Course title: Energy Conservation, Audit and Management			
Course code: DSE 107	**No. of credits:** 3	**L-T-P:** 42-03-00	**Learning hours:** 45
Pre-requisite course code and title (if any):			
Department: Sustainable Engineering			
Course coordinator: Dr Sapan Thapar		**Course instructor:** Dr Sapan Thapar	
Contact details: sapan.thapar@terisas.ac.in			
Course type: Core		**Course offered in:** Semester 1	

Course Description:

Energy Conservation has been identified as a key instrument to enhance energy security and reduce energy intensity as well as greenhouse emissions. Energy Audit helps to map the flow of energy across a process, identifying potential saving opportunities. Policy makers and technology providers have been working towards the cause of energy management and encourage its prudential use. This course is designed to educate students on the different dimensions of energy, its conservation, management and audit.

Course objectives:

- To impart knowledge in the domain of energy conservation
- To understand energy conservation measures across different consumer segments
- To inculcate knowledge and skills about assessing energy efficiency of an entity
- To understand Energy Audit procedure along with relevant technologies/tools
- To develop Energy Audit Report writing skills

Course content

Module	Topic	L	T	P
1.	**Introduction to Energy Conservation** • Overview - Global & Indian Energy Scenario • Importance of Energy Conservation • Institutional Structure and Key Initiatives	4	0	0
2.	**Policy & Regulations for Energy Conservation** • Bureau of Energy Efficiency (BEE) • Indian Programmes – PAT, S&L, Ujala, MuDSM, AgDSM, ECBC • Impact of Energy Efficiency Measures	8	0	0
3.	**Energy Audit Basics** • Definition and Objectives • Types of Audit • Energy Sources (Electrical and Non-Electrical) • Baseline Assessment and Energy Audit Report • Tools and Techniques, Audit Equipment • Roles and Responsibilities of Energy Auditor and Energy Manager	8	0	0
4.	**Energy Conservation Opportunities – Electrical and Thermal** • Building & Lighting Systems • Motors, Pumps, Transformers • Power Transmission & Distribution Systems • Boilers, Furnaces & Waste Heat Recovery Systems Cogeneration Systems HVAC, Cooling Towers & DG	8	0	0

	Systems			
5.	**Energy Analytics** • Basics of Energy Analytics • Overview on Applications and Tools • Building Energy Management Systems • Case Studies	2	0	0
6.	**Energy Efficiency Finance and Business Models** • Financing Instruments • Key Financial Ratios • Role of Energy Service Company (ESCO) & ESCO Business Models • Climate Finance • Case Studies	6	1	0
7.	**Industrial Use Cases** • Concept of Specific Energy Consumption • Use Cases - Industries/ Power Distribution Utilities/ Railways/ Buildings	6	2	0
	Total	42	03	00

Evaluation criteria

Minor Test 1: Assignment (after completion of modules 1, 2 and 3)- 20%
Minor Test 2: Written test (after completion of modules 1, 2, 3 and 4)- 25%
Minor Test 3: Written test/ Case Study Presentation (after completion of modules 5 and 6)- 25%
Major Test: Written test/ Presentation (after completion of all modules) - 30%

Learning outcomes

- Comprehend importance of energy conservation and associated policies
- Analyze energy systems from a supply and demand perspective
- Identify energy conservation opportunities in different consumer segments
- Understand procedure of energy audit (tools, techniques, finance)

Pedagogical approach

A combination of class-room interactions, tutorials, group discussions assignments, expert talks / site visits

Materials:

Text Books:

LC Witte, PS Schmidt and DR Brown: **Industrial Energy Management and Utilization** (Hemisphere Publishing Corporation, Washington, 1998).

Reference Books:

JL Threlkeld: **Thermal Environmental Engineering**, Second Edition (Prentice Hall,1970)
YP Abbi and Shashank Jain: **Handbook on Energy Audit and Environment Management**, (TERI Press, 2006)
WC Turner: **Energy Management Handbook**, Seventh Edition, (Fairmont Press Inc., 2007) George
Polimeros: **Energy Cogeneration Handbook**, (Industrial Press, Inc., New York, 1981)

Websites:

National Productivity Council (http://www.npcindia.gov.in/) Bureau of Energy Efficiency (https://www.beeindia.gov.in/) Petroleum Conservation Research Association (http://www.pcra.org/) EA/EM Guide E--Books (http://www.em-ea.org/)
Additional information (if any): N.A.
Student responsibilities Attendance, discipline, feedback as per TERI SAS rules

Course reviewers:

Dr Amarjeet Singh, Adjunct Professor, IIIT Delhi and CTO, Zenatix

Mr Shubhashis Dey, Director, Shakti Foundation

Dr O. Prosada Rao, Scientist 'F' (Retd.), CSIR