UNIVERSITY OF BENGHAZI
FACULTY OF ENGINEERING
PETROLEUM ENGINEERING DEPARTMENT
Undergraduate Courses

1- First Semester Courses

Code	Course Title	Units	Prerequisite
ES 101	Engineering Mathematics I	12	-
ES 111	Physics I	12	-
ES 121	Chemistry I	9	-
EL 101	English Language I	9	-
AL 100	Arabic Language	6	-
ES 181	Physics Laboratory I	3	ES111*
ES 183	Chemistry Laboratory I	3	ES121*
ME 101	Engineering Drawing I	6	
		60	

2- Second Semester Courses

Code	Course Title	Units	Prerequisite
ES 102	Engineering Mathematics II	12	ES 101
ES 112	Physics II	12	ES 111
ES 122	Chemistry II	9	ES 121
EL 102	English Language II	9	EL 101
ES 182	Physics Laboratory II	3	ES112*
ES 184	Chemistry Laboratory II	3	ES122*
ME 102	Engineering Drawing II	6	ME101
		54	

3- Third Semester Courses

Code	Course Title	Units	Prerequisite
PE 203	Fundamentals of Electrical Engineering	6	ES112
PE 211	Applied Chemistry I	6	ES122
PE 221	General Geology	12	ES112, ES122
PE 231	Applied Mechanics	12	ES102, ES111
PE 241	Introduction to Petroleum Engineering	6	-
ES 201	Differential Equations	12	ES102
ES 261	Fundamentals of Computers and Programming	9	-
		63	

4- Fourth Semester Courses

Code	Course Title	Units	Prerequisite
PE 242	Set Theory & Statistics	6	ES201
PE 244	Applied Chemistry II	6	PE211
PE 246	Applied Thermodynamics	9	PE211
PE 248	Structural Geology	9	PE221
PE 250	Fluid Mechanics	9	PE231
PE 252	Drilling & Production Machinery	9	PE241
PE 254	Fluid Mechanics Laboratory	3	PE231
ES 206	Linear Algebra	12	ES102
		63	

5- Fifth Semester Courses

Code	Course Title	Units	Prerequisite
PE 321	Exploration Methods for Oil	9	PE325*
PE 323	Drilling fluids	6	PE244, PE252
PE 325	Petroleum Geology	9	PE248
PE 327	Drilling & Oil Well Design	9	PE252
PE 329	Reservoir Rock Properties	9	PE241
PE 331	Reservoir Fluid Properties	9	PE241, PE250
PE 333	Geological Laboratory	3	PE248, PE325*
PE 336	Drilling Fluid Laboratory	3	PE323
		57	

6- Sixth Semester Courses

Code	Course Title	Units	Prerequisite
PE 340	Applied Reservoir Engineering	9	PE329, PE331
PE 342	Fluids Flow in Porous Media	9	PE329, PE331
PE 344	Well Testing analysis	9	PE327
PE 346	Well Completion	9	PE327, PE348*
PE 348	Drilling Technology	9	PE252, PE323
PE 350	Production Engineering I	9	PE252, PE346*
PE 352	Reservoir Rock and Fluid Laboratory	3	PE329, PE331
		57	

7- Seventh Semester Courses

Code	Course Title	Units	Prerequisite
PE 451	Production Engineering II	9	PE350
PE 457	Natural Gas Engineering	6	PE340, PE331
PE 459	Well Logging	9	PE346
PE 466	Computer Applications in Petroleum Engineering	9	ES261
PE 463	Well Logging Laboratory	3	PE346, PE459*
PE 469	Seminar	6	-
PE 470	Reservoir Simulation	9	PE340
PE xxx	Elective Course	9	-
		60	

8- Eighth Semester Courses

Code	Course Title	Units	Prerequisite
PE 453	Transportation & Storage Of Petroleum	6	PE250, PE350
PE 472	Enhanced Oil Recovery (EOR)	9	PE340
PE 474	Safety & Loss Prevention	6	-
PE 480	Project	18	-
PE 482	Petroleum Engineering Economics	6	-
PE xxx	Elective Course	9	-
		54	

Total courses: 61   **Total Units: 468**   * Corequisite

Elective Courses

Code	Course Title	Units	Prerequisite
PE 473	Application of EOR	9	PE 472*
PE 475	Petroleum Refining Engineering	9	PE 350
PE 484	Reservoir Management	9	PE 340
PE 486	Corrosion in Oil Industry	9	PE 244
PE 488	Fuel and Combustion	9	PE 250
PE 489	Oil Property Evaluation	9	PE340, PE482*
PE 490	Project Management	9	PE 484

PETROLEUM ENGINEERING DEPARTMENT

Courses Syllabus Contents and Prerequisite

❶ First Semester Courses

Code	Course Contents	Units	Prerequisite
ES 101	**Mathematics I** Set. Real and complex number systems. Functions and their graphs. Vectors in the plan and space. Determinants, solutions of a system of linear equations. Limits and continuity of functions. Derivatives, derivatives of elementary functions, Roll's and Mean value theorems, maximum, minimum and graph sketching, applications of L'hopital rule.	12	-
ES 111	**Physics I** Mechanics: Linear and circular motion, Newton's Laws of motion, work energy, conservation laws - Properties of matter: elasticity, surface tension, and fluid mechanics - Heat and thermodynamics: heat, laws of thermodynamics, ideal gas. Vibration and waves: simple harmonic motion, vibrations, traveling and standing waves, properties and propagation of sound.	12	-
ES 121	**Chemistry I** The course covers the study, of the atomic structure, periodic table, gaseous state, thermo-chemistry, and introduction to the different classes of organic compounds with special emphasis of functional groups, nomenclature, isomerism and fundamental concepts bout structure and reactivity.	9	-
EL 101	**English Language I** This course is design for first-year students of Engineering during the first semester of their academic year. It consists of two parts: a- a short refresher course in ordinary English to help bridge the gap between school and university standards; aural / oral approaches and techniques are used; and b- a lengthily intensive course in scientific English to enable the students to understand their lectures and textbooks on engineering topics.	9	-
AL 100	**Arabic Language** Introduction and augmentation of grammar, vocabulary, literature and aspects of scientific technical Arabic used in the different departments of engineering.	6	-
ES 181	**Physics Laboratory I** Laboratory works includes experiments on the acceleration of gravity, Hook's Law. Young's modulus, surface tension thermal conductivity, and specific heat, Newton's Law of cooling. sonometer, frequencies measurements and the velocity of sound.	3	ES111*
ES 183	**Chemistry Laboratory I** Laboratory rules and techniques, common reagents. chemical equations, cations and anions, reactions of cations and anions, classification of cations and anions into groups, group reagents and group precipitate of cations, identification of cations and anions from simple inorganic compounds.	3	ES121*
ME 101	**Engineering Drawing I** The need for a graphic language - Use and care of drawing instruments and equipment - Freehand sketching - Orthographic projections sectioning and dimensioning of single machine elements - Isometric drawing and dimensioning - Space analysis of points and lines with applications.	6	-

❷ Second Semester Courses

Code	Course Contents	Units	Prerequisite
ES 102	**Mathematics II** Definite integral, fundamental theorem of calculus. Exponential and logarithmic functions, hyperbolic functions. Techniques of integration. Geometrical and physical applications of the definite integrals. Functions of several variables, partial derivative. Maximum and minimum and Lagrange's multipliers. Line integrals. Double integrals in rectangular and polar coordinates. Series, power series. Taylor's theorem.	12	ES101
ES 112	**Physics II** Electricity and magnetism: charge. Coulomb's Law, electric field. Gauss's Law and its applications, electric potential, capacitors and dielectrics, current and resistance, EMF and circuits, magnetic field, magnetic induction hall effect. Ampere's Law, inductors and solenoids, self-induction, R-L and R-C circuits, magnetic properties of matter. Electromagnetic oscillators, E.M.W and Maxwell's equations, transmission lines. Travelling waves. Alternating currents and voltages. Waves and optics: Light waves, refraction and reflection of light, mirrors and lenses and their applications in optical instruments.	12	ES111
ES 122	**Chemistry II** The course covers the study of artificial radio-activity, chemical bonds, theory of the covalent bond, classification compounds, chemical behavior of some common substances, thermodynamics, electrochemistry, solid-state chemistry and the organic reaction of alkanes, cyclo-alkanes, alkenes, alkyl halides, alcohols, aldehydes and ketones, with detailed study of reaction mechanisms.	9	ES121
EL 102	**English Language II** This course is designed for first-year students of Engineering during the second semester of their academic year. It consists of two parts: a- a more advanced course in ordinary English to improve the student's standards in the four basic language skills: the aural / oral approach and modern techniques are adopted; and b- a still more intensive course in scientific English to enable the student to pursue their higher and more complex studies in engineering.	9	EL101
ES 182	**Physics Laboratory II** Laboratory works includes experiments on the verification of Ohm's Law, the e.m.f. value and the internal resistance of cells, specific receptivity, electrochemical equivalent of copper, mechanical equivalent of heat, temperature coefficient of a resistance, pulling power of an electromagnet. Focal length of mirrors and lenses.	3	ES112*
ES 184	**Chemistry Laboratory II** Volumetric Analysis. Use of volumetric apparatus, standard solutions, volumetric solutions, procedure of titration, indicators titration involving acid-base, argentimetric, complexometric and oxidation-reduction reactions, determination of strength of some unknown samples utilizing the above methods of titration.	3	ES122*
ME 101	**Engineering Drawing II** Thread dimensioning, standard M/C elements assembly, inking, space analysis, views of a point, lines, true length of line and oblique lines, bearing slope and grade, Steel structure drawing.	6	ME101

❸ Third Semester Courses

Code	Course Contents	Units	Prerequisite
ES 201	**Differential Equations** Basic concepts - First-order differential equations - Equations of second order and higher order - Exact and inexact differential - Useful theorem of partial differentiation (wave equation, diffusion equation) - Boundary value problems - Series solutions - Some classical equations - System of first order equations - Laplace transform and operational methods - Simple numerical methods - Linear difference equations.	12	ES102
ES261	**Fundamentals of Computers and Programming** Introduction to the organization and characteristics of computers. Concepts of an algorithm. Flowcharting. The programming process. Programming in FORTRAN. Programming in Basic. Application to numerical and non-numerical problems.	9	-
PE 231	**Applied Mechanics** Statics: Basic laws and concepts of Mechanics - Force systems - The equilibrium of particles, rigid body and systems of rigid bodies - The internal forces of a straight beam - Strength of Materials: Basic concepts and constitutive equations of linearly elastic materials - Tension and compression of a straight bar - Shear and bending of a straight beam - Torsion and buckling of a bar - Dynamics: Plane kinematics and kinetics of a particle and a rigid body - Theorems of impulse and energy - Harmonic vibrations of single-degree-of-freedom systems.	12	ES102-ES111
PE 211	**Applied Chemistry I** General Chemistry Basics: Mole & Avogadro's Number- Oxidation – Reduction and Valency – Gas Laws – Dalton's Law – Henry's Law – Graham's Law – Gay-Lussac's Law – Raoult's Law – Equilibrium and Le chatelier;s principle. Physical Chemistry Concepts: Thermodynamics – Kinetics – Catalysis – Adsorption – Membranes. Colloid Chemistry Concepts: Colloidal Dispersions in Liquids and Air – Hydrophobic and Hydrophilic Colloids – Emulsions. Industrial Chemistry Concepts: Material Balances – Gases – Vapors – Liquids and Solids – Energy Balances.	6	ES122
PE 221	**General Geology** Introduction to geology, definitions of geology and engineering geology, general outline of the structure of the Earth, most abundant elements and minerals of the crust. Magma, rock cycle, minerals, physical properties of minerals. Classification of minerals on basis of chemical composition. Rocks classification : Igneous rocks, sedimentary rocks, metamorphic rocks. External Processes of the Earth (Weathering- Erosion-Transportation - Sedimentation). Sedimentary Basins System - Sedimentary Environment (Aeolian System, Fluvial System, Deltaic). Introduction to simple geologic structures: fold, fault, joint and unconformity. Deformation and failure behavior of rocks and factors controlling these behaviors.	12	ES112-ES122
PE 241	**Introduction to Petroleum Engineering** Origin, Chemical Composition, Migration, and Accumulation of Petroleum - Subsurface Pressures and Temperatures - Petroleum Exploration Methods –Basic Reservoir Rock Properties: Porosity, Permeability, Saturation, and Capillary Pressure - Properties of Gaseous Petroleum - Oil and Gas Reserves Calculations – Drilling Methods: Cable Tool and Rotary Drilling - Drilling Techniques: Vertical and Directional Drilling, Fishing Operations - Rotary Drilling Fluids - Well Completion Types - Well Logging - Production Methods.	6	-
PE 203	**Fundamentals of Electrical Engineering** System of Units - Types of circuits and circuit elements - Ohms law - Kirchoffs laws - Nodal analysis - Mech analysis - Thevenins and Nortons theorems - Inductance and Capacitance - The Sinusoidal forcing function - The phasor Concept - Sinusoidal Steady State response - Phasor Diagrams - Impedance - Admittance - Instantaneous , average, apparent, and Complex powers.	6	ES112

❹ **Fourth Semester Courses**

Code	Course Contents	Units	Prerequisite
PE 242	**Set Theory & Statistics**	6	ES201
	Introduction to Statistics - The Use of Statistical Methods in Analyzing and Interpreting Experimental Data and in Planning Experiments Programs Probability - Distributions, Parameters, Estimation, Use of Hypotheses, Control Charts, Regression and an Introduction to Analysis of Variance - Introduction to Experimental design.		
PE 244	**Applied Chemistry II**	6	PE211
	Petroleum Chemistry Concepts: Formation and Existence – Chemical composition – Physical and Chemical Properties. Natural Gas Chemistry Concepts: Chemical and Physical Behaviors – Gas Laws – Chemical and Physical Properties. Chemical Process Thermodynamics': Energy Relations and Balances – Free Energy and Entropy – Equilibrium Relations. Chemical Process Kinetics: Rates and Orders of Reactions – Kinds of Reactions – Reactor Design.		
PE246	**Applied Thermodynamics**	9	PE211
	Main Principle and Definitions - Temperature and Zeroth Law of Thermodynamics - Heat and Work - The Definitions of Process and the Path - The State of Working Fluid - Reversible and Irreversible Processes - Reversible Work - First Law of Thermodynamics - Internal Energy - Application of the First Law and No-Flow Process - Working Fluid: Liquid-Vapor, Gas, Steam Tables - Perfect Gas – Specific Heat - Reversible and Irreversible Process - Reversible No-Flow Process on (P - V) Diagram for Steam and Perfect Gas - Second Law of Thermodynamics - Heat Engine - Thermal Efficiency - Entropy - Reversible No-Flow process on (T-S) Diagram - Carnot Cycle - Constant Pressure Cycle.		
PE 248	**Structural Geology**	9	PE221
	Definition of Geological Structures and their Importance - Studying of Primary Geologic Structures and their Significant - Mechanical Properties of Rocks Under Stresses and Factors Controlling their Behavior - Studying of Secondary Structure (Folds - Faults - and Joint and Cleavages) - Classification of Different Type of Folds, Faults and Joints - Appearance of Different Structures on Maps - Studying of Unconformities Surfaces and their Significances - The Earth Movement in the Light of Plate Tectonic Theory - Examples of Major Structures Feature of Libya.		
PE 250	**Fluid Mechanics**	9	PE231
	Fluid Properties - Fluid Statics: Pressure at a Point, Pressure Variation in a Static Fluid, Units and Scales of Pressure Measurement, Manometers, Forces on Submerged Surfaces, Buoyant Force, Masses of Liquids Subjected to an Acceleration – Fluid Flow Concepts and Basic Equations: Flow Characteristics, Continuity Equation, Momentum Equation, Euler s Equation of Motion a long a Streamline, Bernoulli's Equation, Steady-State Energy Equation, Energy Losses - Dimensional Analysis: Dimensional Homogeneity and Dimensionless Ratios, The **Π** Theorem - Compressible Flow: Speed of a Sound Wave, Mach Number, Isentropic Flow, Converging-Diverging Nozzle Flow - Velocity and Flow Rate Measurements.		
PE 252	**Drilling & Production Machinery**	9	PE241
	I. Drilling Machinery: The Rotary Rig and Its Components: The Rotating System , The Hoisting System, The Circulating System - Power Requirements and Ton-Miles of a Drilling Line - Drilling Techniques: Control of Hole Deviation in Vertical Drilling, Control of Hole Deviation in Directional Drilling, Fishing Operations -Well Control Equipments: Fluid Density Control, Blow Out Preventers. *II. Production Machinery:* Surface Gathering Systems - Gas Lift Valves: Types and Mechanics - Sucker Rods Pumps -.Production Packers - Oil and Gas Separators.		
ES 206	**Linear Algebra**	12	ES102
	Vector spaces, matrices and determinants, simultaneous linear equations, linear transformations, eigenvalue problems, canonical forms, numerical linear algebra, linear differential equations, linear programming, linear product spaces. Applications in various areas such as control theory, statistics, linear circuit and vibration theory, etc.		

PE 254	Fluid Mechanics Laboratory	3	PE231
	Measurement of pressure, velocity, temperature and mass flux. Hot Wire Anemometry. Laser Doppler Anemometry. Water Tables, Water Tunnels and Wind Tunnels. Friction and total pressure losses in pipes. Axial and radial compressors, turbines and fans. Turbulent flow measurements. Compressor, turbine and wing blades and profiles. Jets, wakes, waves and vortices. Hydraulic and pneumatic circuits. Fluid power control systems.		

❺ Fifth Semester Courses

Code	Course Contents	Units	Prerequisite
PE 321	Exploration Methods for Oil	9	PE325*
	Introduction to exploration methods- Role of Applied Geophysics in Field of Oil and Gas Exploration - Magnetic Method: Basic Concepts, Field Work, Results and Interpretation - Gravity Method: Basic Concepts, Field Work , Results and Interpretation - Seismic(Refraction Method): Basic Concepts, Field Work, Results and Interpretation - Seismic(Reflection Method): Basic Concepts, Field Work, Results and Interpretation - Seismology(Induce Tremors): Relation to Oil Production, Basic Concepts, Field Work, Results and Interpretation – Resistivity Method: Basic Concepts, Field Work, Results and Interpretation –Radioactive method: Basic Concepts, Field Work, Results and Interpretation - Geothermal: principle of the Method, Source of Temperature, Measurements and Interpretation - Application of Geophysical Method to Problems in Petroleum Engineering.		
PE 323	Drilling Fluids	6	PE244, PE252
	Introduction and Review to the System of Units - Subsurface Pressure Control with Definitions to Some Criteria - Review to Some Fluid Flow Fundamentals - Drilling Fluid Functions - Types of Drilling Fluids - Drilling Fluid Properties and Methods of Measurements - Drilling Fluid Calculations - Drilling Fluid Contaminations and Treatments - Drilling Fluid Properties Affecting Penetration Rate - Hole Problems Related to Drilling Fluids - Mud Conditioning Equipment and their Layout - Air or Gas Drilling.		
PE 325	Petroleum Geology	9	PE248
	Origin of Petroleum - Theories of Organic & In-Organic Origin - The Present Theory - Occurrence of Petroleum - Surface Occurrence - The Kerogen and the Type of its Occurrence. Formation of Petroleum - Source Rock- Migration of Petroleum: Primary & Secondary Migration - The Reservoir Rock: Sandstone & Carbonates - Oil Traps: Stratigraphic, Structural & Combined Traps - Accumulation of petroleum - Study of Some Productive Oil Fields in Libya, its Depositional Basin, Source Rock, Reservoir, Migration & Accumulation of Oil.		
PE 327	Drilling & Oil Well Design	9	PE252
	Factors Affecting the Penetration Rate - Rheological Classification of Fluids - Pipe Flow of Newtonian Liquids - Annular Flow of Newtonian Liquids - Pipe Flow of Bingham Plastics - Annular Flow of Bingham Plastics - Rotary Drilling Hydraulics - Casing String (Function of Casing, Types of Casing String, Classification of Casing) - Selection of Casing Sizes - Design of a Combination String - Rotary Drilling Techniques (Vertical Drilling, Directional Drilling) – Cost of Drilling - Drilling Problems.		
PE 329	Reservoir Rock Properties	9	PE241
	I. Fundamental Properties of Fluid-Permeated Rocks: Porosity: Types and Measurement of Porosity in Laboratory - Permeability: Types and Measurement of Permeability in Laboratory - Permeability of Combination Layers - Fluid Saturations and their Measurements in Laboratory - Electrical Conductivity of Fluid-Saturated Rocks, Resistivity Relations. II. Properties of Porous Media Containing Multiple Fluid Saturations: Fundamentals of Surface and Capillary Forces - Water Saturation from Capillary Pressure data - Calculation of Wettability - Effective and Relative Permeability.		

Code	Course Contents	Units	Prerequisite
PE 331	**Reservoir Fluid Properties** Fundamentals of the Behavior of Hydrocarbon Fluids - Single Component System - Binary System - Multi Components Systems - Classification of Crude Oils and Natural Gases According to Their Phase Diagrams - Properties of the Gaseous State (Ideal Gas Laws, Behavior of Natural Gases, Properties of Natural Gases) - Properties of Hydrocarbon Liquids - Properties of Two Phase Hydrocarbon Systems (Oil Formation Volume Factor, Bubble Point Pressure, Solution Gas Oil Ratio, Flash PV Test, Differential Oil Formation Factor and Gas in Solution) - Equilibrium Relations - Physical Properties of Formation Water.	9	PE241, PE250
PE333	**Geological Laboratory** Minerals Identifications – Rocks Identifications – Contour Maps – Cross Sections – Fault Types – Fold Types – Dip and Strike – Stereographic Problems – Examination of Well Cutting – Thin Section Analysis – Well Correlation – Subsurface Mapping.	3	PE248, PE325*
PE336	**Drilling Fluid Laboratory** Laboratory experiments are designed to help students better understand the factors controlling drilling fluid properties as well as familiarize students with field testing procedures of drilling fluids.	3	PE 323

❻ Sixth Semester Courses

Code	Course Contents	Units	Prerequisite
PE 340	**Applied Reservoir Engineering** Petroleum Reservoirs - Estimation of Hydrocarbon Volume Volumetrically – Gas Reservoirs (Estimation Gas in Place by Material Balance Equation) – Oil Reservoirs (Estimation Oil in Place by Material Balance Equation) - The Material Balance Equation as a Straight Line Equation - Estimation of Original Oil in Place by the Material Balance Equation as a Straight Line Equation - Predicting Reservoir Performance - Tamer Method - Muskat Method - Estimation Recovery Factor (Reserves) - Actual Example (Oil Reservoir).	9	PE329, PE331
PE 342	**Fluids Flow in Porous Media** Darcy's Law - Classification of Fluid Flow System: Linear, Radial, Spherical - Steady-State Linear Flow: Incompressible Fluids, Gases - Linear Flow in Beds in Series and in Parallel - Poiseuille s Law for Capillary Flow - Flow through Fractures - Steady-State Radial Flow: Incompressible Fluids, Gases - Permeability Variation in Radial Flow - Unsteady-State Radial Flow: Diffusivity Equation, Exponential Integral Solution and its Applications - Radial Flow in Bounded Drainage Areas - Water Influx: Hydraulic Analogs of Water Influx, Water Influx from Solutions of the Diffusivity Equation, General Material Balance Equation, Water Influx from Material Balance Equation, Simultaneous Calculation of Initial Oil in Place and Water Influx from Material Balance Equation.	9	PE329, PE331
PE 344	**Well Testing analysis** Drill Stem Testing Steps & Reading the Test - DST Test and its Analysis - Pressure Buildup & Drawdown Tests and their Usage for Calculating Reservoir Characteristics - Average Reservoir Pressure - Gas Well Testing - Use of Typical Kind Curve.	9	PE327
PE 350	**Production Engineering I** Outline of Oil and Gas Production Methods - Production-Rate Decline Curves - The Performance of Productive Formations: Productivity Index and Inflow Performance Relationships - Factors Influencing Shape of IPR - Predicting the Shape of IPR for Depletion - Drive Reservoir - Vertical Lift Performance: Flow Regimes in Vertical Two - Phase Flow Pressure - Distribution Curves - The pressure Grid - Slippage and Flow Resistance: Optimum GLR - Effect of Tubing Size and Depth - The Flowing Well Including: Choke Performance, Down-Hole and Flow-Line Chokes - Effects of Changes in Choke Size, Static Pressure, the Producing GLR on Well Efficiency - The Heading Cycle -Water and Gas Coning Problems and Proposed Solutions.	9	PE252, PE346*

Code	Course Contents	Units	Prerequisite
PE 346	**Well Completion** Oil Well Cementing - Completion Operation - Completion Fluids – Perforating Operations - Water and Gas Coning - Well Completion Program and Control – Sand Control - Completion Efficiency - Formation Damage - Well Stimulation Techniques for Removing the damage and Improving the Flow Efficiency: Hydraulic Fracturing and Acidizing.	9	PE327, PE348*
PE 348	**Drilling Technology** Drilling Technology of Horizontal Wells (Equipments Used, Hydraulics, Casing Design, Cementing, Completion) - Problems of Horizontal Drilling- Well Testing in Horizontal Wells -Production from Horizontal Wells - Off Shore Drilling.	6	PE252, PE323
PE352	**Reservoir Rock and Fluid Laboratory** Determinations of physical properties of reservoir rock: absolute and effective porosity, gas and liquid permeability and Klinkenberg effect, capillary pressure curves and pore size distribution, fluid saturation. Measurements of PVT characteristics of reservoir fluids: bubble-point pressure, oil formation volume factor, gas solubility, gas formation volume factor and compressibility factor, oil, gas and water viscosities.	3	PE329, PE331

❼ Seventh Semester Courses

Code	Course Contents	Units	Prerequisite
PE 451	**Production Engineering II** Major Methods of Artificial Lift - Gas Lift: Gas Lift Valve Characteristics, Type of Gas Lift Installations, Factors to Consider in the Design of Continuous Flow Gas Lift Installations, Determination of the Gas Injection Point, Spacing of Gas lift Valves, Determination of the Flow Rate Possible by Gas Lift, Compressor Horse Power Requirements - Different Types of Pumping System: Hydraulic Pumps, Jet Pumps, Plunger Lift, Beam Pumping, Electrical Submersible Centrifugal Pumps, Components of the Submersible Pumping System, Types of Electrical Pumping Installations - Planning for and Comparison of Different Artificial Lift Methods - Surface Production Facilities: Fluid Separators, Heater Treaters and Oil Skimmers.	9	PE350
PE 457	**Natural Gas Engineering** History, Occurrence, Reserves, Production, and Consumption of Natural Gas - Review of Physical and Thermodynamic Properties of Natural Gas and Condensate Fluids - Determination and Estimation of Heating Value of Natural Gases - Water Content of Natural Gas and Properties of Natural Gas Hydrates - Calculations for Flow and Metering of Gases in Pipelines and Gas Wells - Calculation of Static and Flowing Bottom-hole Pressures of Gas Wells - Compression of Natural Gas - Estimates of Gas Reserves or using P/Z Curves - Deliverability and Isochronal Testing and Analysis of Gas Wells - Storage Means of Natural Gas.	6	PE340, PE331
PE 470	**Reservoir Simulation** Reservoir Simulation , What , Why and How - Single and Multiphase Flow in Porous Media in 3-D for Steady and Unsteady Cases - Finite Difference Method for solving Diffusivity Equation - Simulator Classification - Data Preparation – History Matching(Mode1 Verification) - Application of Reservoir Models in Field Development.	9	PE340
PE 459	**Well Logging** The basic of Resistivity Equation - Formation Temperature - Archie's Formula - Spontaneous Potential: The SP Log, SSP and SP curves, Inflection Point, Recording of Potential Drop, Uses of SP Log, , Factors Affecting SP Curve - Resistivity Logs: Devices, Measurement, Normal Devices - Focused Tools - Induction Tools: Measurement, Calculation of Water Saturation - Sonic logs: Interpretation, Theory of Propagation, Type of Sonic Measurements, Generation of the Signals, Signal Path - Analysis of the logs: Pattern Recognition, Quick Look Technique, Rw Computation Method, Chart Method, Comparison – Nuclear logs: Introduction, Sources, Devices, Dual Spaced - Density Log: Log Pad Content, Porosity Determination - Shaly Formation Neutron Logging: Tools, Measurements, Corrections, Neutron Density Pattern, Cross	9	PE346

plotting N-O for Shale - Gamma Ray Properties - Radio Element Depositum - Gamma Ray Curves Characteristics - Use of Gamma Ray to Determine V. Shale.

Code	Course Contents	Units	Prerequisite
PE 471	**Computer Applications in Petroleum Engineering** Review of Used Programming Language and Computer Structure – Curve Fitting Program (Least Square Method) - Interpolation and Extrapolation Program - Application of Computer in Drilling Engineering - Application of Computer in Reservoir Engineering - Application of computer in Natural gas Engineering – The Use of Decline Curve Analysis by Computer - Miscellaneous Applications - Software Applications.	9	ES152
PE xxx	**Elective Course**	9	-
PE 469	**Seminar** Lectures are Presented on Subjects Related to Preparation of Technical Presentations, Use of Visual Aids, and Platform and Vocal Techniques - Each Student is then Required, as a Practice, to Prepare and Deliver a Presentation on Selected Subjects - Each Presentation is Discussed and Methods for Improvements are Highlighted - Finally, Students are Evaluated for their Final Presentations.	6	-
PE463	**Well Logging Laboratory** Introduction to well logging types – Mud and cutting Logging – Estimation of; Formation Temperature, Mud Fill rate Resistivity, Solutions – Determination of Water Resistivity from SPLOG – Determination of True Resistivity from R logs – Estimation of Formation Factor and Porosity – Estimation of Porosity from Sonic Log – Determination of Saturation: Using Archie Formula, Using Ratio Method – Gamma Ray Log Interpretation – Neutron Log Interpretation – Dip meter Log Interpretation – Correlation using Logs.	3	PE346, PE459*

❽ **Eighth Semester Courses**

Code	Course Contents	Units	Prerequisite
PE 453	**Transportation & Storage of Petroleum** Design of Oil Pipelines: Major & Miner Pressure Drop, Optimum Pipe Size, Hydraulic Gradient Curves - Mechanical Design - Pressure Drop Using Monographs - pumping stations arrangement - Design of Gas Transmission Pipelines: Pressure Drop, Pipe Line Storage Capacity, Optimum Pipe Diameter, Gas Hydrate - Two-Phase (Liquid & Gas) Flow: Type of Flow, Pressure Drop, Correlations for Multiphase Flow - Petroleum Storage Tanks: Optimum Tank Proportions, Mechanical Design - Pressure Vessel Design: Optimum Proportions, Mechanical Design, Wind Effect, Spherical Tanks.	6	PE250, PE350
PE 472	**Enhanced Oil Recovery** Outline of EOR Methods and Common Factors Affecting them – Fluid Distribution and the Theory of Frontal Displacement - Buckely-Leverett Theory - Injection Well Location - Water Injection: Water Injection Performance Calculations for Homogenous and Stratified Formations - Gas Injection: Gas Injection Performance Calculations - Miscible Drive: High Pressure Dry Gas Injection - Enriched Gas Injection - Liquefied Petroleum Gases - Alcohol Slug Injection - Carbon Dioxide Injection - Chemical Flooding: Surfactant Injection, Polymer Flooding, Caustic Flooding, the Use of Micro Emulsions – Thermal Recovery Methods: Hot Water Injection, Steam Injection, Cyclic Steam Injection, In-Situ Combustion(Forward and Reverse Combustion).	9	PE340
PE 474	**Safety & Loss Prevention** Introduction - Type of Hazards and Hazardous Materials - Hazards Dealing with Oil Industry - Safety Equipments - Factors Enhance Safety: Training, equipments, periodic inspection, etc. - Environment Pollution from Oil Industry - Accidents - Reports.	6	-
PE xxx	**Elective Course**	9	-

PE 480	**Project**	18	-
	Experimental and/or Theoretical Approaches with Possible Application of Computer Techniques to Integrate Various Components of the Curriculum in a Comprehensive Engineering Design Experience - Design of a Complete Project Including: Identification of a Problem, Formulation of Design, Preparation of Specifications - Consideration of Alternative Feasible Solutions - The Work will be Supervised by a Faculty Member - The Student has to Submit a Detailed Final Project Report and Present his Work.		
PE 482	**Petroleum Engineering Economics**	6	-
	Introduction - Interest: Simple Interest, Compound Interest, Continuous Interest - Present Day Value and Discount Annuities - Depreciation: Type of Depreciation, Methods for Calculating Depreciation, Straight Line Method, Declining Balance Method, Sum of the Year Digits Method – Capital Investment - Estimation of the Total Production Cost – Petroleum Engineering Economics..		

∗ Elective Courses

Code	Course Contents	Units	Prerequisite
PE 484	**Reservoir Management**	9	PE340
	Exploration Background - Reservoir Engineering Activities - Possible Technical Solutions - Economic Analysis - Decision Criteria.		
PE 486	**Corrosion in Oil Industry**	9	PE244
	Introduction: Direct and Indirect Corrosion Losses - Electrochemical - Mechanism - Metallic Passivity - Corrosion Rats Expression – Economic Consideration: Net Present Value Method & its Application in Corrosion Control - Corrosion Forms: Uniform Attack, Galvanic Corrosion, Erosion Corrosion – Stress Corrosion: Forms, Mechanisms, Factors Affect, Prevention and Control - Cathodic & Anodic Protection - Isolation & Coating - Metals of Constructer: Stainless Steel, Copper, Aluminum, Lead, Nickel, Titanium, Tantalum - Corrosion Inhibitors: Mechanics & Applications - Corrosion Charts.		
PE 488	**Fuel & Combustion**	9	PE250
	Introduction - Heating Value - Combustion Calculations - Heat Loss in Fuel Gas - Flame Temperature - Stack Draft Calculation - Stack Height & Diameter - Classification of steam - Shifting Reaction to CH4 production - Fuel: Solid Fuels: Content, Classifications - Liquid & Gas Fuels: Refinery Processing of Crude Oil - Natural Gas: Liquefied Natural Gas - Secondary Fuels: Conversion Processes: Cracking and Reforming - Fuel & Energy: Electricity from Combustion – Solar Energy - Atomic Energy - Wind energy - Tide energy - Energy by Non-Combustion Processes.		
PE 475	**Petroleum Refining Engineering**	9	PE350
	Introduction - Composition of Crude Oil, its Classification and Evaluation Methods - Preparation of Crude to Refine - Type of Refinery - Crude Oil as Source of Petrochemical Industry - Distillation Processes - Petroleum Processing Equipments - Processing of Hydrocarbon Gases - Thermal and Catalytic Processes - Lubricate Oil Production and its Additives.		
PE 489	**Oil Property Evaluation**	9	PE 340, PE 482*
	Economical and technical aspect 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, optional analysis. Filed development decision –making. Influencing factors. Risk, ventures. Oil market and prices. Government oil policy. Financing, capital for oil projects. Technical and scientific development, technology transfers.		

PE 473	**Application of EOR**	9	PE 472*

Enhanced oil recovery (EOR) theoretical principles, methods, criteria for selection. Analysis of reservoir and fluid data for EOR purposes. Recovery evaluation, economics and statistics of EOR, pilot projects, EOR techniques methods: thermal methods (combustion steam) chemical flooding, hydrocarbon miscible; immiscible, miscellar flooding, gas system (natural gas, $Co2$), polymer flooding methods. EOR requirements and implementation, performance, follow up, evaluation of project at certain stages, prediction.

PE 490	**Project Management**	9	PE 484*

Concepts, development of industrial 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. Feed back, flow of data, information, presentation, preparation of technical reports.

* Corequisite