

Branch Name:	Mechanical Engineering
Semester/Year:	Semester VII / Forth Year
Subject Title:	Energy Conservation and Management
Subject Code:	1ET1010705
Pre-requisite:	Zeal to learn the subject

Course Objectives:

- To distinguish importance of various energy resources and its sensible use
- To understand the energy data from industries and carry out energy audit for energy savings

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
02	01	00	03	70	30	-	20	120

Subject Contents			
Sr. No	Topic	Total Hours	Weightage (%)
1	Introduction: • Basic Definitions- • Energy and Energy Types- Energy, Energy Types, Non Renewable Energy Sources, Heating Value of Fuels, Renewable Energy Resources, Hydrogen, Electric Energy, Magnetic Energy, Chemical Energy, Energy and Global Warming, Tackling the Global Warming • Mechanical Energy and Electrical Energy Mechanical Energy, Kinetic Energy, Potential Energy, Pressure Energy, Surface Energy, Sound Energy, Mechanical Work, Electric Energy, Other Forms of Work, Internal Energy and Enthalpy, Heat Transfer, Entropy	02	05
2	Energy-Management & Audit: • Energy Balances- Balance Equations, Mass Balance, Energy Balance, Entropy Balance, Exergy Balance, Fluid-Flow Processes, Energy Balance in a Cyclic Process. • 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	06	25

	energy substitution, energy audit instruments and metering.		
3	Energy Production: Energy Production, Electric Power Production, Transmission of Energy, Power Producing Engine Cycles, Improving the Power Production in Steam Power Plants, Geothermal Power Plants, Cogeneration, Nuclear Power Plants, Hydropower Plants, Wind Power Plants, Solar Power Plants, Hydrogen Production, Fuel Cells, Biomass and Bioenergy Production, Other Energy Production Opportunities, Levelized Energy Cost, Thermodynamic Cost, Ecological Cost	04	15
4	Energy Conversion: Energy Conversion, Series of Energy Conversions, Conversion of Chemical Energy of Fuel to Heat, Thermal Efficiency of Energy Conversions, Ideal Fluid-Flow Energy Conversions, Lost Work, Efficiency of Mechanical Conversions, Conversion of Thermal Energy by Heat Engines, Improving Efficiency of Heat Engines, Hydroelectricity, Wind Electricity, Geothermal Electricity, Ocean Thermal Energy Conversion, Thermoelectric Effect, Efficiency of Heat Pumps and Refrigerators, Efficiency of Fuel Cells, Energy Conversions in Biological Systems	04	15
5	Energy Storage: Energy Storage and Regulation, Types of Energy Storage, Thermal Energy Storage, Electric Energy Storage, Chemical Energy Storage, Mechanical Energy Storage	02	10
6	Energy Conservation: Energy Conservation and Recovery, Conservation of Energy in Industrial Processes, Energy Conservation in Home Heating and Cooling, Energy Efficiency Standards, Energy Conservation in Electricity Distribution and Smart Grid, Conservation of Energy and Sustainability, Exergy Conservation and Exergy, Energy Recovery on Utilities Using Pinch Analysis	07	25
7	Energy Coupling: Energy Coupling and Gibbs Free Energy, Energy Coupling in Living Systems, Bioenergetics, Simple Analysis of Energy Coupling, Variation of Energy Coupling, Metabolism, Bioenergy Sources	03	05

Course Outcomes:

The student will be able to

1. appreciate the availability of various energy resources in the nature
2. recognize the need of energy balance in various process cycles
3. classify the energy losses and their economic implication on plant/processes
4. perform of energy auditing for the energy consumption of industries.

List of Reference Books:

1. Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, 2nd Edition, CRC Press
2. Energy: production, conversion, storage, conservation, and coupling. Demirel, Yaşar. Springer Science & Business Media, 2012.
3. Handbook of Energy Audits, Albert Thumann, 6th Edition, The Fairmont Press
4. Bureau of Energy Efficiency Reference book: No.1, 2, 3 4
5. Energy Management Handbook, W.C. Turner, John Wiley and Sons, A Wiley Interscience publication
6. Witte L.C. , Schmidt P.S. and Brown D.R., Industrial Energy Management and Utilization, Hemisphere Publ., Washington,
7. Callaghn P.W., Design and Management for Energy Conservation, Pergamon Press, Oxford,

8. Murphy W.R. and McKay G., Energy Management, Butterworths, London,
9. Energy Manager Training Manual, Bureau of Energy Efficiency (BEE) under Ministry of Power, GOI, 2004 (available at [www.energymanager training.com](http://www.energymanagertraining.com)).

Assignment:

- Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical/field work
- The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered.

E-Resources:

1. <https://nptel.ac.in/courses/112105221/>
2. <http://nptel.iitm.ac.in/>
3. www.bee.com
4. www.powermin.nic.in
5. <https://geda.gujarat.gov.in/>