# WASTE TO ENERGY

| III Semester: COMMON FOR ALL BRANCHES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Hours / Week** | | | **Credits** | **Maximum Marks** | | |
| | | **L** | **T** | **P** | **C** | **CIA** | **SEE** | **Total** |
| **BPSC30** | **Core** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| **Contact Classes: 45** | **Total Tutorials: Nil** | **Total Practical Classes: Nil** | | | | **Total Classes: 45** | | |

## I. COURSE OVERVIEW:

The course is designed to create environmental awareness and consciousness among the present generation to become environmental responsible citizens. The course will discuss on the municipal solid waste composition, characteristics and to improve the methods to minimize municipal solid waste generation. This course deals with methods of disposal of solid waste by thermal biochemical processes and production of energy from different types of waste sand to know the environmental impacts of all types of municipal waste.

## II. COURSE OBJECTIVES:

**The students will try to learn:**

I. The principles of solid waste management in reducing and eliminating dangerous impacts of waste materials on human health and the environment to contribute economic development and superior quality of life.
II. The insight of the design and operations of a municipal solid waste landfill by collection, transfer and transportation of municipal solid waste for the final disposal.
III. The insight of the design and operations of a municipal solid waste landfill by collection, transfer and transportation of municipal solid waste for the final disposal.

## III COURSE OUTCOMES:

**After successful completion of the course, students will be able to:**

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|---|---|---|
| CO 1 | **Identify** the different sources and types of solid waste by the properties of municipal solid waste for segregation and collection of waste. | Apply |
| CO 2 | **Illustrate** the classification, preliminary design considerations of landfill and methods of landfill disposal of solid to control greenhouse gases. | Understand |
| CO 3 | **Understand** the Composition, characteristics of leachate to control the emission of gases by monitoring the movement of landfill leachate. | Understand |
| CO 4 | **Outline** the Biochemical conversion of biomass for energy generation by anaerobic digestion of solid waste. | Understand |
| CO 5 | **Apply** the knowledge in planning and operations of waste to Energy plants by following legal legislation related to solid waste management. | Apply |
| CO 6 | **Illustrate** the thermo-chemical conversion of Biogas by using Gasification process for energy generation. | Understand |

## IV. SYLLABUS

### MODULE –I: WASTE SOURCES & CHARACTERIZATION (09)

Waste production in different sectors such as domestic, industrial, agriculture, postconsumer, waste etc. Classification of waste – agro based, forest residues, domestic waste, industrial waste (hazardous and non-hazardous). Characterization of waste for energy utilization. Waste Selection criteria.

### MODULE –II: TECHNOLOGIES FOR WASTE TO ENERGY (09)

Biochemical Conversion – Energy production from organic waste through anaerobic digestion and fermentation. Thermo-chemical Conversion – Combustion, Incineration and heat recovery, Pyrolysis, Gasification; Plasma Arc Technology and other newer technologies.

**MODULE –III: WASTE TO ENERGY & ENVIRONMENTAL IMPLICATIONS (09)**

Environmental standards for Waste to Energy Plant operations and gas clean-up. Savings on non-renewable fuel resources.

Carbon Credits: Carbon foot calculations and carbon credits transfer mechanisms.

**MODULE –IV: THERMO-CHEMICAL CONVERSION (09)**

Biogas production, land fill gas generation and utilization, thermo-chemical conversion: Sources of energy generation, gasification of waste using gasifies briquetting, utilization and advantages of briquetting, environmental benefits of bio-chemical and thermo- chemical conversion, comparison of various thermo-chemical conversion.

**MODULE –V: E- CENTRALIZED AND DECENTRALIZED WASTE TO ENERGY PLANTS (09)**

Waste activities – collection, segregation, transportation and storage requirements. Location and Siting of 'Waste to Energy' plants. Industry Specific Applications – In-house use – sugar, distillery, pharmaceuticals, Pulp and paper, refinery and petrochemical industry and any other industry. Centralized and Decentralized Energy production, distribution and use. Comparison of Centralized and decentralized systems and its operations.

**V. TEXT BOOKS:**


1. Nicholas P Cheremisinoff, "Handbook of Solid Waste Management and Waste Minimization Technologies", An Imprint of Elsevier, New Delhi, 2003.
2. Paul Breeze, "Energy from Waste", An Imprint of Elsevier, New Delhi, 2018.
3. P Aarne V esilind, William A Worrell and Debra R Reinhart, "Solid Waste Engineering", 2nd Edition 2002.


**VI. REFERENCE BOOKS:**


1. Challal, D S, "Food, Feed and Fuel from Biomass", IBH Publishing Co. Pvt. Ltd., 1st Edition, 1991.
2. C Y Were Ko-Brobby and E. B. Hagan, "Biomass Conversion and Technology", John Wiley & Sons, 1st Edition, 1996.
3. C Parker and T Roberts (Ed), "Energy from Waste", An Evaluation of Conversion Technologies, Elsevier Applied Science, London, 1985.
4. KL Shah, "Basics of Solid and Hazardous Waste Management Technology", Prentice Hall, Reprint Edition, 2000.
5. M Datta, "Waste Disposal in Engineered Landfills", Narosa Publishing House, 1997


**VII. WEB REFERENCES:**


1. https://www.e-waste Management: From waste to Resource Klaus Hieronymi, RamzyKahnat, Eric williams Tech. &Engg.-2013 (Publisher: Earthscan 2013)
2. https://www.What is the impact of E-waste: Tamara Thompson
3. https://www. E-waste poses a Health Hazard: SairudeenPattazhy


**VIII. E-TEXT BOOKS:**


1. https://www.e-waste Management: From waste to Resource Klaus Hieronymi, RamzyKahnat, Eric williams Tech. &Engg.-2013 (Publisher: Earthscan 2013)
2. https://www.What is the impact of E-waste: Tamara Thompson
3. https://www. E-waste poses a Health Hazard: SairudeenPattazhy