University of Mosul

جامعة الموصل

Bachelor's degree (B.Sc.) – petroleum Reservoir Engineering

بكالوريوس –علوم هندسة المكامن النفطية

Table of Contents

1. Overview

This catalogue is about the courses (modules) given by the program of Petroleum and Mining Engineering University to gain the Bachelor of Science degree. Currently, the program delivers (43) Modules for (6) semester and 2 level with an additional stage being added each year until it reaches four stages, (6000) total student workload hours and 240 total ECTS. The module delivery is based on the Bologna Process.

2. Undergraduate Modules 2025-2026

2.1. Modules First Level

2.1.1. Modules First Semester

2.1.1.1. General Geology I

Code	Course/Module Title	ECTS	Semester
PRE 111	General Geology I	7	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	2	79	96
Description			
Geology is the science of the Earth, its composition and structure, its history, and its past plant and animal life. Modern geology developed in the late 18th century as a result of the need for a practical knowledge of rocks and minerals in the mining industry. The geology is divided into two major groups. The first, called Physical Geology deals with the materials that constitute the Earth (soils and rocks), the structures and surface features of the Earth, and the processes that created these structures. The second group called Historical Geology deals with the history of the Earth. Geology is further divided into a number of branches according to the subject matter that is covered or to the industrial or commercial applications. Subject matters of possible interest to engineers include: Petrology: systematic study of rocks and their origin. It consists of Petrography (identification, description, and classification of rocks) and Petrogenesis (study of origin of rocks); Mineralogy: study of rock constituents or minerals; Crystallography: deals with the atomic structure of minerals and their external appearance; Geochemistry: study of the chemistry of rocks; Geomorphology: study of landforms, their origin and development; Stratigraphy: study of layered rocks, mostly those of sedimentary origin; Structural Geology: deals with the position of rock bodies, their deformation, and fracturing; Geophysics: application of principles of physics to the study of the Earth. It consists of Geomagnetic (study of Earth's magnetic field) and Seismology (study of earthquakes); and Geodesy: study of the form and size of the Earth; Paleontology: study of life of past geologic periods and evolution of plants and animals; Engineering Geology: geology and engineering; Hydrogeology, Hydrology: study of underground and surface water. A good understanding of geology concepts plays an extremely important role in reservoir characterization, as it can be used to predict where oil accumulations might occur.			

2.1.1.2. Mathematics I

Code	Course/Module Title	ECTS	Semester
PRE 113	Mathematics I	6	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	87
Description			
This module provides a foundational introduction to essential mathematical concepts, focusing primarily on functions, graphing transformations, and introductory calculus. Students will explore the properties of functions, including determining domain and range, and analyze power, exponential, and trigonometric functions alongside their inverse relations. A significant portion of the course is dedicated to graphing techniques, teaching students how to apply shifting, scaling, and transformations, as well as mastering rapid methods for sketching trigonometric graphs. Finally, the module introduces the fundamental principles of limits, covering right-hand and left-hand limits, limit addition formulas, and the concept of continuous functions. By the end of this course, learners will develop strong analytical and graphing skills, establishing a solid mathematical framework necessary for advanced calculus and technical problem-solving.			

2.1.1.3. Workshop Technology

Code	Course/Module Title	ECTS	Semester
PRE114	Workshop Technology	3	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
0	2	33	42
Description			
The course aims to equip students with essential practical and mechanical skills while strictly adhering to occupational safety standards. This is achieved through an industrial safety workshop covering risk analysis, personal protective equipment (PPE), and fire extinguishing. The course also focuses on precision engineering measurement, including reading technical drawings and using vernier calipers and micrometers. Additionally, it covers bench work, including manual machining and metal finishing. Students will also learn about woodworking tools and types of wood joints, welding techniques (electric arc welding and metal joining), and safety procedures. Finally, the course includes lathe work, covering lathe parts, cutting tools, and calculations for rotational speed and feed rates.			

2.1.1.4. Physics

Code	Course/Module Title	ECTS	Semester
PRE115	Physics	3	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	12
Description			
This course delivers advanced physical principles and their direct applications in Petroleum Reservoir Engineering. It focuses on understanding the physical and dynamic properties of reservoir rocks and fluids (oil, gas, and water), interfacial and capillary phenomena, fluid dynamics through porous media, and reservoir thermodynamics governing hydrocarbon phase behavior under sub-surface pressure and temperature conditions. Additionally, it covers the physical fundamentals of formation evaluation and well logging techniques.			

2.1.1.5. Arabic Language

Code	Course/Module Title	ECTS	Semester
UOM 101	Arabic Language	2	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	0	33	17
Description			
The Arabic Language course for engineering students aims to develop Modern Standard Arabic skills by enhancing the ability to read correctly, speak properly, listen effectively, and use clear expressions with linguistic eloquence. The course focuses on providing students with precise knowledge of Arabic grammar rules, such as verbs, subject and predicate (Mubtada and Khabar), abrogators (Nawasikh), objects (Mafa'il), rules of numbers, and punctuation, alongside addressing common linguistic errors. Furthermore, it strengthens the student's connection to Arab and Islamic heritage through the study of poetry and prose, highlighting poets of the Abbasid era, as well as Badr Shakir al-Sayyab. The course also aims to cultivate literary taste and enhance scientific research skills in the language. The course includes theoretical lectures, exams, classroom assignments, reports, and interactive activities that enhance student proficiency in communicating and writing in sound Arabic.			

2.1.1.6. Democracy and Human Rights

Code	Course/Module Title	ECTS	Semester
UOM 104	Democracy and Human Rights	2	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	0	33	17
Description			

The importance of studying **Democracy and Human Rights** lies in acquainting students with the most vital rights stipulated by divine laws, particularly Islamic Law (Sharia), as well as international conventions such as the Universal Declaration of Human Rights (1948), the two International Covenants on Civil and Political Rights, and Economic, Social, and Cultural Rights, alongside national laws such as constitutions—specifically the Constitution of the Republic of Iraq (2005)—and international organizations such as the International Committee of the Red Cross (ICRC). Furthermore, this course aims to introduce students to the importance of democratic systems, their various forms, and types of governance regarding the mechanisms of exercising authority. Additionally, it familiarizes students with past democratic experiences to learn from them and apply their lessons to the local context.

What are the benefits of studying this course? Its benefits include enhancing students' legal and political awareness, enabling them to understand the relationship between human rights and democracy, developing their ability to analyze political systems, and guiding them to become active, conscious members of society who respect rights, believe in pluralism, and participate in building the state on the principles of justice and citizenship.

2.1.1.7. Engineering Mechanics

Code	Course/Module Title	ECTS	Semester
PRE 112	Engineering Mechanics	6	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	87
Description			
Statics is a type of science that helps people design safe and strong structures, like bridges and buildings. It's all about studying how things stay in place even when they are not moving. This is important for engineers and physicists who want to understand how materials react to different forces, like the ones that happen when an airplane takes off or lands. By studying statics, people can make better things and improve technology. Statics is a branch of mechanics that deals with the study of stationary objects and systems under the action of external forces. In other words, statics is concerned with the analysis of forces acting on objects that are not in motion. It is an essential subject for engineers and physicists as it is the foundation for the study of mechanics, which is the branch of physics that deals with the motion of objects. Statics is a crucial sub-topic of mechanics and is essential in engineering and physics courses. It deals with the study of forces acting on objects that are not moving. The primary objectives of statics are to determine the forces acting on an object, the moments of forces acting on an object, and the equilibrium conditions of an object. The study of statics is essential for the design of structures, such as bridges, buildings, and machines, to ensure that they are safe and reliable. The study of statics is also important in understanding the behavior of materials under different conditions. It helps engineers and physicists to understand how different materials react to external forces and how they can be designed to withstand these forces. For example, in aerospace engineering, the study of statics is essential in the design of aircraft and spacecraft to ensure that they can withstand the forces of takeoff, landing, and flight. In general, the study of statics is crucial for the development of new technologies and the improvement of existing ones.			

2.1.**2**. Modules Second Semester

2.1.2.1. General Geology II

Code	Course/Module Title	ECTS	Semester
PRE 121	General Geology II	7	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	2	79	96
Description			

Geology is the science of the Earth, its composition and structure, its history, and its past plant and animal life.Modern geology developed in the late 18th century as a result of the need for a practical knowledge of rocks and minerals in the mining industry. The geology is divided into two major groups. The first, called Physical Geology deals with the materials that constitute the Earth (soils and rocks), the structures and surface features of the Earth, and the processes that created these structures. The second group called Historical Geology deals with the history of the

Earth. This course, General Geology II, focuses on the dynamic and historical aspects of geology, with emphasis on the processes that shape the Earth's crust over time. Geology is further divided into a number of branches according to the subject matter that is covered or to the industrial or commercial applications.

Subject matters of possible interest to engineers include: Plate Tectonics: study of the movement of lithospheric plates and their role in shaping the Earth's surface, including continental drift and the distribution of earthquakes ; Stratigraphy: study of layered rocks, mostly those of sedimentary

origin, and includes the classification of Stratigraphic Units) such as groups, formations, and members; Historical Geology: study of the Earth's history through the Geologic Time Scale, which divides Earth's 4.6billion-year history into eons, eras, and periods; Paleontology: study of fossils

as evidence of past life, used for relative dating, paleoenvironmental reconstruction, and biostratigraphic correlation; Seismology: study of earthquakes and seismic waves, which provides critical information about Earth's interior and helps in identifying subsurface structures; Geomorphology: study of landforms, their origin and development in response to tectonic and erosional processes; and Structural Geology: deals with the position of rock bodies, their deformation, folding, and fracturing due to tectonic forces. A good understanding of these geological concepts plays an extremely important role in reservoir characterization, as it can be used to predict where oil accumulations might occur, identify structural and stratigraphic traps, and evaluate the burial history and thermal maturation of source rocks.

2.1.2.2. Chemistry

Code	Course/Module Title	ECTS	Semester
PRE 122	Chemistry	4	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	37
Description			
This course provides a comprehensive understanding the concepts of electrochemistry and electrochemical phenomenon involved in the energy storage and energy conversion devices. Able to know the mechanism of corrosion and its control and application of electrochemical concepts for surface modification techniques. Know the importance of petroleum products as conventional sources of energy and the importance of polymers as an engineering material, their synthesis and application in automobile, electronic and aerospace applications. Know the importance of analysis of water and waste.			

2.1.2.3. Mathematics II

Code	Course/Module Title	ECTS	Semester
PRE 123	Mathematics II	6	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	87
Description			
This module offers an in-depth exploration of core calculus principles, focusing on the theories and applications of differentiation and integration. Students will first master the fundamental rules of differentiation, extending their skills to higher-order derivatives, trigonometric and inverse trigonometric functions, the chain rule, and parametric equations. The course also covers advanced limits using L'Hôpital's rule. The second half of the module shifts to integral calculus, introducing both indefinite and definite integrals. Learners will study key integration techniques, including the integration of rational functions, integration factors, and integration by parts. Finally, the module examines practical applications of definite integrals. By concluding this course, students will possess robust analytical problem-solving abilities and a comprehensive understanding of calculus, essential for advanced studies in mathematics, engineering, and science.			

2.1.2.4. Engineering Drawing and Descriptive Geometry

Code	Course/Module Title	ECTS	Semester
PRE124	Engineering Drawing and Descriptive Geometry	5	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
1	3	63	62
Description			
Manual Engineering Drawing serves as the cornerstone of engineering education, aiming to equip students with the skill to express technical ideas through a precise visual language. The guide begins with an introduction to engineering tools and their application in drawing fundamental geometric operations and tangents. It then progresses to enhancing the student's spatial visualization through the study of orthographic projection to derive the three primary views of an object. The course also covers the art of isometric drawing to represent three-dimensional forms. Beyond manual dexterity, the curriculum emphasizes discipline in line standards and meticulous accuracy, preparing students to understand complex blueprints before transitioning to Computer-Aided Design (CAD). Ultimately, sheet cleanliness and dimensional precision are regarded as fundamental criteria for professional success.			

2.1.2.5. Engineering Practices

Code	Course/Module Title	ECTS	Semester
PRE125	Engineering Practices	3	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	48	27
Description			
This foundational course introduces students to the core methodologies, tools, and mindsets required in professional engineering. The curriculum begins with the fundamental challenges engineers face, focusing on information gathering, technology integration, and the systematic engineering design process. Collaboration is emphasized through structured teamwork and an applied group design project. Students will develop essential engineering communication skills and master technical fundamentals, including estimation strategies, structured problem-solving frameworks, and the precise application of dimensions and universal unit systems. Finally, the course provides intensive training in Microsoft Excel, equipping students to build functional workbooks for data analysis and technical computations, ensuring they are prepared for advanced coursework and real-world engineering practices.			

2.1.2.6. English Language I

Code	Course/Module Title	ECTS	Semester
Uom 102	English Language I	2	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	0	33	17
Description			
By teaching the English language we can use it independently or alongside a general English course book such as New Headway or New Headway Plus. studying English grammar is so important to strengthen the student's capacity of English language rules, as well as the scientific study of petroleum glossaries to enrich the students of petroleum and mining engineering with specialization vocabularies cause they are so important during practicing their work. The course focuses on developing the specific skills required for academic studies and exploring strategies for success in academic learning. It also offers guidance in key study areas and provides plenty of practice to encourage learner independence.			

2.1.2.7. Computer Science |

Code	Course/Module Title	ECTS	Semester
UOM 103	Computer Science l	3	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
1	2	48	27
Description			
This module provides a concise, practical introduction to essential digital literacy skills and core computer applications, beginning with basic hardware components and their practical uses. Students will gain proficiency in the Microsoft Office suite, focusing on advanced presentation techniques in MS PowerPoint, professional document creation and academic referencing in MS Word, and data analysis with advanced formulas and dynamic charting in MS Excel. Additionally, the course covers fundamental internet concepts, basic networking, and digital communication methodologies, equipping learners with essential skills for document processing, data analysis, and online communication in academic and workplace environments.			

2.**2**. Modules Second Level

2.2.1. Modules Third Semester

2.2.1.1. Structural Geology

Code	Course/Module Title	ECTS	Semester
PRE 211	Structural Geology	4	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	37
Description			
Structural Geology is a fundamental course that examines the processes responsible for the deformation of rocks within the Earth's crust. The course focuses on the principles of stress and strain, rock mechanics, and the geometric and kinematic analysis of geological structures. Major topics include folds, faults, joints, fractures, cleavage, lineation, and unconformities. Students learn how to interpret geological maps, construct cross-sections, and analyze structural data from surface and subsurface sources. Emphasis is placed on understanding tectonic regimes and their role in basin development and hydrocarbon accumulation. Practical applications include structural interpretation in petroleum exploration, drilling stability analysis, and reservoir characterization. Field observations and problem-solving exercises are integrated to enhance analytical skills and professional competence in geoscience and petroleum engineering.			

2.2.1.2. fundamental of Petroleum Engineering

Code	Course/Module Title	ECTS	Semester
PRE 212	**fundamental of Petroleum Engineering**	5	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	37
Description			
This course introduces students to the fundamentals of petroleum engineering and the theories that explain oil formation; the stages of oil formation within an oil reservoir and the petroleum system; the stages of oil exploration; methods of oil exploration; and the stages of drilling and well testing. Petroleum exploration: the process of locating petroleum reservoirs. This process, direct indicators, geological methods intended to migrate petroleum, and factors that control the presence of petroleum. Characteristics of rocks in petroleum reservoirs. Classification of petroleum traps. Classification of reservoir fluid types.			

2.2.1.3. Petroleum Properties

Code	Course/Module Title	ECTS	Semester
PRE 213	Petroleum Properties	4	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	37
Description			
This Petroleum Properties course familiarizes students with the foundational theories and processes governing petroleum origin and composition. Topics include organic and inorganic formation theories, reservoir accumulation conditions, and the classification of crude oil by API gravity, density, and viscosity. Laboratory sessions develop experimental skills for assessing physical properties such as flash point, fire point, water and sediment content, and vapor pressure. Students also explore hydrocarbon and non-hydrocarbon compounds, refining processes, and the production of petroleum derivatives. By integrating lectures, labs, and assignments, the course equips students with the analytical and practical expertise needed for petroleum characterization and downstream processing.			

2.2.1.4. Mathematics III

Code	Course/Module Title	ECTS	Semester
RRE214	Mathematics III	4	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	48	52
Description			
Mathematics III is a fundamental university-level course that aims to enhance students' understanding of advanced mathematical concepts widely applied in engineering and scientific fields. The course covers topics such as differential equations, multivariable functions, advanced integration techniques, and mathematical series, with an emphasis on their practical applications in solving real-world engineering and applied science problems. This course also strengthens students' analytical and logical problem-solving skills.			

2.2.1.5. Thermodynamics

Code	Course/Module Title	ECTS	Semester
RRE215	Thermodynamics	4	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	37
Description			
This course introduces the foundational principles of thermodynamics, focusing on energy transformations and the governing laws of thermal systems. Students will explore basic concepts, system boundaries, and fluid properties while mastering the application of standard measurement units. The curriculum covers the First Law of Thermodynamics, focusing on energy conservation across closed systems and steady-flow open systems including turbines and compressors. Additionally, students will analyze ideal gas behavior, enthalpy, and specific heat capacities. The latter part of the course evaluates phase-change phenomena using property diagrams and introduces the Second Law of Thermodynamics. Through studying heat engines, refrigerators, and the Carnot cycle, students will develop the critical analytical skills necessary to design, evaluate, and optimize real-world engineering thermal systems.			

2.2.1.6. Fluid Mechanics

Code	Course/Module Title	ECTS	Semester
PRE216	Fluid Mechanics	4	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	37
Description			
This course aims to equip engineering students with a robust theoretical and practical foundation for understanding fluid behavior under both static and dynamic conditions. The curriculum begins with fluid properties and the principles of fluid statics (pressure distribution, hydrostatic forces on dams and gates, and buoyancy). It then progresses to fluid dynamics, where students apply the conservation laws of mass, momentum, and energy (including Bernoulli's equation) to analyze engineering systems. Key focus areas include the analysis of internal flow in pipes and distribution networks, the calculation of head losses, and the principles of external flow (boundary layer theory, lift, and drag forces). The course also covers turbomachinery (pump and turbine performance) and flow measurement techniques. By integrating mathematical analysis with laboratory experiments, this course qualifies students to design and evaluate hydraulic systems and solve real-world engineering problems with high efficiency.			

2.2.1.7. English

Code	Course/Module Title	ECTS	Semester
UOM202	English	2	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	0	33	17
Description			
The second-year English language course aims to develop the language proficiency of petroleum engineering students by enhancing their practical and theoretical understanding of general and specialized English. The course includes explanations and applications of basic and advanced English grammar rules, with an emphasis on their correct use in academic and scientific contexts. The course also focuses on developing students' skills in reading specialized scientific texts, understanding technical terminology related to their field, and memorizing and using it accurately. In addition, the course works to develop academic writing, listening, and speaking skills, which contributes to enabling students to communicate effectively in a scientific and professional environment, and to prepare for the requirements of advanced study and global scientific resources in the field of petroleum engineering..			

2.2.1.8. Computer Science 2

Code	Course/Module Title	ECTS	Semester
UOM 203	Computer Science 2	6	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
1	2	48	27
Description			
This module offers a comprehensive overview of modern Information and Communication Technology (ICT), bridging foundational computing concepts with the transformative era of Artificial Intelligence. Students will examine the essential components of computer networking, digital security, and the operational mechanisms of e-commerce. A substantial portion of the course is dedicated to Artificial Intelligence, tracing its integration into daily life, its profound societal implications, and its diverse practical applications across various industries. Crucially, the module addresses the pressing ethical challenges and responsibilities arising from AI development. Additionally, learners will gain practical skills in basic computer troubleshooting. Grounded in contemporary ICT frameworks, this module equips students with the digital literacy, technical awareness, and critical thinking necessary to navigate and responsibly utilize emerging technologies in an evolving digital landscape.			

2.2.**2**. Modules Fourth Semester

2.2.2.1. Petroleum Geology

Code	Course/Module Title	ECTS	Semester
PRE 221	**Petroleum Geology**	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	2	78	72
Description			
Explain the geological processes involved in petroleum formation and understand the factors that contribute to its accumulation in sedimentary basins. Identify and classify different types of sedimentary basins, and describe their characteristics and formation mechanisms. Analyze the properties of source rocks and understand their role in hydrocarbon formation and preservation. Describe the mechanisms of petroleum migration within sedimentary basins and understand the factors that influence migration pathways and distances. Evaluate the properties and characteristics of reservoir rocks and apply the principles of their characterization to effectively evaluate resources.			

2.2.2.2. Strength of Materials

Code	Course/Module Title	ECTS	Semester
PRE222	Strength of Materials	4	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	37
Description			
Strength of Materials introduces students to the behavior of materials under different types of loads and the analysis of stress and strain in structural members. The course covers topics such as tension, compression, shear, torsion, and bending, as well as the deformation of beams and columns. It emphasizes fundamental principles for designing safe and stable structural elements. This course develops students' ability to apply theoretical concepts to practical engineering problems related to structures and construction materials.			

2.2.2.3. Mathematics IV

Code	Course/Module Title	ECTS	Semester
PRE223	Mathematics IV	5	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	48	77
Description			
Mathematics IV provides students with advanced mathematical knowledge essential for engineering and scientific applications. The course covers topics such as partial differential equations, numerical analysis, and mathematical transformations, with emphasis on quantitative methods for solving complex problems. It develops students' analytical and modeling skills, enhancing their ability to apply mathematics in interpreting engineering phenomena and supporting decision-making in various engineering projects.			

2.2.2.4. Petrophysical Rock Properties

Code	Course/Module Title	ECTS	Semester
PRE 224	Petrophysical Rock Properties	7	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	78	97
Description			
Petrophysical Rock Properties is a specialized course that focuses on the physical and reservoir characteristics of rocks and their significance in petroleum engineering and geoscience applications. The course covers fundamental properties including porosity, permeability, fluid saturation, wettability, capillary pressure, and electrical properties of reservoir rocks. Students study the relationship between rock texture, mineral composition, and pore system geometry, and how these factors influence fluid flow and storage capacity. The course also introduces well log interpretation, core analysis, and laboratory measurement techniques used to evaluate reservoir quality. Emphasis is placed on integrating petrophysical data for reservoir characterization, reserve estimation, and production performance prediction. Practical examples and problem-solving exercises enhance students' ability to analyze real reservoir data and make engineering decisions in hydrocarbon exploration and development.			

2.2.2.5. Occupational Safety and Health

Code	Course/Module Title	ECTS	Semester
PRE 225	Occupational Safety and Health	4	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	48	52
Description			
This module introduces the fundamental principles of occupational safety and health, focusing on hazard identification, risk assessment, and environmental protection. Students explore mechanical, electrical, chemical, and thermal hazards, along with workplace best practices to minimize risks. The course emphasizes the development of skills to design, implement, and manage effective safety systems. Key topics include hazardous waste, fire safety, airborne contaminants, and industry-specific risks in the oil and gas sector. Through lectures, labs, and assessments, students gain the knowledge necessary to comply with safety regulations and promote a culture of health and environmental responsibility in engineering workplaces.			

2.2.2.6. Arabic Language ||

Code	Course/Module Title	ECTS	Semester
UOM 201	Arabic Language ||	2	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	0	33	17
Description			
This course explores the importance of Arabic grammar, starting with the subject and predicate alongside their abrogators: Kana and its sisters, Inna and its sisters, and Zanna and its sisters. It also covers accusative/accidental nouns, focusing on the absolute object, while addressing spelling rules and common linguistic mistakes. Following the midterm exam, the module examines literature in the Abbasid era by analyzing the poetry of major figures: Al-Mutanabbi, Abu Tammam, and Abu Firas Al-Hamdani. Learners will ultimately acquire strong practical skills in both linguistic accuracy and literary critique.			

2.2.2.6. Crimes of the Baath Regime in Iraq

Code	Course/Module Title	ECTS	Semester
UOM 205	Crimes of the Baath Regime in Iraq	2	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	0	33	17
Description			
This module offers a comprehensive study of the concept of crimes and their classifications, focusing on social and psychological crimes, their mechanisms, and their impact on human rights violations. The course examines military and environmental crimes, including scorched earth policies, city destruction, marshland drainage, orchard dredging, and radiation pollution. Furthermore, it explores mass graves their events and chronological classification alongside the key decisions issued by the Supreme Criminal Court. Ultimately, learners will gain a profound legal and historical understanding of these grave violations and their lasting societal and environmental consequences.			

2.3. Modules Third Level

2.3.1. Modules Fifth Semester

2.3.1.1. Applied reservoir engineering |

Code	Course/Module Title	ECTS	Semester
PRE 311	Applied Reservoir Engineering I	5	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	62
Description			
Applied Reservoir Engineering I is a fundamental undergraduate module that introduces the principles and analytical methods used to evaluate petroleum reservoirs and predict their performance. The module covers the physical properties of reservoir rocks and fluids, including porosity, permeability, crude oil and natural gas properties, and formation volume factors. Students develop an understanding of petroleum reservoir classification, fluid flow through porous media, pressure distribution, and radial flow toward wellbores, together with the influence of the Klinkenberg effect and the relationship between porosity and permeability. The course also examines primary oil recovery mechanisms, reserve estimation techniques, and the application of the Material Balance Equation, including drive indices and straight-line methods for estimating hydrocarbons in place. Through engineering calculations and practical problem-solving, students acquire the knowledge and analytical skills required for reservoir evaluation, performance analysis, and effective reservoir management.			

2.3.1.2. Drilling Fluid & Hydraulics

Code	Course/Module Title	ECTS	Semester
PRE 312	Drilling Fluid & Hydraulics	5	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	62
Description			
This course provides a comprehensive foundation in drilling engineering, seamlessly bridging theory with practical oilfield applications. Students will explore drilling rig components, rotary systems, and fluid design, with a strong focus on mud properties, rheology, and clay chemistry. The curriculum emphasizes critical engineering calculations, including hydrostatic pressure in complex wellbores, hydraulic pressure losses, bit nozzle pressure drops, and surge/swab pressures. By addressing fluid-dependent hazards and bit selection, the course prepares students to mitigate drilling risks. Additionally, hands-on laboratory sessions reinforce learning, training students to measure vital mud properties, optimize hydraulics, and maintain well control.			

2.3.1.3. Production Engineering

Code	Course/Module Title	ECTS	Semester
PRE 313	Production Engineering	4	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	0	48	52
Description			
This module provides a comprehensive introduction to petroleum production systems and well completion techniques. It covers essential completion concepts and design methodologies, including open hole, liner, and perforated casing completions. Students will explore fluid flow dynamics through tubing and casing, multiple and dual completion systems, completion equipment, and tubing design principles. Additionally, the course addresses wellhead and Christmas tree equipment, gas and water coning phenomena, and formation damage mechanisms. Key emphasis is placed on well testing fundamentals, artificial lift technologies, and production optimization strategies, concluding with an integrated review of end-to-end petroleum production management.			

2.3.1.4. Engineering Analytics

Code	Course/Module Title	ECTS	Semester
PRE314	Engineering Analytics	4	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	37
Description			
The **Engineering Analytics** course introduces students to the principles and quantitative methods of data analysis and modeling in engineering fields. It covers the application of statistical and mathematical techniques, along with modern analytical tools, to support decision-making, solve engineering problems, and optimize project performance. The course also develops students' skills in handling engineering data and using analytical software in various engineering applications.			

2.3.1.**5**. Geophysics

Code	Course/Module Title	ECTS	Semester
PRE315	Geophysics	4	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/w)**
2	1	48	52
Description			
It aims to teach the students the basics and applications of many geophysical methods, especially the seismic exploration for both refraction and reflection methods. The importance of this exploration in the field of surveys for the study of reservoirs and oil fields and follow-up production and development through 2D, 3D, and 4D surveys; periodic seismic monitoring of the oil fields; principles of processing seismic data; the most important processing for these data; the beginning of seismic interpretation and making various underground maps; and practical cases similar to reality in the field.			

2.3.1.6. Well Logging and Formation Evaluation

Code	Course/Module Title	ECTS	Semester
PRE316	Well Logging and Formation Evaluation	5	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	62
Description			
This comprehensive course covers foundational and advanced principles of well logging and formation evaluation for reservoir characterization. Students explore essential petrophysical properties like rock types, porosity, and permeability before examining drilling mud interactions and modern wireline techniques, including open-hole, cased-hole, LWD, and MWD methods. The curriculum covers specialized tools such as Mechanical Calipers, Gamma-Ray, and Spontaneous Potential (SP) logs to estimate shale volume and identify minerals. Additionally, it focuses on quantitative interpretation using resistivity measurements (Laterologs and Induction logs) and porosity logs (Density, Neutron, and Sonic). Ultimately, students master the "Quick-look" technique and cross-plotting methods to perform integrated interpretations of complete log suites, gaining the practical skills necessary to successfully evaluate subsurface hydrocarbon-bearing formations.			

2.3.1.7. Gas Technology

Code	Course/Module Title	ECTS	Semester
PRE 317	Gas Technology	3	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	0	48	27
Description			
In this course, learn about the gas technologies and applications used by industrial and commercial end users. Understand of the natural gas value chain. It covers the fundamental physical and thermodynamic properties of natural gas, as well as phase behavior and fluid flow dynamics. Students will learn about the design concepts and operational issues for important processing units such as intake separation, gas sweetening, dehydration, NGL recovery, fractionation, and sulfur recovery. The course will also address important support systems like compression and refrigeration, contextualizing the technology with an awareness of economics and environmental regulations.			

2.3.**2**. Modules Sixth Semester

2.3.2.1. Applied reservoir engineering ||

Code	Course/Module Title	ECTS	Semester
PRE 321	Applied Reservoir Engineering 2	5	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	62
Description			
Applied Reservoir Engineering II is an advanced undergraduate module that builds on the principles introduced in Applied Reservoir Engineering I, with emphasis on reservoir performance analysis, aquifer behavior, and fluid flow. The module focuses on the application of the Material Balance Equation using straight-line methods to estimate Original Oil in Place (OOIP) and evaluate reservoir performance. Students study aquifer classification, water influx mechanisms, and analytical water influx models, including the Pot Aquifer, Schilthuis, Hurst, Van Everdingen–Hurst, and Fetkovich methods. The course also covers the principle of superposition, reservoir flow regimes, steady-state linear flow, and pressure distribution around producing wells. Through analytical calculations and engineering applications, students develop the skills required to evaluate aquifer support, predict reservoir behavior, interpret pressure data, and make informed reservoir management decisions.			

2.3.2.2. Rock Mechanics for Petroleum Engineers

Code	Course/Module Title	ECTS	Semester
PRE 322	Rock Mechanics for Petroleum Engineers	4	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	48	52
Description			
This course enables students to analyze the mechanical behavior of rocks under in-situ stresses to ensure wellbore stability and production efficiency. It begins with the physical and mechanical properties of intact rocks (such as UCS and Young's Modulus), progressing to the assessment of fractured rock masses using parameters like RQD and the Schmidt Hammer. The curriculum delves into failure mechanics by applying the Mohr-Coulomb criteria to understand the formation of wellbore breakouts and calculate tangential and radial stresses. Additionally, the course covers applied aspects of reservoir geomechanics, including surface subsidence modeling due to pressure depletion and the determination of the optimal drilling mud weight window. The course concludes with the study of deviated wells, qualifying students to design safe drilling trajectories in complex tectonic environments and translate laboratory data into engineering decisions that minimize drilling risks and costs.			

2.3.2.**3**. Casing Design and Cemneting

Code	Course/Module Title	ECTS	Semester
PRE 323	Casing Design and Cemneting	5	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	62
Description			
This comprehensive course provides essential expertise in well integrity, focusing on structural well design and effective zonal isolation. Students begin by exploring casing functions, classification standards, liner options, and downhole accessories. The curriculum emphasizes the selection of casing setting depths using mud windows, alongside critical stress analysis under burst, collapse, and axial tension loads using API design factors. Complementing this, the cementing phase covers cement chemistry, API classifications, and optimized chemical additives. Students will master primary and secondary cementing workflows, slurry property calculations (density and yield), and primary cementing hydraulics. Through practical graphical workflows and calculations, this course equips students to design secure, efficient, and structurally sound wellbore architectures.			

2.3.2.**4**. Petroleum Economics

Code	Course/Module Title	ECTS	Semester
PRE 324	Petroleum Economics	4	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	0	48	52
Description			
Petroleum Economics is a core course designed to deepen students' understanding of the economic, technical, and strategic dynamics of the oil and gas industry. It examines global oil markets, supply-demand mechanisms, and price volatility influenced by geopolitical and economic factors. The curriculum covers exploration and production economics, project evaluation tools (such as NPV and IRR), and key petroleum contract models. Additionally, it addresses oil revenue management, sovereign wealth funds, and contemporary challenges like energy transition and carbon pricing, equipping learners with essential analytical skills for sound decision-making in the energy sector.			

2.3.2.**5**. Applied Mathematics and Geostatistics

Code	Course/Module Title	ECTS	Semester
PRE325	Applied Mathematics and Geostatistics	5	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	37
Description			
This module introduces core geostatistical principles tailored specifically for reservoir engineering, focusing on modeling spatial heterogeneity in subsurface formations. Students will learn to characterize reservoir properties such as porosity, permeability, and fluid saturation from sparse well data and seismic attributes. The curriculum covers spatial continuity analysis using variograms, deterministic estimation via Kriging, and stochastic approaches like Sequential Gaussian Simulation (SGS) to capture geological uncertainty. Emphasizing practical applications, the course demonstrates how to integrate static data into robust 3D geological models that serve as the foundation for dynamic fluid flow simulations. By the end of this module, participants will be able to quantify volumetric uncertainty, optimize well placement, and mitigate financial risks in oil and gas field development.			

2.3.2.**6**. Nodal Analysis

Code	Course/Module Title	ECTS	Semester
PRE326	Nodal Analysis	4	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	0	48	52
Description			
This course covers Nodal Analysis, the industry-standard methodology for optimizing petroleum production systems. Students will analyze the entire production network as a holistic system, evaluating pressure drops from the reservoir to surface facilities. The curriculum focuses on reservoir inflow performance relationship (IPR) modeling for oil and gas wells. Participants will learn to predict current and future well behaviors using Vogel, Standing, and Fetkovich methods. Additionally, the course explores single-phase and multiphase fluid flow dynamics through tubing, chokes, and restrictions.By coupling inflow with vertical lift performance (VLP), students will identify production bottlenecks. Ultimately, engineers will master sensitivity analysis to evaluate operational changes, maximize well productivity, and make data-driven decisions to optimize total asset value.			

2.3.2.**7**. Artificial Intelligence

Code	Course/Module Title	ECTS	Semester
PRE327	Artificial Intelligence	3	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	48	27
الوصف			
This course introduces foundational AI and remote sensing principles tailored for engineering applications. Students learn data preprocessing, noise reduction, and data handling before exploring core machine learning concepts, including supervised and unsupervised learning, regression models, and time-series forecasting. The curriculum covers exploratory data analysis and engineering statistics using Python libraries to interpret complex datasets from the petroleum and mining sectors. Additionally, the course highlights intelligent diagnostics, fault detection, and process automation in engineering facilities. Finally, participants build end-to-end predictive models in hands-on final projects using actual industry datasets to solve practical engineering challenges and optimize workflows.			