined in relation to the driving forces of plate tectonics, and to the principles of isostasy. Gravity measurements and modeling are used to examine uplift and erosion. The structural geology part of the covers aspects of stress, strain, rock failure, rock deformation, rheology, and the origin and significance of commonly observed brittle and ductile structures in rocks. ***Pre-req.: PTRE303.***

GEOL 507 SEISMIC EXPLORATION (3Crs.:3Lec,0Lab): Principles of the seismic method; exploration objectives and requirements of seismic data acquisition; the seismic pulse – its generation and transmission; partition of seismic energy at an interface; seismic energy reflection, refraction, attenuation, and travel time – distance functions; reflection time corrections; field testing and procedures with emphasis on multiple coverage and design of source and receiver arrays for signal enhancement; well velocity survey; the synthetic seismogram and the convolution model. ***Pre-req.: GEOL202.***

GEOL 508 FUNDAMENTAL OF SEISMIC ACQUISITION, PROCESSING AND INTERPRETATION (3Crs.:2Lec,2Lab): Fundamentals; Introduction to Seismic exploration; Overview of non-seismic geophysical techniques; Wave Propagation; Reflection Principles and Resolution; Signal Analysis; Migration Principles Acquisition; Principles of data acquisition; 3D Survey Design • QA/QC Processing; Principles and Processing Flows. Prestack Analysis and Signal Corrections; Velocity/ Normal Move out Analysis; Static Corrections; Migration and Imaging Interpretation; Trap Definition; Structural Mapping; Stratigraphic Interpretation; Amplitude Interpretation. ***Pre-req.: GEOL507***.

GEOL 509 BASIN EVOLUTION AND HYDROCARBON RESOURCES (3Crs.:3Lec,0Lab): Origin of sedimentary basins; structural styles of basins and their expression in seismic data; lateral variations of sedimentary facies in differing basin settings; models of external controls on depositional and seismic architectures; an introduction to sequence stratigraphy; burial histories and the derivation of tectonic subsidence/uplift histories from stratigraphic data; an overview of the petroleum play system; the petroleum charge system; reservoir, top seal and trap; quantifying risk in hydrocarbon exploration; petroleum geology Middle East. ***Pre-req.:GEOL206.***

PTRE 413 NATURAL GAS ENGINEERING (3Crs.:3Lec,0Lab): Natural Gas Composition and Phase Behavior, Natural Gas and Liquid Separation, Gas Sweetening, Water and Gas Removal, Liquefied Natural Gas LNG, Gas to Liquids GTL. ***Pre-req.: PTRE308***

PTRE 415 FIRE CONTROL ENGINEERING (3Crs.:3Lec,0Lab): Aspects involved in the control from fire, explosion, and other related hazards. Protective considerations and building design and construction. Fire and explosive protection organization including fire detection and control. ***Pre-req.: PTRE412***

PTRE 417 HYDROCARBON PHASE BEHAVIOR (3Crs.:3Lec,0Lab): Thermodynamics fundamentals, petroleum reservoir fluids, cubic equations of state, C7+ characterization and lumping, viscosity measurements, sampling, pressure/temperature (P/T) flash calculations, prediction of transport properties, pressure-volume-temperature (PVT) experiments, regression to experimental PVT data, evaluation of PVT reports and field experience. ***Pre-req.: MCHE329.***

PTRE 419 PETROLEUM ECONOMY, RISK AND MANAGEMENT (3Crs.:3Lec,0Lab): This unit aims to teach the student about the economics and risk management of petroleum asset development, supply and demand economics, profit maximization, depreciation and all aspects of oil field project management required to fully understand the risk involved in exploration, production, capital cost and expenditure on assets. ***Pre-req.: MATH381.***

PTRE 503 CRUDE OIL PROCESSING (3Crs.:3Lec,0Lab): Crude Oil Composition and Classification, Fundamentals of a Refinery Plant, Oil processing, Role of Catalyst in Refineries, Desalting of Crude Oil, Conversion Processes, Distillation Unit, Coking Process, Flexicoking Process, Catalytic Process, Fundamentals of phase separators. ***Pre-req.: CHEM331.***

PTRE 506 PROCESS INSTRUMENTATION AND CONTROL (3Crs.:2Lec,2Lab): Control loop hardware.; Mathematical modeling of chemical processes for control purposes.; Dynamic behavior of processes.; Development of dynamic models from experimental data for control purposes; Introduction to strain gauges; Basic components of control systems.; Design of single-loop control systems.; Controller tuning techniques.; Introduction to frequency domain methods.; Experimental rigs on process control. Block diagrams. Transient behavior of closed-loop control systems. Stability analysis. Controller tuning. Controller design: direct synthesis and frequency response methods. General comments on other types of controllers. ***Pre-req.: POWE212, MATH284***

Study Plan
Bachelor of Engineering in Petroleum Engineering (150 Credits)

First Semester (15 Credits)		**Crs.**	**Pre-requisites**
COMP208	Programming I	3	
MATH281	Linear Algebra	3	
CVLE210	Statics	3	
PHYS282	Material Properties and Heat	3	
MCHE210	Engineering Drawing and Graphics	3	

Second Semester (15 Credits)		**Crs.**	**Pre-requisites**
MATH282	Calculus	3	MATH111
MCHE213	Dynamics	3	
PHYS281	Electricity & Magnetism	3	
PTRE201	Introduction to Petroleum Engineering	3	
CHEM281	Principles of Chemistry I	3	CHEM110

Summer I Semester (9 Credits)		**Crs.**	**Pre/Co-requisites**
ARAB001	Arabic Language	2	
ENGL001	English Language	2	
BLAW001	Human Rights	1	
	Elective (General)	4	

Third Semester (17 Credits)		**Crs.**	**Pre-requisites**
MATH283	Differential Equations	3	MATH281 + MATH282
MCHE339	Fluid Mechanics for PE	3	PHYS282
ENGL211	Advanced Writing	2	ENGL001
PTRE202	Reservoir Rock Properties	3	PTRE201
GEOL205	Geophysical Techniques	3	PHYS281
GEOL201	Physical Geology	3	

Fourth Semester (18 Credits)		**Crs.**	**Pre-requisites**
MATH284	Numerical Analysis and Techniques	3	MATH283
CHEM282	Principles of Chemistry II	3	CHEM281
PTRE206	Petroleum Drilling Systems	3	PTRE201
PTRE301	Reservoir Fluids	3	PTRE202 + MCHE339
GEOL206	Principles of Petroleum Geology	3	GEOL201 + MCHE201
CHEM331	Organic Chemistry	3	CHEM281

Summer II Semester (8 Credits)		**Crs.**	**Pre/Co-requisites**
ENGL300	Speech Communication	2	ENGL211
MGMT002	Entrepreneurship	2	
	Elective (General)	4	

Fifth Semester (18 Credits)		**Crs.**	**Pre-requisites**
PTRE405	Well Testing	3	PTRE301
MCHE329	Thermodynamics for PE	3	PHYS282
PTRE409	Reservoir Simulation	3	PTRE301 + MATH284 + COMP208
MCHE319	Mechanics of Materials for PE	3	CVLE210
PTRE303	Well Logging	3	GEOL206
	Technical Elective	3	

Sixth Semester (17 Credits)		**Crs.**	**Pre-requisites**
PTRE308	Petroleum Production Technology	3	PTRE206
PTRE410	Reservoir Characterization	3	PTRE202 + PTRE303
PTRE412	Drilling Technology	3	PTRE206
MATH381	Probability & Statistics	3	MATH282
PTRE306	Petroleum Geomechanics	3	MCHE319
PTRE500	Research Methodology	2	ENGL300

Seventh Semester (17 Credits)		**Crs.**	**Pre-requisites**
PTRE513	Reservoir Engineering	3	PTRE301
PTRE501	Final Year Project 1	1	PTRE500
PTRE511	Petroleum Refining Operations	3	CHEM331
PTRE499	Internship (Approved Experience / Independent Study)		PTRE500
GEOL401	Geology of Lebanon and Levantine Region	3	GEOL206
INME221	Engineering Economy	3	
	Technical Elective	3	

Eighth Semester (16 Credits)		**Crs.**	**Pre-requisites**
PTRE502	Final Year Project 2	3	PTRE501
PTRE512	Environment & Safety	3	PTRE306
PTRE414	Natural Gas Production	3	MCHE329 + PTRE308
ENGR001	Engineering Ethics	1	
	Technical Elective	3	
	Technical Elective	3	