



**Sana'a University**

**Faculty of Petroleum and Natural Resources**

**Petroleum Engineering Department**

**Handbook of  
Petroleum & Natural Gas Engineering B.Sc.  
Program**

**2020-2021**

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

**Handbook of  
Petroleum & Natural Gas Engineering B.Sc. Program  
Faculty of Petroleum and Natural Resources**

**Introduction:**

The Department of Petroleum Engineering was established to coincide with the establishment of the College of Petroleum and Natural Resources in September 2019. The idea of establishing the college began with transforming the Department of Earth and Environmental Sciences into a specialized, quality college that can serve the community and graduate cadres that meet the labor market and development of the country, especially in exploiting oil and mineral wealth and other natural resources such as the cement industry. Glass and exploitation of industrial rocks such as zeolite, marble and ornamental stones. The fact that Sana'a University represents the oldest and largest university in the country and does not have specific departments for petroleum and minerals, in light of the presence of such departments in private universities whose opening period does not exceed ten years, was an incentive for the university leadership to direct the establishment of new specific departments, including this department.

The bachelor's program was designed, the curriculum map was prepared, and the structure of the oil and natural gas engineering program was built based on a survey of the structures of approved and similar reference programs at the level of universities around the world. The program follows the semester system of study, in a regular manner, and the department's graduate obtains a Bachelor's degree in Science (specialization: Petroleum and Natural Gas Engineering) after completing four years (8 semesters) of study and passing 137 credit hours of study.

The program's courses are divided into three main areas of scientific program content. These areas are: general culture courses (university requirements) with 19 credit hours, basic sciences courses (college requirements) with 40 credit hours, and major specialization

courses (program requirements with 78 credit hours). The team in charge of structuring the department's materials was keen that the student would obtain, at the end of the fourth year of his studies, all the sufficient practical and applied information and skills that would make him able to work in the diverse and diverse petroleum industry. This qualifies him to compete and succeed in the labor market related to oil and gas technology and engineering, in addition to general job opportunities close to this field, according to international quality standards, which will represent a starting point for a wide range of jobs and postgraduate research.

### **Department Mission:**

The Department of Petroleum Engineering strives to provide high quality educational programs, training and research activities. And to graduate students with the skills required to compete at the local and regional level with the education required by the petroleum industry with the latest technologies. As well as participating in the development of the country and finding national, international and societal solutions to environmental issues related to the petroleum industry.

### **Department Aims:**

The Department of Petroleum Engineering aims at the following:

1. Provide students with the principles of various sciences, especially oil and gas engineering, and provide them with the latest experiences, in addition to improving their computer skills on how to use the computer programs necessary to simulate the oil reservoir and improve production.
2. Providing students with the necessary skills to communicate within a team and to be productive within the community.
3. Provide students with technical and scientific skills capable of working in the various fields of oil and gas.
4. Developing the skills and capabilities of academic cadres and attracting qualified people to join the department.
5. Enhancing the confidence of society and oil and gas companies with our outputs.

### **Conditions for Admission:**

The department accepts Secondary school graduates (scientific section) or its equivalent, who have achieved an average score of 75%, and after passing the entrance exams, or any other conditions set by Sana'a University for admission and registration.

### **Job Opportunities:**

Graduates of the Department of Petroleum Engineering have many job opportunities available in many governmental and private institutions, the most important of which are but not limited to:

- Ministry of Oil & Minerals.
- PEPA (Petroleum Exploration & Production Authority)
- Yemen Oil Company.
- YLNG ( Yemen Liquefying Natural Gas)
- Local and international companies working in the petroleum field.
- Any other institutions related to Oil & Gas issues.
- Private Sector such as industries, oil or mining companies, *etc.*
- Environmental Protection Authority (EPA).

### **The Study Plan:**

The Petroleum & Natural Gas B.Sc. Program consists of 19 credit hours of university requirement which are:

<b>University Requirements</b>		
No.	Course	C.H.
1	Islamic Culture	3
2	Arabic Language (1)	3
3	Arabic Language (2)	3
4	English Language (1)	3
5	English Language (2)	3
6	Arabic Zionist Conflict	2

7	National Culture	2
<b>Total Credit Hours (C.H.)</b>		<b>19</b>

There are also a number of compulsory courses for the study of the program, and these courses are among the requirements of the Petroleum and Natural Resources Faculty, with a total of 40 credit hours, which are as follows:

<b>Faculty Requirements</b>		
No.	Course	C.H.
1	General Geology (1)	3
2	General Geology (2)	3
3	General Math	3
4	General Chemistry	3
5	General Physics	2
6	Principles of Environmental Sciences	2
7	Computer Programming	3
8	Sedimentology & Stratigraphy	3
9	Geophysics	3
10	Statistics	3
11	Principles of Engineering Geology	2
12	Structural Geology	3
13	Remote Sensing and GIS	3
14	Geology of Yemen	3
<b>Total Credit Hours (C.H.)</b>		<b>40</b>

There are a number of compulsory specialized requirements that the student should pass in order to complete the program, and the total credit hours of these courses amount to 78, and these courses are:

<b>Program Requirements</b>
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No.	Course	C.H.
1	<b>Petroleum Geology for Engineers</b>	<b>3</b>
2	<b>Introduction to Petroleum Engineering</b>	<b>3</b>
3	<b>Strength of Materials</b>	<b>3</b>
4	<b>Fluid mechanics</b>	<b>3</b>
5	<b>Engineering Thermodynamics</b>	<b>3</b>
6	<b>Reservoir Rock and Fluids Properties</b>	<b>3</b>
7	<b>᐀Sedimentary Basins and Petroleum System of Yemen</b>	<b>2</b>
8	<b>Sedimentation Process and Production</b>	<b>2</b>
9	<b>Drilling Engineering (1)</b>	<b>3</b>
10	<b>Drilling Engineering (2)</b>	<b>3</b>
11	<b>Reservoir Engineering (1)</b>	<b>3</b>
12	<b>Reservoir Engineering (2)</b>	<b>3</b>
13	<b>Petroleum Production Engineering</b>	<b>3</b>
14	<b>Natural Gas Production Engineering</b>	<b>3</b>
15	<b>Well Logging</b>	<b>3</b>
16	<b>Formation Evaluation</b>	<b>3</b>
17	<b>Petroleum Properties</b>	<b>3</b>
18	<b>Enhanced Oil Recovery</b>	<b>3</b>
19	<b>᐀Reservoir Modeling &amp; Simulation</b>	<b>4</b>
20	<b>Well completion</b>	<b>3</b>
21	<b>Computer Application in Petroleum Engineering</b>	<b>3</b>
22	<b>Natural Gas Engineering</b>	<b>3</b>
23	<b>᐀Petroleum Economics</b>	<b>2</b>
24	<b>Well Testing</b>	<b>3</b>
25	<b>Surface Facilities</b>	<b>2</b>
26	<b>Health and Safety in Petroleum Industry</b>	<b>2</b>
27	<b>Graduation Project (1)</b>	<b>2</b>
28	<b>Graduation Project (2)</b>	<b>2</b>

<b>Total Credit Hours (C.H.)</b>	<b>78</b>
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The above program courses were distributed by taking into account the balance between specialized courses and university and faculty requirements. Also, it was taking into account the pre-requisites of each course separately in a way that did not affect the logical sequence of learning and the acquisition of knowledge and skills of the petroleum specialization. The study plan for the B.Sc. Petroleum Engineering Program courses are distributed as follows:

## First Year:

First Semester						
No.	Course Title	Code	Credit Hours			Pre-requested
			Th.	Pr.	Total	
1	Islamic Culture	UR105	3	0	3	-
2	Arabic Language (1)	UR101	3	0	3	-
3	English Language (1)	UR103	3	0	3	-
4	General Geology (1)	PNR111	2	1	3	-
5	General Maths	PNR113	2	1	3	-
6	Arabic Zionist Conflict	UR107	2	0	2	-
<b>Total Credit Hours</b>					<b>17</b>	
Second Semester						
No.	Course Title	Code	Credit Hours			Pre-requested
			Th.	Pr.	Total	
1	Arabic Language (2)	UR102	3	0	3	UR101
2	English Language (2)	UR104	3	0	3	UR103
3	General Geology (2)	PNR112	2	1	3	PNR111
4	General Chemistry	PNR114	2	1	3	-
5	General Physics	PNR115	2	1	3	-
6	Principles of Environmental Sciences	PNR116	2	0	2	-
7	National Culture	UR106	2	0	2	-
<b>Total Credit Hours</b>					<b>19</b>	



## Second Year:

<b>First Semester</b>						
No.	Course Title	Code	Credit Hours			Pre-requested
			Th.	Pr.	Total	
1	Sedimentology & Stratigraphy	PNR212	2	1	3	PNR112
2	Geophysics	PNR213	2	1	3	PNR112
3	Principles of Engineering Geology	PNR215	2	0	2	PNR112
4	Petroleum Geology for Engineering	PNGE 221	2	1	3	PNR 112
5	MATERIALS STRENGTH	PNGE 223	2	1	3	
6	FLUID MECHANICS	PNGE 224	2	1	3	
<b>Total Credit Hours</b>					<b>17</b>	
<b>Second Semester</b>						
No.	Course Title	Code	Credit Hours			Pre-requested
			Th.	Pr.	Total	
1	Computer Programming	PNR211	2	1	3	-
2	Statistics	PNR214	2	1	3	-
3	Introduction to Petroleum Engineering	PNGE 222	3	0	3	PNGE 221
4	Reservoir Rock and Fluids Properties	PNGE 226	2	1	3	PNR 212
5	Sedimentary Basins and Petroleum System of Yemen	PNGE 261	2	0	2	
6	Sedimentation Process and Production	PNGE 262	2	0	2	
7	Engineering Thermodynamics	PNGE 225	2	1	3	PNGE 224
<b>Total Credit Hours</b>					<b>19</b>	

### Third Year:

First Semester						
No.	Course Title	Code	Credit Hours			Pre-requested
			Th.	Pr.	Total	
1	Structural Geology	PNR311	2	1	3	PNR112
2	Petroleum Drilling Engineering (1)	PNGE 331	2	1	3	PNGE 222
3	Petroleum Reservoir Engineering (1)	PNGE 341	2	1	3	PNGE 222
4	Petroleum Production Engineering	PNGE 351	2	1	3	PNGE 222
5	Well Logging	PNGE 343	2	1	3	
6	Petroleum Properties	PNGE 327	2	1	3	
<b>Total Credit Hours</b>					<b>18</b>	
Second Semester						
No.	Course Title	Code	Credit Hours			Pre-requested
			Th.	Pr.	Total	
1	Remote Sensing & GIS	PNR312	2	1	3	-
2	Geology of Yemen	PNR313	2	1	3	
3	Petroleum Drilling Engineering (2)	PNGE 332	2	1	3	PNGE 331
4	Petroleum Reservoir Engineering (2)	PNGE 342	2	1	3	PNGE 341
5	Computer Application in Petroleum Engineering	PNGE 363	2	1	3	PNR 211
6	Formation Evaluation	PNGE 344	2	1	3	PNGE 343
<b>Total Credit Hours</b>					<b>18</b>	<b>2</b>

## Fourth Year:

First Semester						
No.	Course Title	Code	Credit Hours			Pre-requested
			Th.	Pr.	Total	
1	Enhanced Oil Recovery	PNGE 453	2	1	3	PNGE 351
2	Reservoir Modeling & Simulation	PNGE 445	3	1	4	PNGE 342, PNR 214, PNGE 363
3	Well completion	PNGE 433	2	1	3	PNGE 332
4	Natural Gas Engineering	PNGE 446	2	1	3	PNGE 342
5	Health and Safety in Petroleum Industry	PNGE 465	2	0	2	
6	Graduation Project (1)	PNGE 466	2	0	2	
<b>Total Credit Hours</b>					<b>17</b>	
Second Semester						
No.	Course Title	Code	Credit Hours			Pre-requested
			Th.	Pr.	Total	
1	Natural Gas Production Engineering	PNGE 452	2	1	3	PNGE 446, PNGE 453
2	Petroleum Economics	PNGE 464	2	0	2	
3	Well Testing	PNGE 434	2	1	3	PNGE 351
4	Surface Facilities	PNGE 454	2	0	2	
5	Graduation Project (2)	PNGE 467	2	0	2	
<b>Total Credit Hours</b>					<b>12</b>	

وصف المقرر Course Description	المستوى/ الفصل	رمز المقرر Course No.	اسم المقرر Course Name	م
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.	م/1ف1	PNR 111	جيولوجيا عامة (1) GENERAL GEOLOGY (1)	1
Sedimentary environments; principle of stratigraphy and historical geology; stratigraphic units and correlations, geology of Yemen and sedimentary basins.	م/1ف2	PNR 112	جيولوجيا عامة (2) GENERAL GEOLOGY (2)	2
Basic Algebraic Operations, Equations and Inequalities, Graphs, Functions, Polynomials and Rational Functions, Exponential and Logarithmic Functions, Trigonometric Functions, Trigonometric Identities and Conditional Equations, Systems of Equations and Inequalities; Matrices, Sequences and Series.	م/1ف1	PNR 113	رياضيات عامة GENERAL MATHS	3
Stoichiometry: SI Units, chemical formulas, the mole, methods of expressing concentration, Calculations based on chemical equations. Gases: laws, kinetic theory, deviation and van der Waals equation. Thermochemistry: Types of enthalpy changes, Hess Law and its applications, first law of thermodynamics. Solutions: Type of solutions and laws related, colligative properties. Chemical kinetics: Law of reaction rate, reaction order, factors affecting the rates. Chemical Equilibrium: Relation between Kc & Kp, Le Chatelier's principle and factor affecting equilibrium. Ionic equilibrium: Acid and base concepts, pH calculations of acid, base and buffer solutions. Atomic Structure: emission spectrum, Bohr's theory de Broglie's hypothesis, quantum numbers, electronic configuration of elements, consequences of the periodic table.	م/1ف2	PNR 114	كيمياء عامة GENERAL CHEMISTRY	4
Introduction (Vectors), Motion in one dimension with constant acceleration, Motion in two dimension with application to projectile motion and circular motion, Newton's Laws of Motion, Work and Energy, Potential Energy and conservation of Energy, Linear Momentum and Collisions, Rotation of rigid object about a fix axis. Electricity and Magnetism: Coulomb's law, electric fields, Gauss' Law, electric potential, potential energy, capacitance and dielectric, currents and resistance, electrical energy and power, direct current circuits, Kirchhoff's rules, magnetic fields, motion of charged particle in a magnetic field, sources of the magnetic field, Ampere's law, Faraday's law of induction	م/1ف2	PNR 115	فيزياء عامة GENERAL PHYSICS	5

General discussion of the relation between man and the earth. Population of the earth (growth rates, doubling time, impact). Methods of environmental geology Energy systems. Mans impact upon the natural systems. Geological hazards and hostile environment. Waste disposal and treatments. Examples and exercises.	م/1ف2	PNR 116	اساسيات علم البيئة <b>PRINCIPLES OF ENVIRONMENTAL SCIENCES</b>	6
Introduction to computers and programming. Data types, constants & variables. Operators & functions assignment statement. Simple input/output. Program composition & format. Types of errors. Formatted output. Algorithm. If construct. Do loop. Data files. One- & two-dimensional arrays. Programming with function. Program	م/2ف1	PNR 211	برمجة الحاسوب <b>COMPUTER PROGRAMMING</b>	7
Through this course student will be able to Know the sedimentary rock and the significant sedimentary structures. Differentiate between the different types of sedimentary Rocks and how to classify these rocks. Development and applications of sedimentology and Stratigraphy. Principles of Stratigraphy and basin analysis.	م/2ف1	PNR 212	علم الرسوبيات والطبقات <b>SEDIMENTOLOGY &amp; STRATIGRAPHY</b>	8
Introduction to geophysical methods; Gravity and Magnetic 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.	م/2ف1	PNR 213	جيوفيزياء <b>GEOPHYSICS</b>	9
	م/2ف2	PNR 214	إحصاء <b>Statistics</b>	10
General discussion of the relation between geology and the engineering applications. Elements of civil, mining and agricultural engineering. Methods in engineering geology. Site investigation. Geotechnical processes. Engineering geological aspects of dams, tunnels, road, important buildings, etc. Case studies. Exercises.	م/2ف1	PNR 215	مبادئ الجيولوجيا الهندسية <b>PRINCIPLES OF ENGINEERING GEOLOGY</b>	11
Mechanics of structural deformation; folds, faults, and joints; unconformities; Cross-section construction; fence diagrams, geologic maps construction and types, sedimentary environments; subsurface mapping.	م/3ف1	PNR 311	الجيولوجيا التركيبية <b>Structural Geology</b>	12
Understanding the concepts of Remote Sensing and GIS techniques and their applications in different field of Petroleum Industry. Training the students for these applications.	م/3ف2	PNR 312	استشعار عن بعد و GIS <b>REMOTE SENSING &amp; GIS</b>	13

<p>To give students an idea on the distribution and geology &amp; tectonic evolution of the Precambrian basement rocks exposed in Yemen and their relationship to the development of the Arabian-Nubian Shield. In addition, the geology of the Cenozoic and the development of the Red Sea-Gulf of Aden-East African Rift System (Triple Junction) will be discussed. The students should to Know the sedimentary basins in Yemen and their evolution. Able to observe the different rock units and correlate them through the outcrops and subsurface.</p>	<p>2م/3ف</p>	<p>PNR 313</p>	<p>جيولوجيا اليمن Geology of Yemen</p>	<p>14</p>
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### Description of the Courses Presented by the Department:

<p>وصف المقرر Course Description</p>	<p>المستوى الفصل /</p>	<p>رمز المقرر Course No.</p>	<p>اسم المقرر Course Name</p>	<p>م</p>
<p>The importance and history of petroleum and natural gas. Origin, formation, migration and accumulation of petroleum and natural gas. Introduction to chemistry of petroleum. Classification of petroleum and natural gas. Introduction to petroleum and natural gas reservoirs geology, rocks and fluids properties. Introduction to petroleum and natural gas exploration and well drilling engineering.</p>	<p>1م/2ف</p>	<p>PNGE 221</p>	<p>جيولوجيا البترول للمهندسين Petroleum Geology for Engineers</p>	<p>1</p>
<p>Introduction to petroleum and natural gas exploration and well drilling engineering. Introduction to natural gas engineering. Petroleum and natural gas reserves estimation. Introduction to petroleum production engineering, transportation and refining of petroleum. Offshore pollution by petroleum. Introduction to energy supply and demand. Included are professionalism and ethics in the work environment.</p>	<p>2م/2ف</p>	<p>PNGE 222</p>	<p>مقدمة في هندسة النفط والغاز Introduction to Petroleum Engineering</p>	<p>2</p>
<p>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.</p>	<p>1م/2ف</p>	<p>PNGE 223</p>	<p>مقاومة مواد Strength of Materials</p>	<p>3</p>
<p>Physical concepts involved in the flow of fluids in porous media; aspects of Darcy's Law; multiphase flow concepts of relative permeability and capillary pressure.</p>	<p>1م/2ف</p>	<p>PNGE 224</p>	<p>ميكانيكا الموائع Fluid mechanics</p>	<p>4</p>
<p>Basic concepts of thermodynamics. Properties of pure substances. First law of thermodynamics for closed systems and for open systems. Second law of thermodynamics. Power cycles. Refrigeration.</p>	<p>2م/2ف</p>	<p>PNGE 225</p>	<p>ديناميكا حرارية هندسية Engineering Thermodynamics</p>	<p>5</p>

Porosity, Permeability, Fluid flow in porous media, Fluid saturations, Capillary pressure, Wettability, surface tension, Relative permabilities. Properties of gases, Phase behavior of liquids, Qualitative phase behavior of hydrocarbon systems, Quantitative phase behavior, Reservoir fluid characteristics.	م/2ف/2	PNGE 226	خواص صخور وموانع المكن <b>Reservoir Rock and Fluids Properties</b>	6
The study of sedimentary basins and their relation to plate tectonic movements and plate margins. The formation of different types of basin and the sediments of these basins in addition to the definition of the terms related to the types of basins in the light of plate tectonic theory. Introduction to the geology of Yemen and the Middle East. Evolution of the Sedimentary basins in the Middle East. Distribution of the oil fields in Yemen and the Middle East. Case studies from different countries in the Middle East	م/2ف/2	PNGE 261	الاحواض الرسوبية والنظام البترولي لليمن <b>Sedimentary Basins and Petroleum System of Yemen</b>	7
The student will be able to classify the clastic rocks, define the accompanied sedimentary structures in the field and interpreted the depositional environments. 3D facies associations of a complete package of sub environments and their depositional products, such as a delta, bounded by either two unconformities or by facies transitions, An expression of a genetic relationship of a succession in terms of 3D facies genetically related for modern and ancient environments.	م/2ف/2	PNGE 262	العملية الترسيبية ونواتجها <b>Sedimentation Process and Production</b>	8
Introduction to drilling engineering through the study of rig equipment functions. Engineering analysis of drill string buoyancy, drilling mud circulation and flow hydraulics, drill string components, and well control. Preliminary discussion of pore and fracture pressure gradients. Well plan profile including drill bit selection, drilling fluid selection, drill string component section, and well control.	م/3ف/1	PNGE 331	هندسة حفر (1) <b>Drilling Engineering (1)</b>	9
Drilling operations technology with an emphasis on field practices and techniques. Advanced topics including drilling fluids rheology and hydraulics. Mechanics of BHA in vertical and directional holes. Directional well trajectory predictions and design. Modeling of drag and torque. Dynamics of drill string, wellbore measurements, deep-water drilling and heat transfer in wells.	م/3ف/2	PNGE 332	هندسة حفر (2) <b>Drilling Engineering (2)</b>	10
Properties of reservoir rocks and homogeneous and multiphase fluid flow in reservoirs. Capillary phenomena, relative permeability, compressibility, and fluid saturation distribution. MTLSerial balances. Statistical analysis using regression, probability concepts, and computer applications to reservoir data.	م/3ف/1	PNGE 341	هندسة المكامن (1) <b>Reservoir Engineering (1)</b>	11
Advanced reservoir engineering principles and applications including MTLSerial balances, decline curve analysis, unsteady flow in porous media, partial penetration, water influx, reservoir heterogeneity, fractional flow, and frontal advance.	م/3ف/2	PNGE 342	هندسة المكامن (2) <b>Reservoir Engineering (2)</b>	12
Elements of producing oil and gas wells. Flow of single and multiphase fluids in vertical and horizontal pipes. Choke	م/3ف/1	PNGE 351	هندسة انتاج النفط	13

performance. Nodal analysis systems approach to well production performance optimization. Production decline analysis using exponential, harmonic, and hyperbolic decline curves applied to actual well production data. Introduction to artificial lift techniques.			<b>Petroleum Production Engineering</b>	
Introduction to gas properties. Gas reservoir performance: well deliverability tests, transient testing, and reservoir limit test, well completion effect on gas reservoir performance. Piping system performance: flow equations, and flow in pipelines. Gas compression: types and design of compressors. Total system analysis: tubing and flow line size, separator pressure effect, subsurface safety valve selection, separator pressure effect, and gas condensate reservoir. Field operation problems and gas processing. Gas measurement systems. Determination of gas recovery from unconventional reservoirs; e.g., coalbed methane, tight gas sands, shales. Strategies for gas field development. Additional work is required at graduate level.	م/4ف/2	PNGE 452	هندسة انتاج الغاز الطبيعي <b>Natural Gas Production Engineering</b>	14
Fundamentals, SP-log, electric resistivity logs, sonic log, density log, neutron log, radioactivity logs (natural and induced gamma ray, neutron), production logs (TDT, Temp., RFT), log interpretation.	م/3ف/1	PNGE 343	التسجيلات البئرية <b>Well Logging</b>	15
Introduction to logging tool principles and operation. Evaluation of reservoir properties and interpretation of open hole well logs. Multiwall correlations with application to volumetric calculations. Lab exercises on reservoir mapping and well log case studies.	م/3ف/2	PNGE 344	تقييم المكامن <b>Formation Evaluation</b>	16
Characteristics and properties of reservoir fluids. Representation of fluid property data for computer uses with models and regression.	م/3ف/1	PNGE 327	خواص النفط <b>Petroleum Properties</b>	17
Water flooding techniques. Water handling. Injection and production well patterns. Productive techniques for economic operations. Introduction to enhanced oil recovery; polymer, surfactant, thermal and miscible flooding.	م/4ف/1	PNGE 453	الطرق المحسنة للإنتاج <b>Enhanced Oil Recovery</b>	18
Use reservoir simulator for numerical modeling of petroleum engineering problems beyond classical approaches. Introduction to simulation fundamentals, work with post- and pre-processing software, design and construct black oil, compositional and thermal models. History matching, predict and optimize well performance.	م/4ف/1	PNGE 445	نمذجة ومحاكاة المكمن <b>Reservoir Modeling &amp; Simulation</b>	19
Well completion methods. Design and selection of tubing; perforating performance; sand, water and gas control. Introduction to stimulation operations, selection of stimulation techniques, design of acid and hydraulic fracture treatments.	م/4ف/1	PNGE 433	اكمل الابار <b>Well completion</b>	20



The composition, testing, and design of cement slurries and fracturing fluids. Application of hydraulic fracture design using stimulation software				
Development of algorithms in Excel™ to solve petroleum engineering problems: gas z-factor, static and flowing gradients, pump design, well testing functions and others.	م/3ف2	PNGE 363	تطبيقات الحاسب في هندسة البترول <b>Computer Application in Petroleum Engineering</b>	21
Introduction to natural gas. Physical properties of natural gases. Types of natural gas. Characteristics of gas and gas-condensate reservoirs. Estimation of gas reserves (for normally and abnormally pressured) using different forms of the general material balance equation. Prediction of gas reservoir performance subjected to water drive. Derivation of the basic flow equations for real gas and their solutions in terms of pressure, pressure squared and pseudo function and applications for analyzing gas well testing design and analysis. Production forecasting and decline curve analysis. Gas field development including reservoir deliverability.	م/4ف1	PNGE 446	هندسة الغاز الطبيعي <b>Natural Gas Engineering</b>	22
Economic analysis of petroleum-producing properties; evaluation of reservoir management decisions for oil and gas development; establishing the effect of risk and uncertainty on economic evaluation. Prepare an Authority for Expenditure (AFE) project report.	م/4ف2	PNGE 464	اقتصاديات النفط والغاز <b>Petroleum Economics</b>	23
Diffusivity equation and solutions for slightly compressible liquids; dimensionless variables; type curves; applications of solutions to buildup, drawdown, multi-rate, interference, pulse and deliverability tests; extensions to multiphase flow; analysis of hydraulically fractured wells, production data analysis, rate normalized pressure analysis.	م/4ف2	PNGE 434	اختبار الابار <b>Well Testing</b>	24
	م/4ف2	PNGE 454	معدات سطحية <b>Surface Facilities</b>	25
	م/4ف1	PNGE 465	السلامة المهنية في الصناعة النفطية <b>Health and Safety in Petroleum Industry</b>	26
A capstone design project in which the student start a comprehensive design in the field of petroleum and natural gas engineering. The group of students will develop oil or gas field from A to Z.	م/4ف1	PNGE 466	مشروع التخرج (1) <b>Graduation Project (1)</b>	27
A research project in which the student uses his gained skills to study a specific point in the field of petroleum and natural gas engineering.	م/4ف2	PNGE 467	مشروع التخرج (2) <b>Graduation Project (2)</b>	28