**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW |

 **Course Instructor: Asst. prof. Dr. Jathwa Abdul Karime Ibrahim**

 **COURSE SPECIFICATION**

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| The course offers specialization in selected areas of solid wastes, solid waste generation, and activities associated with waste generation, onsite storage, collection, transfer and transport, processing and recovery, and disposal identified as functional elements, processing of municipal solid waste, material separation, combustion and energy recovery, biochemical processes, landfill siting and planning landfill processes, landfill design ,landfill operation, post –closure care and use of old landfills. The student after studying this science may wish to study further more detailed texts on integrated solid waste management.  |

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| University of Baghdad /College of Engineering | 1. Teaching Institution |
| Environmental Engineering Department | 2. University Department/Centre |
| Solid waste management  | 3. Course title/code  |
| Annual System: They attend in electronic mode 2 hrs. a Week. | 4. Modes of Attendance offered |
| Annual  | 5. Semester/Year |
| 60 hrs./ 2 hrs per week | 6. Number of hours tuition (total) |
| 2/2/2022 | 7. Date of production/revision of this specification  |
| **8. Aims of the Course** |
| The main objectives of the course are: 1. A thorough description of the composition, and ultimate and proximate chemical analysis of municipal solid waste, its composition and characteristics—physical, chemical and biological characteristics.
2. Providing the tools and methodologies to calculate the number of containers on a MSW collection route and the number of collection trucks needed.
3. Describing various separation unit processes (size reduction processes, materials separation.
4. Learning combustion and energy recovery
5. Learning equations to calculate the landfill volume after compaction, estimate the leachate production rate and time, and calculate the landfill gas production rate, planning and siting of solid waste landfills.

**9· Learning Outcomes, Teaching ,Learning and Assessment Method**A- **Cognitive goals.**At the end of the year the students should:A1. Understand the basic concepts of solid waste management and be able to identify different sources and characteristics of solid waste. A2. Understand the physical, chemical, and biological properties of municipal solid waste.A3. Be able to describe how to calculate solid waste generation, on site handling, storage and processing of solid waste. A4. Be able to recognize two main collection systems, different equipment, and labor requirement, collection frequency calculations, transfer station types, design, and sanitation requirements.A5. Recognize disposal methods of solid waste, landfilling, landfill design, amount of gas and leachate generated.A6. 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****B1.** Essential information in solid waste management.**B2** Skills in landfill design in accordance with environmental concerns. **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- Homework and Assignments.3- Tests and Exams.4- In-Class Questions and Discussions.5- Connection between Theory and Application.6- In- and Out-Class oral conservations. **Assessment Methods**1. Examinations, Tests, and Quizzes.2. Student Engagement during Lectures.3. Responses Obtained from Students, Questionnaire about curriculum and faculty member (Instructor).4. Home work related to problem solving. |
| **C. Affective and value goals*** **C1.** What are solid wastes, what are the impacts of solid waste generation, what does the future hold with respect to solid waste generation.
* **C2.** Solid waste management.
* **C3.** The various activities associated with waste generation, onsite storage, collection, transfer and transport, processing and recovery, and final disposal.
* **C4.** Landfill design and management.
* **C5.** Prepare students for successful careers in environmental engineering.
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| Teaching and Learning MethodIntensive studies of regulation |
| Assessment Methods |
| Case studies |
| D. General and rehabilitative transferred skills (other skills relevant to employability and personal development). |
| D1. Become more effective, independent and confident self-directed learnersD2. 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** |
| Assessment Method | TeachingMethod | Unit/Module or Topic Title | ILOs | Hours | Week |
| Questions during the lectures ,quiz, exam, present in the class | Electronic | Evaluation of solid waste management | 1 | 2 (Theo.)  | 1 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Evaluation of solid waste management | 1 | 2 (Theo.) | 2 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Sources, types, and composition of municipal solid wastes | 1 &2 | 2 (Theo.) | 3 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Sources, types, and composition of municipal solid wastes | 1 &2 | 2 (Theo.) | 4 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Sources, types, and composition of municipal solid wastes | 1 &2 | 2 (Theo.) | 5 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Physical, chemical, and biological properties of municipal solid waste | 1,2,&3 | 2 (Theo.) | 6 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Physical, chemical, and biological properties of municipal solid waste | 1,2,&3 | 2 (Theo.) | 7 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Physical, chemical, and biological properties of municipal solid waste | 2,3 &4 | 2 (Theo.) | 8 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Physical, chemical, and biological properties of municipal solid waste | 2,3 &4 | 2 (Theo.) | 9 |
| Questions during the lectures ,quiz, exam, present in the class - |  Electronic | Generation of solid waste , measurements rates (input, output, at source, at site, loud count analysis, weight volume analysis, material balance analysis ) methods | 3&4 | 2 (Theo.) | 10 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Generation of solid waste , measurements rates (input, output, at source, at site, loud count analysis, weight volume analysis, material balance analysis ) methods | 3 &4 | 2 (Theo.) | 11 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Generation of solid waste , measurements rates (input, output, at source, at site, loud count analysis, weight volume analysis, material balance analysis ) methods | 3 &4 | 2 (Theo.) | 12 |
| ----------------- |  Electronic | Examination |  | 2 (Theo.) | 13 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Waste handling and separation, storage, and processing at source | 3 &4 | 2 (Theo.) | 14 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Waste handling and separation, storage, and processing at source | 3 &4 | 2 (Theo.) | 15 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Waste handling and separation, storage, and processing at source | ,3 &4 | 2 (Theo.) | 16 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Collection systems, equipment, and labor requirement | 3 &4 | 2 (Theo.) | 17 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Collection frequency calculations, Transfer station types | 3 &4 | 2 (Theo.) | 18 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | locations, design, equipment, accessory | 3 &4 | 2 (Theo.) | 19 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Sanitation requirements  | 3 &4 | 2 (Theo.) | 20 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Transport of solid waste | 3&4 | 2 (Theo.) | 21 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Separation and processing  | 3 &4 | 2 (Theo.) | 22 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Separation and processing | 3 &4 | 2 (Theo.) | 23 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Transfer and transport | 3 &4 | 2 (Theo.) | 24 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Transfer and transport | 3 &4 | 2 (Theo.) | 25 |
| ---------------------- |  Electronic | Exam. | ------ | 2 (Theo.) | 26 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Landfilling | 5 | 2 (Theo.) | 27 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Landfilling | 5 | 2 (Theo.) | 28 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | Landfilling | 5 | 2 (Theo.) | 29 |
| Questions during the lectures ,quiz, exam, present in the class |  Electronic | National Legislations | 5 | 2 (Theo.) | 30 |

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| 11. Infrastructure |
| 1. Friedman S. Lauri "Garbage and Recycling" Greenhaven Press. 2009.
2. Bishop, L. Paual . "Pollution Prevention: Fundamentals and Practice", McGraw – Hill International Editions, 2000.
3. Davis, L., Mackenzie, and Cornwell, A., David. “Introduction to Environmental Engineering” 2nd Edition, McGraw Hill. Inc.1985
 | 1. Books required reading:
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| George Tchobanoglous, and Frank Kreith, “Integrated Solid Wastes Engineering principles and Management” Second Edition 1992 | 1. Main references (sources)
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| 1. Friedman S. Lauri "Garbage and Recycling" Greenhaven Press. 2009.
2. Bishop, L. Paual . "Pollution Prevention: Fundamentals and Practice", McGraw – Hill International Editions, 2000.
3. Davis, L., Mackenzie, and Cornwell, A., David. “Introduction to Environmental Engineering” 2nd Edition, McGraw Hill. Inc.1985

4.Worrell A. William and Vesilind P Arine “Solid Wastes Engineering” 2nd ed. Cengage Learning 2012. | A- Recommended books and references (scientific journals, reports…). |
| <https://onlinelibrary.wiley.com/doi/book/10.1002/9780470666883><https://libraryguides.uwsp.edu/c.php?g=525918&p=3595622><https://ascelibrary.org/doi/book/10.1061/9780784414101>https://www.springer.com/gp/book/9783642286803 | B-Electronic references, Internetsites |

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| 12. The development of the curriculum planNot to relay on traditional examinations but inviting guest lectures , internship , field studies)and the creation of reports following the reading of textbooks. These reports are validated and transformed into academic credits for graduation purposes. |