

Branch Name:	Civil Engineering/ ICT
Semester/Year:	Semester V / Third Year
Subject Title:	Energy Conservation and Audit (Open Elective)
Subject Code:	1ET1020506
Pre-requisite Subject:	Elements of Electrical Engineering, Electrical Machines, Environmental Studies.

Course Objective:

To provide basic knowledge of energy conservation, energy management and energy audit.

To provide energy efficiency in industrial, commercial and domestic sector.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
01	--	02	02	35	15	30	20	100

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
1.	Elements of Energy Conservation :	04	25
	Classification of Energy, Indian energy scenario, Sectorial energy consumption (domestic, industrial and other sectors), energy needs of growing economy, energy intensity, long term energy scenario, energy pricing in india, energy security, energy conservation and its importance, energy strategy for the future , Energy conservation Act 2001 and its features, notifications under the Act, Schemes of Bureau of Energy Efficiency (BEE) including Designated consumers, State Designated Agencies, Electricity Act 2003 and its features, Integrated energy policy, National action plan on climate change, ECBC code for Building Construction. [1,2]		
2.	Energy Management & Audit :	04	25
	Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, Bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel and energy substitution, energy audit instruments and metering. [2,3,4]		
3.	Financial Analysis Techniques:	02	20
	Simple payback period, Return on investment, Net present value, Internal rate of return. [1,2]		
4.	Energy Efficiency in Electrical Utilities:	04	30
	Energy efficiency for electric motors, lighting systems, Demand side management , power factor controller ,soft starters , electronics ballast. [1,2]		

List of References:

1. Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, 2nd Edition, CRC Press
2. Bureau of Energy Efficiency Reference book: No.1, 2, 3 4
3. Handbook of Energy Audits, Albert Thumann, 6th Edition, The Fairmont Press
4. Energy Management Handbook, W.C. Turner, John Wiley and Sons, A Wiley Inter science publication

Course Outcome:

After studying this course students will be able to:

1. Understand the basic knowledge of different terms & principles of energy conservation, audit and management.
2. Identify and assess the energy conservation / saving opportunities in different electric system
3. Prepare energy audit report for different energy conservation instances.

List of Suggested Experiments

1. Study of various measuring instruments used for energy audit.
2. Study of various energy efficient equipment like LED lighting devices, Energy Efficient motors, Electronics ballast etc.
3. Study of Variable frequency drive based IM speed control for energy conservation.
4. Soft starting of an induction motor
5. Studying the various energy conservation methods useful in power generation, transmission and distribution.
6. Study of APFC panel or Estimating the requirement of capacitance for power factor improvement.
7. Computing efficiency of DC motor/Induction Motor/Transformer
8. Evaluating the energy conservation opportunity through various methods like simple payback period, IRR and NPV.
9. Determine depreciation cost of a given energy conservation project/equipment .
10. Industry visit with an aim of
 - (i) Studying various energy management systems prevailing in a particular industry/Organization
 - (ii) Identifying the various energy conservation methods useful in a particular industry
11. Draw the energy flow diagram for an industry/shop floor division.
12. Identifying the energy conservation opportunities in a lab, department or institute.
13. Prepare a sample energy audit questionnaire
14. Prepare a sample energy audit report
15. Prepare a technical report on energy conservation act 2003

List of Open Source Software/learning website:

<https://beeindia.gov.in/>
<http://nptel.ac.in/>
https://lbre.stanford.edu/sem/energy_conservation
<https://powermin.nic.in>
<https://teriin.org>
<https://geda.gujarat.gov.in/>