23SC811 WASTE TO ENERGY CONVERSION 3-1-0-4

Course Objective:

- To introduce students to the different types of waste and their characterization.
- To teach students the various methods of converting waste to energy.
- To develop students' understanding of the principles behind the conversion processes.
- To equip students with the knowledge and skills to design and implement waste-to-energy projects.

Course Outcome:

CO1. Student will be able to characterize different types of waste and understand the principles behind waste-to-energy conversion processes.

CO2. Analyze the suitability of different waste-to-energy conversion methods for specific waste types.

CO3. Design and implement waste-to-energy projects.

CO4. Apply practical experience in waste-to-energy conversion techniques.

Syllabus:

Module 1 – Wastes: Introduction and characterization of wastes, definition of waste, types of waste, characteristics of waste, waste disposal methods.

Module 2 – Energy Production from Wastes - I: Energy production through incineration, gasification, pyrolysis and syngas utilization. Incineration: principle, advantages, and disadvantages; Gasification: principle, advantages, and disadvantages; Pyrolysis: principle, advantages, and disadvantages; Syngas utilization: principle, advantages, and disadvantages.

Module 3 – Energy Production from Wastes - II: Energy production through anaerobic digestion, fermentation, transesterification and introduction to microbial fuel cells. Anaerobic digestion: principle, advantages, and disadvantages; Fermentation: principle, advantages, and disadvantages; Transesterification: principle, advantages, and disadvantages; Introduction to microbial fuel cells: principle, advantages, and disadvantages.

Module 4 – Energy Production from Algae: Cultivation of algal biomass from wastewater and energy production from algae. Algae cultivation: principle, advantages, and disadvantages; Energy production from algae: principle, advantages, and disadvantages; Applications of algae in waste management.

Module 5 – Energy Production from Solid Wastes: Densification of solids, efficiency improvement of power plant and energy production from waste plastics. Densification of

solids: principle, advantages, and disadvantages; Efficiency improvement of power plants: principle, advantages, and disadvantages; Energy production from waste plastics: principle, advantages, and disadvantages; Applications of waste plastics in energy generation.

References Books:

1. Rogoff, M. J. and Screve, F., "Waste-to-Energy: Technologies and Project Implementation", Elsevier Store, 2011.

2. Young G. C., "Municipal Solid Waste to Energy Conversion processes", John Wiley and Sons, 2010.

3. Harker, J. H. and Backhusrt, J. R., "Fuel and Energy", Academic Press Inc, 1981.

4. EL-Halwagi, M. M., "Biogas Technology - Transfer and Diffusion", Elsevier Applied Science, 1986.

5. Hall, D.O. and Overeed, R.P.," Biomass - Renewable Energy", John Willy and Sons.

Mondal, P. and Dalai, A. K. eds., 2017. Sustainable Utilization of Natural Resources. CRC Press.

Scheme of Evaluation:

<table>
<tr><td colspan="2">Internal Assessment</td><td colspan="2">End-semester Assessment</td></tr>
<tr><td>Mid-semester exam</td><td>30 Marks</td><td rowspan="3">End-semester examination</td><td rowspan="3">50 Marks</td></tr>
<tr><td>Assignment</td><td>10 Marks</td></tr>
<tr><td>Seminar</td><td>10 Marks</td></tr>
<tr><td>Sub Total</td><td>50 Marks</td><td colspan="2">50 Marks</td></tr>
<tr><td colspan="2">Grand Total</td><td colspan="2">100 Marks</td></tr>
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