



**دليل
كلية الهندسة
2020**

**قسم هندسة النفط
Petroleum Engineering Department**



First: List of General courses

أولاً: قوائم مسميات المقررات الدراسية للمرحلة العامة

General Humanities Courses

العلوم الإنسانية العامة

Course No.	Course name	Pre-requisite(s)	Credits	اسم المقرر	رقم المقرر
		المتطلبات	الوحدات		
GH141	English Language I	Nil	3	لغة إنجليزية 1	ع 141
GH142	English Language II	GH141	3	لغة إنجليزية 2	ع 142
GH150	Arabic Language I	Nil	2	لغة عربية 1	ع 150
GH151	Arabic Language II	GH150	1	لغة عربية 2	ع 151
GH152	Technical Writing	GH151	1	كتابة التقارير التقنية	ع 152
Total Credits			10	إجمالي عدد الوحدات	

General Science Courses

العلوم الأساسية العامة

Course No.	Course name	Pre-requisite(s)	Credits	اسم المقرر	رقم المقرر
		المتطلبات	الوحدات		
GS101	Mathematics I	Nil	3	رياضيات 1	ع 101
GS102	Mathematics II	GS101	4	رياضيات 2	ع 102
GS111	Physics I	Nil	3	فيزياء 1	ع 111
GS112	Physics II	GS111	3	فيزياء 2	ع 112
GS112L	Physics Lab.	GS111	1	فيزياء معمل	ع 112 م
GS115	General Chemistry	Nil	3	كيمياء عامة	ع 115
GS115L	General Chemistry Lab.	Nil	1	كيمياء معمل	ع 115 م
GS200	Computer Programming	Nil	3	برمجة حاسوب	ع 200
GS203	Mathematics III	GS102	3	رياضيات 3	ع 203
GS204	Mathematics IV	GS102	3	رياضيات 4	ع 204
GS206	Statistics & Probability	Nil	3	الأحصاء والاحتمالات	ع 206
Total Credits			30	إجمالي عدد الوحدات	



General Engineering Courses

العلوم الهندسية العامة

Course No.	Course name	Pre-requisite(s)	Credits	اسم المقرر	رقم المقرر
		المتطلبات	الوحدات		
GE121	Engineering Mechanics I	Nil	3	ميكانيكا هندسية 1	ع هـ 121
GE127	Engineering Drawing	Nil	2	رسم هندسي	ع هـ 127
GE129	Workshop Technology	Nil	2	تقنية الورش	ع هـ 129
GE129L	Workshop Technology Lab.	Nil	1	معمل تقنية الورش	ع هـ 129 م
GE133	Properties of Materials	GS101 + GS111 + GS115	3	خواص المواد	ع هـ 133
GE222	Engineering Mechanics II	GE121	3	ميكانيكا هندسية 2	ع هـ 222
EE280	Fundamentals of Electrical Eng.	GS102 + GS112	3	أساسيات الهندسة الكهربائية	هـ كه 280
Total Credits			17	إجمالي عدد الوحدات	

ثانياً: قائمة مسميات المقررات التخصصية الملزمة لجميع طلبة قسم هندسة النفط

Second: List of departmental courses in Petroleum Engineering

Course No.	Course name	Pre-requisite(s)	Credits	اسم المقرر	رقم المقرر
		المتطلبات	الوحدات		
GS201	Computer Programming II	GS200 + PE253	3	برمجة حاسوب 2	ع ع 201
CHE211	Physical Chemistry	GS115	3	كيمياء فيزيائية	هـ كم 211
CHE211L	Physical Chemistry Lab.	GS115L + CHE211	1	معمل كيمياء فيزيائية	هـ كم 211 م
GS215	General Geology	GH142	3	جيولوجيا عامة	ع ع 215
PE240	Engineering Economy	GS102	3	اقتصاد هندسي	هـ نف 240
GS242	Structural Geology	GS215	3	جيولوجيا تركيبية	ع ع 242
PE253	Introduction to Petroleum Engineering	CHE211 + GS215	3	مقدمة هندسة النفط	هـ نف 253



CHE301	Thermodynamics	GS102 + GS112 + CHE211	3	ديناميكا حرارية	هـ كم 301
CHE311P	Fluid Mechanics	GS102 + GS112 + CHE211	3	ميكانيكا الموائع	هـ كم 311 ن
PE312	Heat Transfer	GS102 + GS112 + GS204 + CHE211	3	انتقال الحرارة	هـ نف 312
PE315	Petroleum Geology	GS242 + PE253	3	جيولوجيا النفط	هـ نف 315
PE322	Oilfield Equipments	PE253	3	معدات حقول نفطية	هـ نف 322
CHE331	Organic Chemistry	CHE211	3	كيمياء عضوية	هـ كم 331
PE353	Reservoir Rock Properties	EE280 + PE315	3	خواص صخور المكن	هـ نف 353
PE363	Reservoir Fluid Properties	PE253 + CHE301 + CHE331	3	خواص موائع المكن	هـ نف 363
PE373	Drilling Engineering	GE133 + GE222 + GS242 + PE322	3	هندسة الحفر	هـ نف 373
PE383L	Drilling Fluids Lab.	PE373	2	معمل هندسة الحفر	هـ نف 383 م
PE402L	Reservoir Rock & Fluid Properties Lab.	PE353 + PE363	2	معمل خواص صخور وموائع المكن	هـ نف 402 م
PE413	Well Logging	PE353 + PE363 + PE373	3	سرود الآبار	هـ نف 413
PE423	Fluid Flow Through Porous Media	CHE311P + PE353 + PE363	3	سريان الموائع في الأوساط المسامية	هـ نف 423
PE433	Production Design I	CHE311P + PE353 + PE363	3	هندسة الإنتاج 1	هـ نف 433
PE443	Well Completion	PE413 + PE433	3	استكمال الآبار	هـ نف 443
PE453	Applied Reservoir Engineering	PE353 + PE363	3	هندسة المكامن النفطية	هـ نف 453
PE463	Transient Pressure Analysis	PE423	3	اختبارات الضغوط في الآبار	هـ نف 463
PE473	Production Design II	PE322 + PE433	3	هندسة الإنتاج 2	هـ نف 473
PE474	Natural Gas Engineering	GS201 + CHE301 + PE453	3	هندسة الغاز الطبيعي	هـ نف 474
PE484	Numerical Methods	GS201 + GS204 + GS206 + PE363 +	3	طرق التحليل العددي	هـ نف 484



		PE353			
PE510	Enhanced Oil Recovery	Minimum 125 Credits + PE474	3	طرق الاسترداد الإضافي	هدف 510
PE520	Petroleum Engineering Seminar	Minimum 125 Credits	3	الندوة النفطية	هدف 520
PE523	Oil Property Evaluation	Minimum 125 Credits + PE433 + PE474	3	اقتصاديات هندسة النفط	هدف 523
PE540	B. Sc. Project	All 300 Level + Minimum 130 Credits	3	مشروع التخرج	هدف 540

PE Elective Courses

مقررات تخصصية اختيارية

على الطالب اختيار مقرر دراسي واحد.

Course No.	Course name	(Pre-requisite(s)	Credits	اسم المقرر	رقم المقرر
		المتطلبات			
PE502	Oilfield Technology	PE453 + PE473	3	تقنيات الحقول النفطية	هدف 502
PE511	Project Management	GS206 + PE240 + PE453	3	إدارة مشاريع	هدف 511
PE512	Introduction to Reservoir Simulation	PE453 + PE474 + PE484	3	مقدمة محاكاة المكامن النفطية	هدف 512
PE516	Application of EOR	PE510	3	تطبيقات طرق استرداد الاضافي	هدف 516

الجدول التالي يبين تفاصيل توزيع متطلبات عدد الوحدات اللازمة لتخرج الطالب من قسم هندسة النفط

القسم	الشعبة	العلوم الإنسانية		العلوم الأساسية العامة		العلوم الهندسية العامة		المقررات التخصصية الملائمة لجميع طلبة القسم		العلوم التخصصية الاختيارية		الإجمالي
		عدد	النسبة المئوية من إجمالي عدد الوحدات الكلية	عدد	النسبة المئوية من إجمالي عدد الوحدات الكلية	عدد	النسبة المئوية من إجمالي عدد الوحدات الكلية	عدد	النسبة المئوية من إجمالي عدد الوحدات الكلية	عدد	النسبة المئوية من إجمالي عدد الوحدات الكلية	
هندسة النفط	القسم شعبة واحدة	10	6.7%	30	20.1%	17	11.4%	89	59.7%	3	2.0%	149



المحتوى العلمي للمقررات الدراسية بقسم هندسة النفط

GS201	Computer Programming II	3 Credits
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Pre-requisites: GS200 + PE253

Function and subprograms; library functions; functions and subroutine Call-Return; equivalence and common statements; engineering oriented exercises and programming debugging.

CHE211	Physical Chemistry	3 Credits
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Pre-requisite: GS115

Behavior of real and ideal gases; the first law of thermodynamics and its applications; the second law of thermodynamics; the third law of thermodynamics; electromotive force; thermodynamics of electrochemical cells; chemical kinetics; reaction rates including zeroth, first, second and third order reactions.

CHE211L	Physical Chemistry Lab.	1 Credits
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Pre-requisites: GS115L + CHE211

Measurement of density, viscosity, phase-equilibria, kinetics of first order reaction (inversion of sources), refractive index, equilibrium constant (by means of electrical conductivity), K_a values of Succinic acid, molecular weight determination (Victor-Meyer's method), thermodynamics of galvanic cells (Zinc-Copper electrodes).

GS215	General Geology	3 Credits
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Pre-requisite: GH142

Introduction to geology, definitions of geology and engineering geology; general outline of the structure of the earth; most abundant elements and minerals of the earth crust, Magma; rocks cycle, minerals, physical properties of minerals; classification of mineral on basis of chemical composition; rocks classification: igneous, sedimentary and metamorphic rocks; weathering, erosion and soil formations; introduction to simple geologic structures: fold, fault, joint and unconformity; deformation and failure behavior of rocks and factors controlling these behaviors.

PE240	Engineering Economy	3 Credits
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Pre-requisite: GS102

Fundamental aspects of an economic system in a society, this includes the fundamental problems of any economic system, the economic development and its limitation, role of the government; supply and demand, and the economic cycle of the price system; worth concepts normally used in engineering economics to provide a deep understanding of the different evaluation techniques necessary for the proper comparison and decision of the relative economic materials of investment alternatives.



GS242	Structural Geology	3 Credits
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Pre-requisite: GS215

Mechanical principles, force, stress, strain, stress-strain diagrams; factors controlling behavior of rock materials; folds, description, field study, mechanics and causes of folding; concentric folds and associated faults and oil accumulation; faults, description, classification and recognition; diapses and related structures; dating of the structural events; tectonic and tectonic classification.

PE253	Introduction to Petroleum Engineering	3 Credits
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Pre-requisites: CHE211 + GS215

Basic parts of petroleum engineering: reservoir, drilling, and production engineering; the first part covers: origin, migration and accumulation of petroleum, subsurface pressures and temperatures, composition of petroleum and its physical and chemical properties, petrophysical properties of fluid permeated rock such as porosity, permeability, and fluid saturations; the second part covers: drilling methods, equipments and basic techniques, functions, compositions, general nature and properties of drilling fluids, types and function of casing, properties of cement classes and additives, well completion; the third part covers the surface production facilities.

CHE301	Thermodynamics	3 Credits
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Pre-requisites: GS102 + GS112 + CHE211

Concepts of thermodynamics with definitions and units; conservation and transfer of energy; volumetric properties of pure fluids; Equations of state and their applications of heat effects calculations; concepts of entropy and the second law of thermodynamics; thermodynamic properties of single and two phase systems; Maxwell's relations; thermodynamic diagrams, generalized correlation, power cycles and their applications; refrigeration and liquefaction thermodynamic analysis of flow processes.

CHE311P	Fluid Mechanics	3 Credits
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Pre-requisites: GS102 + GS112 + CHE211

Fluid properties; fluid statics, velocity and shear; continuity, momentum and energy equations; Bernoulli equation; laminar and turbulent flow regimes; frictional loss in pipes; transportation and metering of fluids; pumps and compressors; agitation of liquids; compressible flow; flow around submerged objects; fluidization.

PE312	Heat Transfer	3 Credits
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Pre-requisites: GS102 + GS112 + GS204 + CHE211

Steady state heat conduction in one and two dimensions including extended surfaces; illustration of methods of solutions for two dimensions problems; unsteady state conduction in solids; lumped heat capacity approach; illustration of methods of solution for selected geometries and boundary conditions; dimensional analysis in relation to



heat transfer; boundary layers; empirical correlation for heat transfer coefficient inside and across pipes; natural and forced convection; boiling condensation double pipe and shell and tube heat exchangers; heat transfer by radiation.

PE315	Petroleum Geology	3 Credits
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Pre-requisites: GS242 + PE253

Earth structure; geological times; sedimentary rocks; hydrocarbon bearing rocks and strata; depositional environments; structures, traps, origin and sources of oil and gas; accumulation and migration; geographical distribution of oil and gas basins, worldwide, typical fields in Libya; subsurface fluid distribution; subsurface geology of Sirte basin, its stratigraphy, oil and gas bearing formations, reservoirs, distribution, classification, methods of exploration; subsurface geological mapping; cross sections and their uses to evaluate the original-oil-in-place and in drilling operation.

PE322	Oilfield Equipments	3 Credits
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Pre-requisite: PE253

In the first part, specific emphasis will be placed on the rotary rig and its components: the hoisting system, the rotating system, the circulating system, power requirements; casing; cementing; roller bits; fishing tools; and well controlling system. Second part covers the principle and components of production equipment: subsurface and surface equipment of natural flow; equipment of artificial flow; gathering systems; surface equipment of fluids separations; fluid separators; storage tanks; meters and meter proving; types of valves. The third part covers preliminary corrosion of the oilfield equipment: inspection, evaluation, measurement, control and prevention. Emphasizing on estimation of different design parameters of equipment such as: horsepower of rotary, slush pump and drawworks, mud circulation cycle time, drilling lines required length, oil and gas capacities of fluid separators and others.

CHE331	Organic Chemistry	3 Credits
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Pre-requisite: CHE211

Introduction; nomenclature; preparation and reaction of aliphatic hydrocarbons (alkanes, alkenes, alkynes and alicyclic hydrocarbons); alkyl-halides; alcohols and glycols; ethers; aldehydes and ketones; carboxylic acids and its derivatives (acid anhydrides, esters and amides).

PE353	Reservoir Rock Properties	3 Credits
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Pre-requisites: EE280 + PE315

Concepts and applications of rock properties which are fundamental to engineering analysis of petroleum reservoir such as: porosity; permeability; fluid saturation and electrical conductivity. These terms are used in calculations of relative permeability, relative permeability ratio, pore size and fluid saturation for multi-fluid system calculations. The capillary pressure characteristics of the reservoir rock; displacement



pressure; wettability; free water level. The measurement and use of these various factors are discussed.

PE363	Reservoir Fluid Properties	3 Credits
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Pre-requisites: PE253 + CHE301 + CHE331

Changes of state: behavior of pure component, binary and multi-component systems; properties of hydrocarbon gases: the equation of state for gases, PVT correlations for reservoir fluids; the properties of reservoir liquids; the coefficient of isothermal compressibility of liquids; estimation of FVF at pressure below and above the bubble-point pressure; estimation of oil viscosity; gas-liquid equilibria; calculation of bubble-point and dew-point pressures; equilibrium ratio correlations; flash vaporization; differential vaporization; gas solubility; properties of oilfield waters; gas hydrates.

PE373	Drilling Engineering	3 Credits
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Pre-requisites: GE133 + GE222 + GS242 + PE322

Theory and practice in rotary drilling processes; mechanical properties of rock; bit selections; drilling cost evaluation; well planning; optimizing of bit weight; bit nozzle diameter, and rotary speed; pore pressure and fracture pressure gradient determinations; function properties of drilling fluids; the mathematical modeling of flow behavior of drilling fluids; rotary drilling hydraulics; well control; casing design and cementing.

PE383L	Drilling Fluids Lab.	2 Credits
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Pre-requisite: PE373

Physical, chemical, and rheological properties of the drilling fluids; lab tests, pilot tests, and experiments on the drilling fluids: salinity, and influencing factors, treatments methods, ion exchange tests; fluid (water) loss; sand and solid content; pressure control tests; Kind of drilling fluids water base muds, oil base muds, aerated muds, their physical and chemical treatments; separation of rock cuttings and suspended solids from muds; measurements of density, viscosity, gel and shear strengths; tests and lab measurements for cement slurries and their additives.

PE402L	Res. Rock & Fluid Properties Lab.	2 Credits
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Pre-requisites: PE353 + PE363

Calculation of the original-oil-in-place by using geological contour, isopach, isoporosity and isosaturation maps; covering procedure and apparatus for measuring the petrophysical core rock properties: porosity, permeability, fluid saturation, capillary pressure, relative permeability, and rock electrical resistivity; reservoir fluid properties: viscosity, density, and compressibility.

PE413	Well Logging	3 Credits
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**Pre-requisites: PE353 + PE363 + PE373**

Formation evaluation; rock petrophysical properties; role of well logging; logging environment in well and formation; measurement parameters, factors, corrections; kind of logs based on well conditions; types of logs: resistivity logs, acoustic logs, radioactive logs; technology: tools; equipment, responses, interpretation and analysis; lithological, quantitative; qualitative methods, approaches, computer interpretation.

PE423	Fluid Flow Through Porous Media	3 Credits
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Pre-requisites: CHE311P + PE353 + PE363

Pressure energy, static pressure; equations governing fluid flow; orientation and patterns of flow, forms of Darcy's flow equations for non-compressible fluids; capillary pressures, capillary systems; fluid saturations, distribution, relative permeabilities; flow of more than one fluid; fractional fluid flow; frontal advance displacement mechanism; fluid diffusion, diffusivity equation, pressure behavior, distribution, pressures versus time analysis, flow and pressure test.

PE433	Production Design I	3 Credits
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Pre-requisites: CHE311P + PE353 + PE363

Production aspects of naturally flowing oilwell. The performance of such wells is determined through understanding of multiphase flow of fluids through various components that comprise a production system, starting from the reservoir and ending at the separator; derivations, applications and limitations of the inflow performance relationships; vertical lift performance correlations; horizontal flow performance correlation; deviated flow performance correlations, and surface choke performance equations are presented and discussed.

PE443	Well Completion	3 Credits
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Pre-requisites: PE413 + PE433

Concepts, purpose of completion; secondary cementing squeezes liner and plug-back cementing; completion designs and factors effecting it, choice, methods and types; completion fluids; equipment: downhole and surface, tubular, strings; perforating operations; sand control; fluids displacement; well bringing in; swabbing; well stimulation treatments: acidizing and hydraulic fracturing; workovers: cause, problems, remedies; workover planning.

PE453	Applied Reservoir Engineering	3 Credits
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Pre-requisites: PE353 + PE363

Hydrocarbon reservoirs classification; reservoir fluid systems; hydrocarbon in-place evaluation by volumetric methods: oil, gas, gas condensates; material balance equations and its reserve estimation; hydrocarbon reserve evaluation by other methods; mechanisms and drives of reservoir production; predicting future performance; fluid



properties; water influx models, aquifer evaluation; historical performance, depletion performance, performance prediction; applicability of material balance method.

PE463	Transient Pressure Analysis	3 Credits
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Pre-requisite: PE423

Solutions to diffusivity equation; principle of superposition; pressure build-up tests, pressure drawdown tests, and multi-rate tests; analysis of well tests using type curves; analysis of well tests using derivatives.

PE473	Production Design II	3 Credits
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Pre-requisites: PE322 + PE433

Methods normally used in oilwells subjected to artificial lift. Methods of: gas lift, electric submersible pumps and sucker rod (piston) pumps are considered in details as far as description and function of equipment, installations, design calculations involved and limitations of application are concerned. Attention is given to their applications in Libyan oilfields.

PE474	Natural Gas Engineering	3 Credits
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Pre-requisites: GS201 + CHE301 + PE453

Properties of natural gas and gas condensate systems, their PVT relation; evaluation of original-gas-in-place by volumetric methods; gas material balance method and its application; flow of gas in porous medium and well; gas well deliverability tests; gas separation, treatment, dehydration, gathering, transportation, and measurements; storage: underground storage, liquefied natural gases; Libyan gas fields development and their feasibility.

PE484	Numerical Methods	3 Credits
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Pre-requisites: GS201 + GS204 + GS206 + PE353 + PE363

Statistics, data presentation and handling; power series; polynomials; solutions of non-linear equations; solving sets of equations; interpolation of polynomials; numerical differentiation and integration; numerical solutions of ordinary differential equations; introduction to finite differences approximation.

PE502	Oilfield Technology	3 Credits
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Pre-requisites: PE453 + PE473

Chemical oilfields problems, surface and subsurface, theoretical and technical aspects, factors involved, interaction between gases, liquids and materials for field installation and equipment; chemical treatments applied in oilfields for oil, water, gas and their mixtures; scales, emulsions, corrosion, flocculation, sedimentation, filtration, and floatation; water treatment for water injection and other purposes.



PE510	Enhanced Oil Recovery	3 Credits
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Pre-requisites: Minimum 125 Credits + PE474

Review the oil production categories; study the factors that affect the selection and efficiency of any enhanced oil recovery (EOR) process; water and gas injection and performance calculations; types of miscibility, conditions and factors affecting the miscibility, calculation and estimation of the MMP; natural gas injection, mechanics, and types of gas injection: high-pressure lean gas, liquefied petroleum gases, enriched gas, carbon dioxide; chemical flooding: mechanics, types of chemical flooding: surfactant, polymer, alkaline; thermal flooding: mechanics, types of thermal flooding: hot water, steam injection, in-situ combustion; factors affecting engineering design of any EOR processes.

PE511	Project Management	3 Credits
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Pre-requisites: GS206 + PE240 + PE453

Concepts, development of engineering management; objectives, planning, organization, follow-up, supervision, control, evaluation; national planning, national plan preparation; stages of industrial project: studies, evaluation, and execution of the projects; optional analysis, field surveys and studies, market studies, economical studies, input, output, technical studies; indicator for the choices of technology, technology updating; feasibility, profitability analysis of the projects; progress, targets, achievements, time schedule; feedback, flow of data, information, presentation, preparation of technical reports.

PE512	Introduction to Reservoir Simulation	3 Credits
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Pre-requisites: PE453 + PE474 + PE484

Reservoir simulation concepts, simulation background and growth; fluids and fluid flow through porous media equations as elements and basics for simulation; formulation of simulation equations with respect to fluid phases and with respect to dimensions; finite differences models, discretization process; definition of reservoir geological models, grid definition, stability criteria; data preparation for fluids, rock, production, flow rate and pressure; solution of the simulator equations.

PE516	Application of EOR	3 Credits
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Pre-requisite: PE510

Enhanced oil recovery theoretical principles, methods, and selection criteria; analysis of reservoir and fluid data for EOR purposes; recovery evaluation, economics and statistics of EOR, pilot projects; EOR techniques, methods, requirements and implementation, performance, follow-up, evaluation of project at certain stages, prediction.

PE520	Petroleum Engineering Seminar	3 Credits
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Pre-requisite: Minimum 125 Credits

Student or a group of students has to make a technical preparation, literature surveying and investigation concerning one of technical matters in the field of petroleum engineering which should be defined at the beginning of the semester jointly by the



instructor and the students. The student or the group, at the end, has to make a presentation of their work within a session attended by their classmates, some other instructors from the PE department and some interested guests from the oil industry. Then the course instructor would evaluate the students according to their work presentation and their participation in the similar seminars by their classmates.

PE523	Oil Property Evaluation	3 Credits
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Pre-requisites: Minimum 125 Credits + PE433 + PE474

Economical and technical aspects necessary for the evaluation of a petroleum property with special emphasis on application to the oil industry in Libya; field development stages, technical evaluation, original-oil-in-place, reserve types, decline curves; economical aspects: Libyan oil laws and agreements; net profit, present worth, profit parameters, feasibility study, optional analysis; field development decision-making, influencing factors, risk, ventures; oil market and prices, government oil policy, financing, capital for oil projects; technical and scientific developments, technology transfers.

PE540	B. Sc. Project	3 Credits
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Pre-requisites: All 300 Level + Minimum 130 Credits

Student has to prepare and present a complete study on one subject of oil and gas defined by the department research council. The study should be either a laboratory study, field study, or theoretical study using the available data and means from Libyan fields. The project aims to enable the student to depend on him/herself, under faculty supervision, in doing investigation and tackling problems, through data surveying, searching, gathering, analysis, drawing conclusions, or on practical bases as laboratory or field work. Finally, student has to present this research report and discuss it in front of examination committee which composed from department teaching staff members.