GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Subject Code : ME02000571

Subject Name : Energy Conservation & Management

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Elective Course

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.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Discuss various principles of energy conservation and to make calculation of cooling load of different types of building	Apply
2	Discuss and make calculations pertaining to energy efficiency in thermal and electrical utilities	Apply
3	Appraise the energy audit reports of mechanical utilities and lighting system	Evaluate
4	Discuss various methods of energy economics	Apply
5	Examine various climate policies	Analyze

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
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	22

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	11	24
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	10	22
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).	10	22
5.	**Climate Policy:** Kyoto protocol, clean development mechanism (CDM), Geopolitics of GHG control; Carbon Market	04	10
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
-	**20**	**40**	**20**	**20**	**-**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, CRC Press
2. Handbook of Energy Audits, Albert Thumann, 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

(b) Open-source software and 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/

Suggested Course Practical List:

1. To understand detailed energy audit methodology.
2. To perform energy audit of building / institute and suggest energy saving steps.
3. To evaluate the thermal performance of a building.
4. Performance evaluation of air compressors.
5. Determination of efficiency of lighting system/loads.
6. Determination of efficiency of pumping system.
7. To verify "Star Rating" of a Refrigerator/Air conditioner.
8. To understand various aspects of financial management from energy conservation point of view with the help of a case study.
9. To understand different environmental protocols used for clean environment.
10. To carry out load calculation of a residential / commercial building and to suggest modification for energy saving.

List of Laboratory/Learning Resources Required: Compressor, Pump and Domestic Refrigerator available in different laboratories for audit purpose, different testing and measuring equipment

Suggested Project List:

Suggested Activities for Students: Students are required to download 3-5 research papers from reputed international journals on the recent advancement in the areas of Energy Management. They need to go through the same and prepare a review for the research papers. The review should have three parts: Summary, Critical Evaluation and Creative synthesize

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