



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Renewable Energy

Course / Subject Code: 4366402

Course / Subject Name: Energy Efficiency, Economics and Audit

w. e. f. Academic Year:	2024-25
Semester:	6 th
Category of the Course:	Program core

Prerequisite:	Knowledge of Electrical Machines, Electrical Instrumentation, Basic mathematics
Rationale:	Electrical energy is the most common and widely used type of energy in the world. The subject of energy conservation is a concern for most energy users particularly industry. Energy conservation becomes even more important for the third world, developing countries, where the rising energy costs and the use of efficient energy apparatus are of significant concern to both the industry and the utility. The pressure of Technological development in all sectors on the energy sources has led to the growing the cost of energy around the world. Efficient and judicious use of the available energy sources would lead to the easing of such pressures. Thus, it is necessary to save and conserve energy to the maximum possible extent. Also, essential theoretical knowledge and practical skills about the concept of energy conservation is to be provided through different approaches of energy conservation in industries, project management and economic accepts. The process of energy audit will help to identify the various possible avenues in which savings of energy can be effectively adopted. This course makes the diploma holder well acquainted in the techniques of energy conservation in the fields of engineering. It also introduces him to the energy audit procedures.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Understand the need of energy conservation.	U
02	Implement energy conservation techniques in electrical systems.	A
03	Evaluate the techno-economic feasibility for the energy conservation project.	E
04	Carry out energy audit for an industry/ organization.	N

**Revised Bloom's Taxonomy (RBT)*



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Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
2	0	2	3	70	30	25	25	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	ELEMENTS OF ENERGY CONSERVATION Indian energy scenario, Energy conservation Principle, Need of energy conservation, Benefits of energy conservation, Important Aspects of Energy Conservation, Energy conservation act 2001 and its Purpose, Mandatory provision of the energy conservation act 2001, Important features of energy conservation act 2001: Standards and labelling (S&L) Demand side management (DSM), Energy conservation Building Code (ECBC), Designated consumers, Bachat lamp Yojana (BLY), Star labelling: need and benefits, Economic aspect and Environment aspect for energy conservation.	6	22
2.	ENERGY EFFICIENT TECHNOLOGIES IN ELECTRICAL SYSTEMS Energy efficient induction motor and its advantages, Benefits of power factor improvement, Power factor improvement techniques: static capacitor method, synchronous condenser method, phase advancer method and related numerical, automatic power factor controllers, Maximum demand controllers, Energy conservation by variable speed drive, Need of Energy efficient transformer, Comparison between Conventional Transformer and Energy Efficient Transformers, Advantages of amorphous transformers Transformers loss reductions, Energy efficient luminaires: CFL & LED, Advantages of electronic ballast and electronic fan regulator, good lighting practice.	8	28



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3.	TECHNOECONOMIC EVALUATION OF ENERGY CONSERVATION PROJECT Different cost of an energy conservation project, Depreciation and methods to calculate it: straight line method, sinking fund method, diminishing value method, Related numerical, Modes of economic analysis: Payback period, Return on investment and Related numerical	8	28
4.	ENERGY AUDIT Energy audit and its benefits, Types of energy audit, Methodology for conduction of energy audit, Structure of the Energy Audit Report, Energy Audit Instruments, Roles and responsibilities of energy auditor	6	22
Total		28	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	25	25	25	-

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:

Sr. No.	Title of Book	Author	Publication
1	Energy Technology	O.P. Gupta	Khanna Publishing House, New Delhi
2	Energy management	Dr. Sanjeev Singh	S K Kataria & Sons, New Delhi,
3	Financial Management	Prasanna Chandra	Tata Mcgraw Hill, New Delhi
4	Project Management T	Prasanna Chandra	Tata Mcgraw Hill, New Delhi
5	Energy Management and Conservation	Sharma, K. V., Venkataseshaiyah	I K International Publishing House Pvt. Ltd
6	Electric Energy Generation, Utilisation and Conservation	S. Sivaganaraju	Pearson, New Delhi, 2012



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7	Electrical Power	V. K. Mehta	Khanna and Khanna Publishers, New Dehli
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(b) Open-source software and website:

1. <https://beeindia.gov.in/>
2. <http://indianpowersector.com/>
3. www.mnes.nic.in
4. <https://powermin.nic.in/>
5. <https://www.anert.gov.in/>
6. www.nptel.iitm.ac.in
7. www.energymanagertraining.com
8. www.greenbusiness.com
9. www.worldenergy.org

Suggested Course Practical List: If any

1. Identify star labelled electrical apparatus and compare the data for various star ratings.
2. Prepare a technical report on energy conservation act 2001.
3. Estimate energy saving by improving power factor of an Induction Motor.
4. Compare Conventional Transformer and Energy Efficient Transformers.
5. Compare power consumption of different types of TL with choke and electronic ballast.
6. Compare power consumption of different types of conventional tube light, CFL and LED lamps by direct measurements.
7. Determine depreciation cost of a given energy conservation project/equipment.
8. Find out the payback period and return on investment for a given energy conservation project/equipment.
9. Collect electricity bill of an industrial consumer and suggest suitable tariff for energy conservation and its impact on energy bill
10. Collect electricity bill of a commercial consumer and suggest suitable tariff for conservation and reduction of its energy bill
11. Identify various measuring instruments used for energy audit.
12. Use various measuring instruments for carrying out energy audit.
13. Prepare a sample energy audit questionnaire
14. Prepare a sample energy audit report



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List of Laboratory/Learning Resources Required:

Suggested Project List:

1. Carry out internet survey to collect information related to Energy conservation projects.
2. Collect the catalogues of star labeled equipment
3. Write report on performance of motor after rewinding.
4. Collect videos to demonstrate working of Energy Conservation Equipment
5. Prepare PPT presentation on energy efficient motors.
6. Prepare PPT presentation on energy efficient transformers.
7. Collect information about energy efficient luminaries.
8. Collect videos to demonstrate working of Energy Audit instruments.
9. Visit a facility adopting cogeneration system and prepare a presentation.
10. Assignments on solving simple numerical of course content
11. Prepare a report based on a survey of at least two nearby industries on energy conservation measures adopted by them using questionnaire.

Suggested Activities for Students: If any

a. Energy efficient lamps:

Prepare comparative charts with ratings, cost and manufacturer details.

b. Energy efficient home appliances:

Interpret star labelling, its needs and benefits.

c. Energy conservation campaign:

Prepare charts/slogans to create energy conservation awareness among people.

d. Energy efficient electrical machines:

Prepare technical presentation on details of energy efficient transformers/motors.

e. Energy conservation policies:

Prepare report on energy conservation policies of Government of Gujarat.

f. Energy Audit:

Prepare charts based on various measuring instruments for carrying out energy audit

g. Energy Manager and Energy Auditor:



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Identify roles and responsibilities of energy manager as well as energy auditor.

CO- PO Mapping:

Semester 6th	Energy Efficiency, Economics and Audit ()						
	POs						
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1 Understand the need of energy conservation.	3	-	-	-	-	-	-
CO2 Implement energy conservation techniques in electrical systems.	3	3	3	-	3	-	-
CO3 Evaluate the techno economic feasibility for the energy conservation project.	-	3	3	-	3	-	-
CO4 Carry out energy audit for an industry/ organization.	3	3	3	3	3	3	3

Legend: '3' for high, '2' for medium, '1' for low and '-' for no correlation of each CO with PO.

Course curriculum development committee:

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