Template of Course Specification

Name and Scientific title of the subject instructor: Msc. Asmaa A. Alghazi

Name of Course: Resrvoir Engineering I

Course Specification

1.	**Teaching Institution**	**Al-Ayen University / Petroleum Engineering College**
2.	**University Department / Center**	Petroleum Engineering College
3.	**Course Title / Code**	Reservoir Engineering I
4.	**Program(s) to which it contributes**	B.Sc.
5.	**Modes of Attendance offered**	Class attendance
6.	**Semester/Year**	1st and 2nd, 2022-2023
7.	**Number of hours tuition (total)**	96 Theoretical hours+48 lab hours=144Hs
8.	**Date of production/revision of this Specification**	15.Oct. 2022
9.	**Aims of the Course: The student will know the following:**	
	1	Learning Techniques to calculate reservoir fluid propertie
	2	Learning details of reservoir rock properties
	3	Practices and experimental solutions for some of reservoir engineering concepts
10.	**Learning Outcomes, Teaching, Learning and Assessment Methods**	
	A	**Cognitive goals:** A1. Applying different correlations to determine properties of reservoir fluids. A2. Understand role of rock and fluid properties in calculations of reservoir engineering. A3. Understand how to calculate oil reserves
	B	**The skills goals special to the course:** B1. Using graphs to determine reservoir fluid properties. B2. Plotting graphs to represent petrophysical rock properties as functions of fluid saturations.
	C	**Assessment methods:** -The assessment method is divided into; quizzes, monthly exams, and final exams, Homework**,** Evaluation of the performance in the laboratory.
	D	**Affective and value goals:** - Academic honesty in duties and not use cheating. - To have overlook about the new technologies which linked

	with course subjects.
E	**Teaching and Learning Methods:** -Lectures -Discussion ,dialogues and questions -Group tasks
F	**General and rehabilitative transferred skills(other skills relevant to employability and personal development:** - **Encouraging teamwork and self-confidence to accomplish tasks better.** - **Encouraging creativity, innovation, and modernization.**

11.	**Course Structure**				
Week	**Hours**	ILOs	**Unit/Module or Topic Title**	**Teaching Methods**	**Assessment Methods**
1.	3 lecture + 2 lab + 1 tutorial	Rock Types, Source Rock and Reservoir Rock, Migration, Petroleum Traps, Fluid Distribution, Porosity, Permeability, Factors Affecting Porosity and Permeability, Example (Permeability calculation).	Introduction of Reservoir Engineering	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory, and final exam.
2.	3 lecture + 2 lab + 1 tutorial	Classification of Reservoirs and Reservoir Fluids, Composition of the reservoir hydrocarbon fluid, Gas Oil Ratio, Pressure-Temperature Diagram.	Fundamentals of Reservoir Fluid Behavior (part 1)	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory, and final exam.
3.	3 lecture + 2 lab + 1 tutorial	Types of Reservoirs, Oil Reservoirs, Gas Reservoirs.	Fundamentals of Reservoir Fluid Behavior (part 2)	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory, and final exam.
4.	3 lecture + 2 lab + 1 tutorial	Natural Gases, Behavior of Ideal Gases, Ideal Gas Law, Apparent Molecular Weight, Standard Volume, Density, Specific Volume, Behavior of Real Gases, Specific Volume and Density of Real Gases, Cases where the composition of a natural gas is not available, Effect of Nonhydrocarbon	Reservoir-Fluid Properties (Properties of Natural Gases: Part 1)	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory, and final exam.

		Components on the z-Factor, Correction Methods.			
5.	3 lecture + 2 lab + 1 tutorial	Isothermal Compressibility of Natural Gases, Gas Formation Volume Factor, Gas Expansion Factor, Viscosity, Methods of Calculating the Viscosity of Natural Gases.	Reservoir-Fluid Properties (Properties of Natural Gases: Part 2)	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory, and final exam.
6.	3 lecture + 2 lab + 1 tutorial	Specific Gravity of the Solution Gas, Gas Solubility, correlations for estimating the gas solubility, Bubble-Point Pressure, correlations for estimating the bubble-point pressure.	Reservoir-Fluid Properties (Properties of Crude Oil Systems: Part 1)	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory, and final exam.
7.	3 lecture + 2 lab + 1 tutorial	Oil Formation Volume Factor, Oil Formation Volume Factor for Saturated Oils (P ≤ Pb), correlations for estimating Bo of saturated oils, Material Balance Equation to Find the Oil Formation Volume Factor, Oil Formation Volume Factor for Undersaturated Oils (P > Pb), Isothermal Compressibility Coefficient of Crude Oil, The isothermal compressibility coefficient for undersaturated oils (P >Pb), correlations for estimating Co of undersaturated oils, The isothermal compressibility coefficient for saturated oils (P ≤ Pb), correlations for estimating Co of saturated oils.	Reservoir-Fluid Properties (Properties of Crude Oil Systems: Part 2)	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory, and final exam.
8.	3 lecture + 2 lab + 1 tutorial	Crude Oil Density, Density of Saturated Oils (P ≤ Pb), Density of Undersaturated Oils (P > Pb), Total Formation Volume Factor, Correlations to estimate the total formation volume factor, Standing's Correlations, Marhoun's Correlation.	Reservoir-Fluid Properties (Properties of Crude Oil Systems: Part 3)	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory, and final exam.
9.	3 lecture + 2 lab + 1 tutorial	Crude Oil Viscosity, Methods of Calculating Viscosity of the Dead Oil, Methods of Calculating Viscosity of the	Reservoir-Fluid Properties (Properties of	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the

		Saturated Oil, A Method of Calculating Viscosity of the Undersaturated Oil, Surface Tension.	Crude Oil Systems: Part 4)		performance in the laboratory, and final exam.
10.	3 lecture + 2 lab + 1 tutorial	Compositional Characteristics of Formation Water, Formation Volume Factor of Formation Water, Density of Formation Water.	Reservoir-Fluid Properties (Properties of Reservoir Water: part 1)	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory, and final exam.
11.	3 lecture + 2 lab + 1 tutorial	Viscosity of Formation Water, Solubility of Hydrocarbons in Formation Water, Effect of Pressure and Temperature, Effect of Hydrocarbon Composition, Effect of Dissolved Solids, An Empirical Correlation to Calculate Gas solubility in Formation Water, Solubility of Formation Water in Hydrocarbons, Solubility of water in gaseous hydrocarbons, Solubility of water in liquid hydrocarbons, Compressibility of Formation Water.	Reservoir-Fluid Properties (Properties of Reservoir Water: part 2)	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory, and final exam.
12.	3 lecture + 2 lab + 1 tutorial	Collection of Fluid Samples, Subsurface sampling, Surface recombination sampling, Compositional Analysis of the System, PVT Equipment, Constant-Composition Expansion, Differential Liberation, Separator Tests.	PVT Lab Tests	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory, and final exam.
13.	3 lecture + 2 lab + 1 tutorial	Vapor pressure, equilibrium ratios, flash calculations.	Vapor-Liquid Phase Equilibria (Part 1)	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory, and final exam.
14.	3 lecture + 2 lab + 1 tutorial	Equilibrium ratios for real solutions, methods for predicting equilibrium ratios of hydrocarbon mixtures.	Vapor-Liquid Phase Equilibria (Part 2)	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory,

					and final exam.
15.	3 lecture + 2 lab + 1 tutorial	Calculation of dew-point pressure, calculation of bubble-point pressure.	Applications of the Equilibrium Ratio in Reservoir Engineering (Part 1)	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory, and final exam.
16.	3 lecture + 2 lab + 1 tutorial	Separator calculations.	Applications of the Equilibrium Ratio in Reservoir Engineering (Part 2)	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory, and final exam.
17.	3 lecture + 2 lab + 1 tutorial	Porosity, Permeability, Darcy's Law for Linear Flow of Incompressible Fluids, Poueseli law, Kozeny Equation, Flow through channels and Fractures, Darcy's Law for Linear Flow of Gases, Klinkenberg Effect of Gas Permeability Measurements.	Properties of Reservoir Rocks (Part 1)	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory, and final exam.
18.	3 lecture + 2 lab + 1 tutorial	Darcy's Law for Radial Flow of Incompressible Fluids, Averaging Absolute Permeabilities, Weighted-Average Permeability, Harmonic-Average Permeability, Linear System, Radial System, Geometric-Average Permeability.	Properties of Reservoir Rocks (Part 2)	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory, and final exam.
19.	3 lecture + 2 lab + 1 tutorial	Rock Compressibility, Wettability, Surface and Interfacial Tension, Capillary Pressure.	Properties of Reservoir Rocks (Part 3)	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory, and final exam.
20.	3 lecture + 2 lab + 1 tutorial	Multiphase flow through porous media, effective permeability, relative Permeability, Calculation of	Properties of Reservoir Rocks (Part 4)	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the

		relative permeability.			performance in the laboratory, and final exam.
21.	3 lecture + 2 lab + 1 tutorial	Fractional flow equation, Linear flow (piston like, leaky piston), Buckley-Leverett equation.	Fractional Flow Theory	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory, and final exam.
22.	3 lecture + 2 lab + 1 tutorial	Pressures of Reservoir fluids, Isobar, Isobach, Isoporosity and bubble maps, volumetric calculation of reserves, recovery factor.	Volumetric Calculations	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory, and final exam.
23.	3 lecture + 2 lab + 1 tutorial	Reservoir drive mechanisms, solution gas drive, gas-cap drive, gravity-segregation drive, water drive, combination drive.	Reservoir drive Mechanisms	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory, and final exam.
24.	3 lecture + 2 lab + 1 tutorial	Material balance equation, material balance for water derive and gas derive reservoirs.	Material Balance Equation	Theoretical lecture & lab applications	Quizzes, monthly exams, homework, evaluation of the performance in the laboratory, and final exam.

12.	**Infrastructure**
Required reading: **·CORE TEXTS** **·COURSE MATERIALS** **· OTHER**	• Reservoir Engineering Handbook by Tarek Ahmed • Fundamentals of Reservoir Engineering by L.P. Dake • Reservoir engineering practice, Ezekwe • Electronic references, Internet sites
Community-based facilities) include for example, guest Lectures, internship, field	Scientific collaboration with other academic staff in the relevant field is one of our future plan to develop the program.

studies)	

13.	**Admissions**
Pre-requisites	
Minimum number of students	10
Maximum number of students	30