



GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering

Subject Code: 3722115

Semester – II

Subject Name: Energy Conservation & Management

Type of course: Program Elective

Prerequisite: Nil

Rationale: The course is prepared to provide detailed understanding of energy conservation and management, 3Es (Energy, Economics and Environment) and their interaction, energy audit and financial management.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Energy conservation: Principles of energy conservation, Energy Conservation Act 2001 and its features, Electricity Act-2003 & its features, Energy consumption pattern, Resource availability, Energy pricing, Energy Security, Estimation of energy use in a building. Heat gain and thermal performance of building envelope - Steady and non-steady heat transfer through the glazed window and the wall - Standards for thermal performance of building envelope, Evaluation of the overall thermal transfer, ECBC code for Building Construction	10
2	Energy efficiency in thermal utilities: Energy efficiency in boilers, furnaces, steam systems, cogeneration utilities, waste heat recovery, compressed air systems, HVAC&R systems, fans and blowers, pumps, cooling tower Energy efficiency in electrical utilities: Energy efficiency for electric motors, lighting systems, Characteristics of Light, Types of Lighting, Incandescent Lighting, Fluorescent Lighting, Vapor Lighting, Street Lighting, LED Lighting, Lighting Design, Light Dimming, Tips for Energy Conservation, Products for Energy Conservation in lighting system	10
3	Energy Audit: Definition, objective and principles of Energy Management, Need of Energy Audit and Management, types of energy audit, audit process, Guidelines for writing energy audit report, data presentation in report, findings recommendations, impact of renewable energy on energy audit recommendations and energy audit report, energy audit of building system, lighting system, HVAC system, Water heating system, heat recovery opportunities during energy audit, Industrial audit opportunities, Instruments for Audit and Monitoring Energy and Energy Savings	9
4	Energy Economics: Simple Payback Period, Time Value of Money, Internal Rate of Return, Net Present Value, Life Cycle Costing, Equivalent uniform annual cost (EUAC), Life cycle cost, Discounting factor, Capital recovery, Depreciation, taxes and tax credit, Impact of fuel inflation on life cycle cost, Cost of saved energy, cost of energy generated, Energy performance contracts and role of Energy Service Companies (ESCOs).	9



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5	Climate Policy: Kyoto protocol, Clean development mechanism (CDM), Geopolitics of GHG control; Carbon Market	4
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Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	20	20	20	20	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, 2nd Edition, CRC Press
2. Handbook of Energy Audits, Albert Thumann, 6th Edition, The Fairmont Press
3. Bureau of Energy Efficiency Reference book: No.1, 2, 3 4
4. Energy Management Handbook, W.C. Turner, John Wiley and Sons
5. Carbon Capture and Sequestration: Integrating Technology, Monitoring, and Regulation edited by E J Wilson and D Gerard, Blackwell Publishing
6. Heating and Cooling of Buildings - Design for Efficiency, J. Krieder and A. Rabl, McGraw Hill Publication, 1994

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	To discuss various principles of energy conservation and to make calculation of cooling load of different types of building	24
CO-2	To discuss and make calculations pertaining to energy efficiency in thermal and electrical utilities	24
CO-3	To appraise the energy audit reports of mechanical utilities and lighting system	22
CO-4	To discuss various methods of energy economics	22
CO-5	To discuss various climate policies	8

List of Experiments: (any ten)

1. To understand features and policy framework of Energy Conservation Act-2001 and Electricity Act-2003.
2. To understand detailed energy audit methodology.
3. To perform energy audit of building / institute and suggest energy saving steps.
4. To evaluate the thermal performance of a building.
5. Performance evaluation of air compressors.
6. Determination of efficiency of lighting system/loads.
7. Determination of efficiency of pumping system.
8. To verify "Star Rating" of a Refrigerator/Air conditioner.
9. To understand various aspects of financial management from energy conservation point of view with the help of a case study.



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10. To understand different environmental protocols used for clean environment.
11. To carry out load calculation of a residential / commercial building and to suggest modification for energy saving.

Equipment / Computational facility:

Compressor, Pump and Domestic Refrigerator available in different laboratories for audit purpose, different testing and measuring equipment

List of Open Source Software/learning website:

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