**Template of Course Specification**

**Name and Scientific title of the subject instructor: Dr. Raed H. Allawi**

**Name of Course: Secondary Oil Recovery**

**Course Specification**

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| **1.** | **Teaching Institution** | **Al-Ayen University / Petroleum Engineering College** |
| 2. | **University Department / Center** | Petroleum Engineering College |
| 3. | **Course Title / Code** | Secondary Oil Recovery |
| 4. | **Program(s) to which it contributes** | B.Sc. |
| 5. | **Modes of Attendance offered** | Class attendance |
| 6. | **Semester/Year** | 1st and 2nd, 2023 |
| 7. | **Number of hours tuition (total)** | 60 |
| 8. | **Date of production/revision of this Specification** | Oct. 2022 |
| 9. | **Aims of the Course: The student will know the following:** | |
| | 1 | Understanding the PRINCIPLES OF WATERFLOODING. |
| | 2 | Determining the optimum time to start waterflooding |
| | 3 | Selecting the proper pattern that will provide the injection fluid with the maximum possible contact with the crude oil system. |
| | 4 | Understanding the principals of the areal sweep efficiency EA. |
| | 5 | Understanding the vertical sweep efficiency |
| | 6 | Understanding the METHODS OF PREDICTING RECOVERY PERFORMANCE FOR LAYERED RESERVOIRS |
| 10. | **Learning Outcomes, Teaching, Learning and Assessment Methods** | |
| | A | **Knowledge and understanding:** The SOR course aims to develop the capabilities of students to understand the production using waterflooding or immiscible gas injection |
| | B | **Subject-specific skills:** The program provides the capability to choose the best scenario that maximizes the profit and perhaps meets the operator's desirable goal is selected |
| | C | **Assessment methods:** The assessment method is divided into three parts; quizzes, monthly exams, and final exams. |
| | D | **Thinking Skills:** Providing a skilled staff to the scientific community that can effectively contribute to develop and tackle the relevant engineering problems. |
| | E | **Teaching and learning methods:** The teaching is performed theoretically based upon theoretical concepts of SOR |

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| F | **General and Transferable Skills (other skills relevant to employability and personal development):** The most important skills are the knowledge and capability to provide scientific proposals to tackle a given engineering problem. |

| **11.** | **Course Structure** | | | | |
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| **Week** | **Hours** | **Required Teaching Outputs** | **Unit/Module or Topic Title** | **Teaching Methods** | **Assessment Methods** |
| **1.** | 2 | Student will understand | PRINCIPLES OF WATERFLOODING | Class attendance | Quizzes, monthly exams, and final exams |
| **2.** | 2 | Student will understand | FACTORS TO CONSIDER IN WATERFLOODING | Class attendance | Quizzes, monthly exams, and final exams |
| **3.** | 2 | Student will understand | Reservoir Uniformity and Pay Continuity | Class attendance | Quizzes, monthly exams, and final exams |
| **4.** | 2 | Student will understand | OPTIMUM TIME TO WATERFLOOD | Class attendance | Quizzes, monthly exams, and final exams |
| **5.** | 2 | Student will understand | EFFECT OF TRAPPED GAS ON WATERFLOOD RECOVERY | Class attendance | Quizzes, monthly exams, and final exams |
| **6.** | 2 | Student will understand | ELECTION OF FLOODING PATTERNS | Class attendance | Quizzes, monthly exams, and final exams |
| **7.** | 2 | Student will understand | OVERALL RECOVERY EFFICIENCY | Class attendance | Quizzes, monthly exams, and final exams |
| **8.** | 2 | Student will understand | DISPLACEMENT EFFICIENCY | Class attendance | Quizzes, monthly exams, and final exams |
| **9.** | 2 | Student will understand | Fractional Flow Equation | Class attendance | Quizzes, monthly exams, and final exams |
| **10.** | 2 | Student will understand | Effect of Water and Oil Viscosities | Class attendance | Quizzes, monthly exams, and final exams |
| **11.** | 2 | Student will understand | AREAL SWEEP EFFICIENCY | Class attendance | Quizzes, monthly exams, and final exams |
| **12.** | 2 | Student will understand | VERTICAL SWEEP EFFICIENCY | Class attendance | Quizzes, monthly exams, and final exams |

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| **13.** | 2 | Student will understand | Couples; resultant of coplanar force systems | Class attendance | Quizzes, monthly exams, and final exams |
| **14.** | 2 | Student will understand | Calculation of Vertical Sweep Efficiency | Class attendance | Quizzes, monthly exams, and final exams |
| **15.** | 2 | Student will understand | Frontal Advance Equation | Class attendance | Quizzes, monthly exams, and final exams |
| **16.** | 2 | Student will understand | Buckley and Leverett of Frontal Advance Equation | Class attendance | Quizzes, monthly exams, and final exams |
| **17.** | 2 | Student will understand | Oil Recovery Calculations | Class attendance | Quizzes, monthly exams, and final exams |
| **18.** | 2 | Student will understand | Principals of Dynamics | Class attendance | Quizzes, monthly exams, and final exams |
| **19.** | 2 | Student will understand | Recovery Performance to Breakthrough | Class attendance | Quizzes, monthly exams, and final exams |
| **20.** | 2 | Student will understand | Recovery Performance After Breakthrough | Class attendance | Quizzes, monthly exams, and final exams |
| **21.** | 2 | Student will understand | AREAL SWEEP EFFICIENCY | Class attendance | Quizzes, monthly exams, and final exams |
| **22.** | 2 | Student will understand | Flood Patterns | Class attendance | Quizzes, monthly exams, and final exams |
| **23.** | 2 | Student will understand | Cumulative Water Injected | Class attendance | Quizzes, monthly exams, and final exams |
| **24.** | 2 | Student will understand | Recovery Performance to Breakthrough | Class attendance | Quizzes, monthly exams, and final exams |
| **25.** | 2 | Student will understand | Recovery Performance After Breakthrough | Class attendance | Quizzes, monthly exams, and final exams |
| **26.** | 2 | Student will understand | Fluid Injectivity | Class attendance | Quizzes, monthly exams, and final exams |
| **27.** | 2 | Student will understand | Constant Injection Pressure and | Class attendance | Quizzes, monthly exams, and final exams |

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| | | | Variable Injection Rate “iw | | |
| **28.** | 2 | Student will understand | Constant Injection Rate and Variable Injection Pressure | Class attendance | Quizzes, monthly exams, and final exams |
| **29.** | 2 | Student will understand | Effect of Initial Gas Saturation | Class attendance | Quizzes, monthly exams, and final exams |
| **30.** | 2 | Student will understand | Interference– Fill-Up | Class attendance | Quizzes, monthly exams, and final exams |

| **12.** | **Infrastructure** |
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| **Required reading:**<br>**·CORE TEXTS**<br>**·COURSE MATERIALS**<br>**· OTHER** | • Reservoir Engineering Handbook/ Tarek Ahmed<br>• Enhanced Oil Recovery, Second Edition<br>• by Paul Willhite (Author), Don Green (Author)<br>• Mechanics of Secondary Oil Recovery Hardcover<br>• by Charles Robert Smith (Author) |
| **Community-based facilities) include for example, guest Lectures, internship, field studies)** | Scientific collaboration with other academic staff in the relevant field is one of our future plan to develop the program. |

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