The University of Misan

College of Engineering

Petroleum Engineering Department

Curriculum of First year

First Year			First Semester			Second Semester		
Code	Subject	Units	Theo.	Tuto.	Lab	Theo.	Tuto.	Lab
PE 100	General Geology	8	3		2	3		2
GE 101	Analytical Chemistry	3	2		2			
GE 102	Mathematics	6	4			4		
GE 103	Electrical Technology	3				2		2
GE 104	Computer Programing	6	2		2	2		2
GE 106	Engineering Drawing & Descriptive Geometry	4	1		3	1		3
GE 108	Statics & Dynamics	4	3			3		
GE 110	English Language I	4	2			2		
GE 114	Physics	4	2			2		
Total		42	19		9	19		9
Total hours/Week			28			28		

PE = Petroleum Engineering
GE = General Science

The Syllabus:

The following is the syllabus of the subjects in the department curriculum.

FIRST YEAR:

PE 100 General Geology:

Earth in space; shape and surface relief of the earth; matter and minerals; igneous, sedimentary and metamorphic rocks; weathering and soils; processes of erosion, transportation and deposition; ground water; crustal deformation (structural features) and mountain building movements; earthquakes and the earth's interior; keys to the past; time in geology; historical geology; plate tectonics and continental drift.

GE 101 Analytical Chemistry:

Theory: Review of basic concepts; stoichiometry; chemical reaction and heat; organic chemistry; fuels; various batteries and electronic cells; principles of corrosion; water for domestic uses; industrial water;
atmospheric pollution.

GE 102 Mathematics I:

Types of functions (trigonometric; inverse trigonometric functions, logarithmic functions, exponential functions, transcendental functions, other types of functions, graph of functions); Differentiation (explicit and implicit; application of derivatives in graphing); Integrals (integrals as a summation of areas; definite integrals, applications of definite integrals, areas and volumes; techniques of integration); determinants and matrices, conical section; Introduction to polar coordinates.

GE 103 Electrical Technology:

D.C. circuits, A.C. circuits, magnetic circuits, D.C. Machines, Transformers & induction motors, Measuring instruments; Voltage, Current, Resistance Power and Temperature; Laboratory experiments.

GE 104 Computer Programming:

Using Excel (Introduction, Navigating the Interface, Entering Data, Setting Cell Data Types, Selecting More Than a Single Cell, Entering Formulas, Exploring the R1C1 Cell Reference Style, Referring to More Than a Single Cell, Understanding Operator Precedence, Using Exponents in Formulas, Formatting Your Spreadsheets, Leveraging Copy, Cut, Paste, and Paste Special, Using Cell Names, Validating Data, Taking Advantage of Macros, Adding Comments and Equation Notes), Charting (Creating Simple Charts, Exploring Chart Styles, Formatting Charts, Customizing Chart Axes, Setting Log or Semilog Scales, Using Multiple Axes, Changing the Type of an Existing Chart, Combining

Chart Types, Building 3D Surface Plots, Preparing Contour Plots, Annotating Charts, Saving Custom Chart Types, Copying Charts to Word),
Getting Acquainted with Visual Basic for Applications (Navigating the VBA Editor, Writing Functions and Subroutines, Working with Data Types, Defining Variables, Defining Variables, Using Arrays, Commenting Code, Spanning Long Statements over Multiple Lines, Using Conditional Statements, Using Loops, Debugging VBA Code, VBA's Built-in Functions, Exploring Excel Objects, Creating Your Own Objects in VBA) Mathematical Functions (Using Summation Functions, Delving into Division, Mastering Multiplication, Exploring Exponential and Logarithmic Functions, Using Trigonometry Functions, Seeing Signs, Getting to the Root of Things, Rounding and Truncating Numbers, Converting Between Number Systems, Manipulating Matrices, Building Support for Vectors, Using Spreadsheet Functions in VBA Code).
Curve Fitting and Regression (Performing Linear Curve Fitting Using Excel Charts, Least Squares Method, Generating Nonlinear Curve Fits Using Excel Charts, Fitting Nonlinear Curves Using Solver) Solving Equations (Finding Roots Graphically, Solving Nonlinear Equations Iteratively, Automating Tedious Problems with VBA, Solving Linear Systems) Numerical Integration and Differentiation (Integrating a Definite Integral, Implementing the Trapezoidal Rule in VBA).

GE 106 Engineering Drawing and Descriptive Geometry:

Engineering Drawing: Introduction, instruments & their use; applied geometry; dimensions & lettering; orthographic drawing & sketching; pictorial drawing & sketching auxiliary view; section; convection & assembly; projection in general.
Descriptive Geometry: Representation of points, lines, and planes; types of planes; application of lines and planes; development of surfaces; determination of true lengths of straight lines by revolution and auxiliary planes; traces of planes; finding line of intersection of planes by traces and projections.

GE 108 Static's & Dynamics:

Static & dynamic principles; resultant of forces; friction; center of gravity; moment of inertia; rectilinear motion; curvilinear motion; rotation; energy & work; mechanical vibration.

GE 110 English Language I:

Parts of speech (nouns, pronouns, verbs, adverbs, prepositions, conjunctions, interjections); kinds of sentences (simple, compound, complex); subordinate clauses; change of sentences from simple to compound and vice versa; tenses; passive and active; direct and indirect speech.

GE 114 Physics:

Energy and its Conservation: energy, work, power, gravitational potential energy, kinetic energy, conservation of energy. Simple Harmonic Motion: periodic motion, simple harmonic motion, the potential energy of a spring, conservation of energy and the vibrating spring. Wave Motion: mathematical representation of a wave, speed of a transverse wave on a string, reflection of a wave at a boundary, sound
waves, the transmission of energy in a wave and the intensity of a wave. Fluids: density, pressure, Pascal's principle, Archimedes' principle, equation of continuity, Bernoulli's theorem, viscosity, stress and strain. Surface tension: interfacial tension, contact angle, wetting phenomena, capillary pressure. Heat transfer: convection, conduction, and radiation. Coulomb's law and the electric field, flux, Gauss' law, electric potential.

The University of Misan

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Petroleum Engineering Department

Curriculum of Second year

Second Year			First Semester			Second Semester		
Code	Subject	Units	Theo.	Tuto.	Lab	Theo.	Tuto.	Lab
PE 200	Structural & Petroleum Geology	6	2		2	2		2
PE 201	Petroleum Properties	2	1		3			
GE 202	Mathematics	6	3	1		3	1	
GE 203	Engineering Thermodynamics	3	3	1				
GE 204	Computer Programing	4	1		2	1		2
GE 205	Strength of Materials	3				2	1	2
PE 206	Fundamentals of Petroleum Engineering	4	2	1		2	1	
GE 208	Fluid Mechanics	5	2	2		2	2	2
GE 210	English Language II	4	2			2		
GE 212	Democracy	2	1	1		1	1	
Total		39	17	6	7	15	6	8
Total hours/Week			30				30	

SECOND YEAR:

PE 200 Structural and Petroleum Geology:

Mechanics of structural deformation; folds, faults, and joints; unconformities; sedimentary environments; origin of oil: generation, migration and accumulation of petroleum; source rocks; reservoir rocks, cap rocks, traps (types and discovering techniques); reservoir mechanics (pressure, temperature, reservoir energy); subsurface mapping; oil field waters, Iraq and Middle East oilfields.

PE 201 Petroleum Properties:

Crude Oils (chemical composition, classification, properties); density, specific gravity and coefficient of expansion; viscosity, molecular weight; vapor pressure, specific heat; latent heat; heat of combustion; boiling range, flash point; pour point, sulfur content; aniline point; penetration umber; softening point; crude oil evaluation; fractional distillation and TBP curve; analysis of fraction; dehydration of crude oil; natural gas properties; oilfield water properties.

GE 202 Mathematics II:

Polar coordinates (graphs in polar coordinates; arc length and areas in polar coordinates); Vectors in two and three space (Cross products; Vector valued functions; Motion along curves; differentiation and integration of vector valued functions); Infinite series (divergence and convergence of series, Taylor and Maclaurian series); Functions of more than one variable (Partial differentiation ; Extreme values, gradients; Lagrange multiplier); Multiple integrals, change of order; Change from Cartesian to polar coordinates; first order differential equations; Introduction to second order differential equations.

GE 203 Engineering Thermodynamics:

Temperature and heat: temperature, heat, specific heat, calorimetry, change of phase, thermal equilibrium. Thermal expansion: linear, areal, and volume expansion of solids, volume expansion of liquid and gases, Charles's law, Boyle's law, the ideal gas law, kinetic theory of gases, real gases, equations of state. Application of the concept of work to a thermodynamic system, heat added and removed first law of thermodynamics, some special cases of the first law (the gasoline engine, the ideal heat engine, and the Carnot cycle). The second law of thermodynamics: heat engine and the second law, refrigeration and the second law, reversibility, entropy, statistical interpretation of entropy. Binary system, multi-component system, bubble point, dew point, phase envelop, critical pressure-critical temperature.

GE 204 Computer Programming:

FORTRAN 90, Mathlab.

GE 205 Strength of Materials:

Stress; simple stress, shearing stress, bearing stress, thin wall cylinders, strain, stress diagram, Hook law, Poisson's ratio, thermal stress; torsion; torsion formula, flanged bolt; coupling helical springs; shear and bending moments diagrams; analytical and graphical deflection; buckling; special topics.

PE 206 Fundamentals of Petroleum Engineering:

Elements of petroleum engineering; origin of petroleum; reservoir rock properties and fluid distribution; volumetric calculations of oil in place; natural forces in oil and gas reservoirs; oil exploration; rotary drilling; rig components; casing, cementing and well completion; well logging; surface equipment; Iraqi oil fields.

GE 208 Fluid Mechanics:

Dimensions & units, process variables; physical state; overall mass balance; overall energy balance; overall momentum balance, concept of fluid behavior; Newtonian and non-Newtonian fluids, flow measurements; Pitot tube; Venturi meter, orifice meter; Rota meter; some design equations for the flow of incompressible fluids; friction losses in pipes and fittings; two-phase flow; fluid machinery.

GE 210 English Language II:

Punctuations; Phonetics and spelling; Regular and irregular verbs; Words and phrases that require special attention; Idioms with common verbs; Writing (composition, letters, essays).

GE 212 Democracy

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Petroleum Engineering Department

Curriculum of Third year

Third Year			First Semester			Second Semester		
Code	Subject	Units	Theo.	Tuto.	Lab	Theo.	Tuto.	Lab
PE 300	Petroleum Reservoir Engineering I	8	3	1	2	3	1	2
PE 301	Geophysics	2	2	1				
PE 302	Petroleum Drilling Engineering I	8	3	1	2	3	1	2
GE 302	Engineering Mathematics	6	3	1		3	1	
GE 303	Engineering Statistics	2				2	1	
PE 304	Petroleum Production Engineering I	4	2	1		2	1	
PE 306	Well Logging	6	3	1		3	1	
PE 308	Petroleum Engineering Economics	4	2			2		
GE 310	English Language III	4	2			2		
Total		44	20	6	4	20	6	4
Total hours/Week			30				30	

THIRD YEAR:

PE 300 Petroleum Reservoirs Engineering I:

Types of traps; Fluids distribution; Types of oil reservoirs; Porosity, compressibility; permeability; Poueseli law, Kozeny Equation, Darcy's law; measurements of permeability, Klinkenberg effect; Gas flow equation; Radial flow; Productivity equation; radial flow of gas; average permeability for stratified reservoirs; Flow through channels and fractures; Saturation; Capillary pressure; Wettability; Multiphase flow through porous media; Linear flow (piston like, leaky piston); Effective and relative permeability; Calculation of relative permeability; Fractional flow equation; Buckley-Leverett equation; Gas properties (Boyle and Charles laws; Avogadro law; Dalton law, equation of state); compressibility factor; liquids properties (PVT); viscosity, classification of reservoirs according to P-T diagram, Phase behavior; calculation of bubble point and dew point; behavior of non-ideal liquids; flash and differential degassing; determination of reservoir liquids; properties of formation water; Volumetric calculation of reservoirs; Isobar, Isobach,
Isoporosity and bubble maps. Material balance equation; Material balance for water derive and gas derive reservoirs; Calculation of reservoir pressures.

PE 301 Geophysics:

Gravity prospecting: principles, instruments, field measurements & reductions; interpretations; seismic prospecting: wave propagation, instruments, refraction and reflection methods, interpretation; magnetic prospecting: principles, instruments, measurements & interpretation; airborne magnetometer.

PE 302 Petroleum Drilling Engineering I:

Introduction to drilling; classification of drilling operations; Properties and functions of drilling fluid; types and properties of clay in water; types of drilling fluids; drilling hazards dependent on mud control; drilling mud calculations, drilling methods (cable tool drilling, rotary drilling), basic component of rotary drilling equipment; drilling string and accessories; types of bits; casing of oil wells; functions of casing, types of casing, strings, parameters of casing design, selection of casing and bit
types, design of string, graphical design of casing; cementing of oil wells, classification and properties of cements, classification of cementing operations, cementing equipment, methods and calculations of cementing; Hydraulics of primary cementing operations.

GE 302 Engineering Mathematics:

Ordinary differential equations, partial diff. equations, solutions of ordinary diff. equations, applications of first and second order ordinary differential equations; solutions by Laplace transforms; Bessel functions; Fourier series; Taylor series; numerical methods.

GE 303 Engineering Statistics:

Importance of statistics; descriptive and inferential statistics; pictorial description of data; random sample selection; data classifications; frequency distributions; cumulative frequency distributions; graphical representation of data histograms; frequency polygon; measures of probability variation and the binomial distributions; Poisson distribution; normal distribution; correlation and regression analysis.

PE 304 Petroleum Production Engineering I:

Well completion operations (parameter of design, completion methods, equipment, completion fluids); perforation of oil and gas wells (perforation methods, selection of perforation intervals); water and gas coning; methods for determining oil production rate without coning; completion efficiency, drill stem test (DTS) (test method, equipment, pressure versus time curve, theory of pressure buildup, reservoir properties obtained, depletion); Helical buckling of tubing (forces, homogeneous completion, packers permitting free and limited motions, compound completion of wells); surface gathering systems (types of gathering systems, behavior of fluid flow, flow lines, essential flowing lines, valves); separation of oil, gas, & water (types of separators, components of separators and functions); oil storage (storage tanks and accessories, calibration, measurement of liquid level); Production by pumps (sucker and submersible pumps).

PE 306 Well Logging:

Basic rock properties, petrophysics; SP log; conventional resistivity log, induction log; lateral log, macro resistivity log, sonic log, density log, neutron log, gamma ray log, TDT log, CBL log and quick method in (HC) detection.

PE 308 Petroleum Engineering Economics:

Oil and gas reserve, organizations of petroleum exporting and importing countries, international supply and demand of petroleum, classification of petroleum, petroleum pricing, alternative energy, international strategy of energy, time value of money, types of interest rates, rate of return, methods of engineering decisions, depreciation, depletion, amortization, taxation, inflation, sensitivity analysis of engineering projects, risk analysis production decline curves, evaluation of future production of oil and gas well sand ,Expenditure and Net present value.

GE 310 English Language III:

General study of English language through the use of subjects related to the specialization of the department such as: petroleum industry, petroleum exploration, drilling for oil, recovering oil, oil transportation, oil refinery, careers in the petroleum industry.

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Curriculum of Fourth year

Fourth Year			First Semester			Second Semester		
Code	Subject	Units	Theo.	Tuto.	Lab	Theo.	Tuto.	Lab
PE 400	Petroleum Reservoir Engineering II	6	3	2		3	2	
PE 401	Gas Technology	3	3					
PE 402	Petroleum Drilling Engineering II	6	3	2		3	2	
PE 403	Optimization	3				3		
PE 404	Petroleum Production Engineering II	6	3	2		3	2	
PE 405	Integrated Reservoir Management	3	1	1		1	1	
PE 406	Improved & Enhanced Oil Recovery	6	3			3		
PE 408	Numerical Methods & Reservoir Simulations	6	2		2	2		2
GE 410	Engineering Project	4	1		2	1		2
Total		43	19	7	4	19	7	4
Total hours/Week			30				30	

FOURTH YEAR:

PE 400 Petroleum Reservoir Engineering II:

Fundamental concepts; oil reservoirs: depletion drive; gas cap drive, water drive, gravity drainage reservoir, combination drive reservoirs; pressure maintenance; secondary recovery; gas reservoirs; gas condensate reservoirs; miscellaneous subjects.

PE 401 Gas Technology:

Properties of gases; gas system analysis; gas flow through P. M.; gas transportation, gas treatment & liquefaction; gas sweetening and dehydration.

PE 402 Petroleum Drilling Engineering II:

Casing landing (landing as cemented, landing in tension at the freeze point, landing in compression at the freeze point); buckling phenomenon, wellhead loads, blowout and blowout prevention, well kick (methods of control, driller's method, engineer's method); factors affecting drilling rate (effect of pressure, effect of physical properties of drilling mud, effect of weight on bit and rotary speed, economical effect), hole problems (pipe sticking, surge and swab pressure, hole deviation); directional drilling; factors affecting hole inclination of directional wells; types of directional wells; geometry of a directional well; methods of calculations of directional wells; horizontal drilling; types of horizontal wells; air drilling; design of air drilling operations.

PE 403 Optimization:

Introduction, applications in optimization, Linear programming, applications in linear programming, Graphical method, applications in graphical method, Simplex method, applications in simplex method, Transportation method, applications in transportation method, Nonlinear programming, applications in nonlinear programming, Lagrange multiplier method, applications in Lagrange multiplier method.

PE 404 Petroleum Production Engineering II:

Types of reservoirs and radial flow in the reservoirs, productivity index, inflow performance relationship (IPR), effect of stratification and water cut on IPR, productivity index test, Vogel method, Standing method, Couto method, Fetkovich method, Al-Saadoon method, mathematical and physical principles for pressure drop calculations, flow pattern and its relation with pressure drop, Poettmann and Carpenter method, Dukler method, working charts, analysis of choke performance,
prediction of restricted and unrestricted production, effect of other parameters on well performance, derivation and solutions of diffusivity equation, application of Horner solution, multi-rates test, build-up test ,draw-down test, effect of skin factor on well testing, analysis of tests that affected by barrier, bounded reservoirs, gas lift operations, stimulation operations (acidizing and fracturing).

PE 405 Integrated Reservoir Management:

What is reservoir management?, the base map, isopach map, net pay thickness, cross sections, well correlation using logs, isoporosity map, bubble map, routine map, analysis, special core analysis, screening of core data, using correlations to estimate missing data, calculation of initial fluids in place, material balance, determination of reservoir type, building reservoir model, history matching, optimization of surface facilities, suggestions to increase production by plugging, perforation, completion, etc., development strategies, drilling new wells, completion, suggesting additional necessary surface equipment, economic evaluation of the proposed strategy.

PE 406 Improved and Enhanced Oil Recovery:

Principles and definitions, choice of proper methods for enhanced oil recovery, recovery by water displacement, Buckley-Leverett method, Welge mehod, Stiles method, original and improved Dyksra-Parsons method, pattern of flooding, sweep efficiency, properties of injected water, injected pressures, recovery by immiscible gas, Tarner method, Muskat method, recovery by miscible gas, dry gas injection, enriched gas injection, CO_2 injection, N_2 injection, thermal recovery, heat flow through rocks, seam injection, in-situ combustion, tertiary oil recovery, surfactant flooding,, solvent injection, polymer injection.

PE 408 Numerical Methods and Reservoir Simulation:

Interpolation,(Linear; Lagrange); Matrices, Review of matrix properties, Determinants, inverse of matrix; Solution of system of linear equations (Gaussian elimination, Gauss Jordan method, Jacobi method, Gauss Seidel method); Least square method (Linear equations; Polynomial equations); Reservoir simulation (Introduction, types of simulators); Flow through Porous Media (derivation of single-phase, one dimensional flow equation, Two and three-dimensional flow equation); Finite Difference Method (Taylor series; Forward difference; Backward difference; Central difference; Concepts of explicit and implicit methods); Solution of system of difference equations (tridiagonal algorithm); Use of Irregular Gridding: Transmissibility; The finite difference form of the flow equation in terms of Transmissibility; Averaging of rock and fluid properties; Solution of radial form of the
flow equation; Two dimensional flow, setting up the finite difference form; Ordering schemes; Standard row ordering; Standard column ordering; Resulting matrix structure; Introduction to multi-phase flow through porous media.

PE 410 Engineering Project:

Students as groups (of 3 or 4) are requested to carry out a study on one of the problems related to petroleum engineering under the supervision of one of the staff members. Each group must submit a report before the end of the second term. The students must give a presentation of their work to an interview committee of staff members.