**TEMPLATE FOR COURSE SPECIFICATION**

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

Course Instructor: Prof. Dr. Ayad A.H. Faisal

**COURSE SPECIFICATION**

**Full knowledge of Soil science, origin, classification, pollution, and remediation methods.**

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| 1. Teaching Institution | University of Baghdad/ College of Engineering |
| 2. University Department/Centre | Environmental Engineering Department |
| 3. Course title/code | Soil Science and Pollution |
| 4. Modes of Attendance offered | 2 days per week theoretical+ 1 day per week lab (lab for 1st semester only) |
| 5. Semester/Year | Year |
| 6. Number of hours tuition (total) | 90 h for theoretical + 30 h for lab |
| 7. Date of production/revision of thisspecification | 2021/2022 |
| 8. Aims of the Course |
| 1. Understanding origin, composition, classification etc. of soil.
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| 1. Understanding the flow of water in subsurface medium.
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|  3- Sources of soil pollution  |
|  4- Theoretical modeling of contaminant transport |
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9· Learning Outcomes, Teaching, Learning and Assessment Method

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| A- Cognitive goals.

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| A1. After completion of the course students should be able to characterization of soil and modeling of contaminant transport mathematically to find the required time to reach the water resources |
| A2. Identification and measurement the main properties of the soil like porosity, void ratio….etc. |

A3. Attract and welcome undergraduate students to our Bachelor of Science program in Environmental Engineering, and to graduate B.S. students who are innovative problem solvers, who become leaders in their organizations, and who possess the knowledge and skills required for a wide range of careers and career changes. |
| B. The skills goals special to the course.

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| B1.Understand health and environmental issues related to soil and groundwater pollution |
| B2. apply steps in reclamation of soil and contaminated groundwater and resource recovery/recycling, transport. |

B3.Concentrating on scientific research and its leading role in helping to serve the society and solving its problems through conducting application researches |
| Teaching and Learning Methods |
| 1- Lectures.2- Tutorials.3- Homework and Assignments.4- Lab. Applications.5- Tests and Exams.6- In-Class Questions and Discussions.7- Connection between Theory and Application.9- Extracurricular Activities.11- In- and Out-Class oral conservations. |
| Assessment methods |
| 1. Examinations, Tests, and Quizzes.2. Extracurricular Activities.3. Student Engagement during Lectures.4. Responses Obtained from Students, Questionnaire about curriculum and faculty member (Instructor) |
| C. Affective and value goals

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| C1. Optimization of contaminant transport, treatment and disposal techniques |
| C2. Behaviour of soil under different types of stressesC3. Prepare students for successful careers in environmental engineering |

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D. General and rehabilitative transferred skills (other skills relevant to employability and personal development)

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| D1. Become more effective, independent and confident self-directed learners |
| D2. Improve their general skills for study and career managementD3. Articulate personal goals and evaluate progress towards their achievementD4.An ability to identify, formulate, and solve engineering problems |

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| 10. Course Structure |
| Week | Hours | ILOs | Unit/Module orTopic Title | TeachingMethod | AssessmentMethod |
| 1 | 3hrs Theor. and 2hrs Lab. | Origin of soils | Mechanical and chemical weatheringWater content / Atterberg's (or consistency) limits (Lab) |  Electronic +Lab | Questions during the lectures ,quiz, exam, present in the class, Laboratory reports |
| 2 | 3hrs Theor. and 2hrs Lab. | Composition of soils | Minerals of particlesWater content / Atterberg's (or consistency) limits (Lab) | Electronic +Lab | Questions during the lectures ,quiz, exam, present in the class, Laboratory reports |
| 3 | 3hrs Theor. and 2hrs Lab. | Constituents of soils | Solid, liquid and gaseous phasesWater content / Atterberg's (or consistency) limits (Lab) | Electronic +Lab | Questions during the lectures ,quiz, exam, present in the class, Laboratory reports |
| 4 | 3hrs Theor. and 2hrs Lab. | Soil structure | Layers of the soilSpecific gravity (Lab) |  Electronic +Lab | Questions during the lectures ,quiz, exam, present in the class, Laboratory reports |
| 5 | 3hrs Theor. and 2hrs Lab. | Soil structure | classification of the soilSieve analysis (particle size distribution) (Lab) | Electronic +Lab | Questions during the lectures ,quiz, exam, present in the class, Laboratory reports |
| 6 | 3hrs Theor. and 2hrs Lab. | Engineering and physical properties of soil | classification of the soilSieve analysis (particle size distribution) (Lab) | Electronic +Lab | Questions during the lectures ,quiz, exam, present in the class, Laboratory reports |
| 7 | 3hrs Theor. and 2hrs Lab. | Engineering and physical properties of soil | Gravimetric -volumetric relationsHydrometer analysis (Lab) |  Electronic +Lab | Questions during the lectures ,quiz, exam, present in the class, Laboratory reports |
| 8 | 3hrs Theor. and 2hrs Lab. | Engineering and physical properties of soil | Gravimetric -volumetric relationsHydrometer analysis (Lab) | Electronic +Lab | Questions during the lectures ,quiz, exam, present in the class, Laboratory reports |
| 9 | 3hrs Theor. and 2hrs Lab. | Soil permeability | Darcy’s LawConstant head permeameter (Lab) | Electronic +Lab | Questions during the lectures ,quiz, exam, present in the class, Laboratory reports |
| 10 | 3hrs Theor. and 2hrs Lab. | Flow of water through soils | Darcy’s LawConstant head permeameter (Lab) |  Electronic +Lab | Questions during the lectures ,quiz, exam, present in the class, Laboratory reports |
| 11 | 3hrs Theor. and 2hrs Lab. | Flow of water through soils | Darcy’s LawFalling head permeameter (Lab) | Electronic +Lab | Questions during the lectures ,quiz, exam, present in the class, Laboratory reports |
| 12 | 3hrs Theor. and 2hrs Lab. | Soil behavior under stress and compressibility | Deformation and factor of safetyCompaction (Lab) | Electronic +Lab | Questions during the lectures ,quiz, exam, present in the class, Laboratory reports |
| 13 | 3hrs Theor. and 2hrs Lab. | Soil behavior under stress and compressibility | Deformation and factor of safetyCompaction (Lab) |  Electronic +Lab | Questions during the lectures ,quiz, exam, present in the class, Laboratory reports |
| 14 | 3hrs Theor. and 2hrs Lab. | Soil behavior under stress and compressibility | Deformation and factor of safetyCompaction (Lab) | Electronic +Lab | Questions during the lectures ,quiz, exam, present in the class, Laboratory reports |
| 15 | 3hrs Theor. and 2hrs Lab. | Soil behavior under stress and compressibility | Deformation and factor of safety compaction (Lab) | Electronic +Lab | Questions during the lectures ,quiz, exam, present in the class, Laboratory reports |
| 16 | 3hrs Theor. | Environmental geo-technology | Environment and soil | Electronic  | Questions during the lectures ,quiz, exam, present in the class,  |
| 17 | 3hrs Theor. | Environmental geo-technology | Sources of soil pollution | Electronic  | Questions during the lectures ,quiz, exam, present in the class,  |
| 18 | 3hrs Theor. | Environmental geo-technology | Soil and contaminant migration | Electronic  | Questions during the lectures ,quiz, exam, present in the class,  |
| 19 | 3hrs Theor. | Environmental geo-technology | Soil and contaminant migration | Electronic  | Questions during the lectures ,quiz, exam, present in the class,  |
| 20 | 3hrs Theor. | Modeling | Processes governed the contaminant transport | Electronic  | Questions during the lectures ,quiz, exam, present in the class,  |
| 21 | 3hrs Theor. | Modeling | Processes governed the contaminant transport | Electronic  | Questions during the lectures ,quiz, exam, present in the class,  |
| 22 | 3hrs Theor. | Soil erosion  | Causes | Electronic  | Questions during the lectures ,quiz, exam, present in the class,  |
| 23 | 3hrs Theor. | Soil erosion | Consequences | Electronic  | Questions during the lectures ,quiz, exam, present in the class, |
| 24 | 3hrs Theor. | Ion exchange in soils | Definition and description | Electronic  | Questions during the lectures ,quiz, exam, present in the class,  |
| 25 | 3hrs Theor. | Ion exchange in soils | Distribution of contaminants | Electronic  | Questions during the lectures ,quiz, exam, present in the class,  |
| 26 | 3hrs Theor. | Ion exchange in soils | Modeling of process | Electronic  | Questions during the lectures ,quiz, exam, present in the class,  |
| 27 | 3hrs Theor. | Soil as an aid to waste disposal | Landfills | Electronic  | Questions during the lectures ,quiz, exam, present in the class,  |
| 28 | 3hrs Theor. | Soil as an aid to waste disposal | Produced leachate | Electronic  | Questions during the lectures ,quiz, exam, present in the class,  |
| 29 | 3hrs Theor. | Soil as an aid to waste disposal | Importance of soil for landfilling | Electronic  | Questions during the lectures ,quiz, exam, present in the class,  |
| 30 | 3hrs Theor. | Soil as an aid to waste disposal | Spillage | Electronic  | Questions during the lectures ,quiz, exam, present in the class,  |

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| 11. Infrastructure |
| 1. Books Required reading: | 1-Contaminant Hydrogeology 1999 by Fetter2- Geo-environmental Engineering 2000 by Reddi3-2014 HAZARDOUS WASTE REPORT INSTRUCTIONS AND FORMS, Louisiana Department of Environmental Quality, 2014. |
| 2. Main references (sources) | Contaminant Hydrogeology 1999 by FetterCraig’s Soil Mechanics 2004 |
| A- Recommended books and references (scientific journals, reports…). | Journals 1. Journal of contaminant hydrology  |
| B-Electronic references, Internetsites… | Available electronic books related to the soil subject. |

12. The development of the curriculum plan

The development could concentrate on the using familiar software like COMSOL for simulation the migration of contaminant in subsurface environment.