**TEMPLATE FOR COURSE SPECIFICATION**

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

**Course instructor: Prof. Dr. Zainab Ziad Ismail**

**COURSE SPECIFICATION**

This Course provides complete knowledge about the design and arrangements of the major industrial wastewater treatment units and techniques including physical, chemical, and biological methods.

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| 1. Teaching Institution | College of Engineering/University of Baghdad |
| 2. University Department/Centre | Department of Environmental Engineering |
| 3. Course title/code | Industrial wastewater treatment Techniques |
| 4. Modes of Attendance offered | Two days/Week (electronic class) |
| 5. Semester/Year | Two semesters/Year |
| 6. Number of hours tuition (total) | 90 hours |
| 7. Date of production/revision of thisspecification | 2020-2021 |
| 8. Aims of the Course |
| 1- Understanding the basic concepts of wastewater treatment. |
| 2- Recognizing the difference between domestic and industrial wastewater characteristics. |
| 3- Providing full knowledge of how to deal with different types of industrial wastewater. |
| 4- Learning how to select the suitable treatment unit based on wastewater characteristics |
| 5- Learn the design and criteria of the most conventional treatment units. |

9· Learning Outcomes, Teaching, Learning and Assessment Method

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| **A- Cognitive goals.** A1. Upon completion of the two semesters, the students must be able to design and deal with different types of wastewater treatment units. A2. Provides understanding environmental engineers capable of performing complete design of wastewater treatment plant. A3. Encourage and welcome new students to the program of the department of Environmental Engineering as undergraduate and graduate students. Those students can potentially contribute in solving the environmental problems in particular those related to the industry. and they can act as leaders in their organizations. Also, they can offer their knowledge and skills in a wide range of updated carrier applications. |
| **B- The skills goals special to the course**. B1. Articulate an understanding of relevant concepts that underlie environmental processes. B2. Integrate and apply sophisticated perspectives from multiple disciplinary approaches that address complex industrial environmental problems.B3. Design and conduct research on industrial environmental topics. Research could include a variety of methods including quantitative, qualitative, artistic, …. etc.  |
|  Teaching and Learning Methods |
|  Presenting real case studies and real environmental problems. |
|  Assessment methods |
|  - Home works. - Classroom groups to design certain industrial treatment units which can solve environmental problems. |
| C. Affective and value goalsC1. Effective and logical approaches for the design of treatment units.C2. Knowledge of applicable design procedures of effective cost and efficient performance.C3. Provide the society and industry with open minded engineers with updated knowledge. |
|  Teaching and Learning Methods |
|  Intensive class work and looking out for real industrial wastewater treatment plants. |
|  Assessment methods |
|  Applied case studies |

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

D1. Both cognitive and non-cognitive skills- such as critical thinking, problem solving, collaboration, effective communication, motivation, persistence, and learning to learn.

D2. Skills also include creativity, innovation, and ethics that are important to later success and may be developed in formal or informal learning environments.

D3. Develop skills such as problem solving, critical thinking, communication, collaboration, and self-management - often referred to as "21st century skills."

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| 10. Course Structure |
| Week | Hours | ILOs | Unit/Module orTopic Title | TeachingMethod | AssessmentMethod |
| 1 | 3 | Sources and Properties of IWW | Basic raw material balance in industrial processing | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 2 | 3 | Sources and Properties of IWW | Compatibility of industry and municipality | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 3 | 3 | Sources and Properties of IWW | Characteristics of industrial wastes. | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 4 | 3 | Sources and Properties of IWW | Characteristics of industrial wastes. | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 5 | 3 | Management of IWW | The criteria for selecting suitable treatment techniques of industrial wastes. | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 6 | 3 | Management of IWW | Applications and basic design of wastewater treatment technologies. | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 7 | 3 | Treatment of IWW | Physical techniques application/ sedimentation | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 8 | 3 | Treatment of IWW | Physical techniques application/ mixing | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 9 | 3 | Treatment of IWW | Physical techniques application/ filtration | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 10 | 3 | Treatment of IWW | Physical techniques application/ air stripping | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 11 | 3 | Treatment of IWW | Physical techniques application/ steam stripping | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 12 | 3 | Treatment of IWW | Physical techniques application/ flocculation | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 13 | 3 | Treatment of IWW | Physical techniques application/ reverse osmosis | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 14 | 3 | Treatment of IWW | Physical techniques application/ adsorption process | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 15 | 3 | Treatment of IWW | Physical techniques application/ A.C adsorption | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| Break |
| 1 | 3 | Treatment of IWW | Biological methods applications | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 2 | 3 | Treatment of IWW | Biological methods applications | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 3 | 3 | Treatment of IWW | Biological methods applications | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 4 | 3 | Treatment of IWW | Biological methods applicationsBiological methods applicationsBiological methods applicationsBiological methods applicationsBiological methods applicationsBiological methods applicationsBiological methods applications | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
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| 10 | 3 | Treatment of IWW | Biological methods applications | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 11 | 3 | Treatment of IWW | Chemical methods applications | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 12 | 3 | Treatment of IWW | Chemical methods applications | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 13 | 3 | Treatment of IWW | Chemical methods applications | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 14 | 3 | Treatment of IWW | Chemical methods applications | Electronic | Questions during the lectures, quiz, exams, presenting in the class |
| 15 | 3 | Treatment of IWW | Chemical methods applications | Electronic | Questions during the lectures, quiz, exams, presenting in the class |

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| 11. Infrastructure |
| 1. Books Required reading: |  Industrial Water Pollution,  Origins, Characteristics, and Treatment  By Nelson L. Nemerow |
| 2. Main references (sources) |  |
| A- Recommended books and references (scientific journals, reports…). | 1-Theory and practice of water and wastewater treatment. By Ronald L. Droste.2- International Journal of Waste Resources.3- Wastewater Management journal. |
| B-Electronic references, Internetsites… | <https://www.watertechonline.com/wastewater/article/15550541/wastewater-treatment-technologies-for-processing-plants>.<https://www.pseau.org/outils/ouvrages/wrc_wastewater_treatment_technologies_a_basic_guide_2016.pdf><https://www.epa.gov/eg/industrial-effluent-guidelines> |

This curriculum should be supported by several visits to real field industrial wastewater treatment plant

12. The development of the curriculum plan