



Semester – IV

Subject Name: Energy Conservation Techniques and Auditing

Subject Code: 09EE0506

Diploma Branches in which this subject is offered: Electrical Engineering

Objective: The use of energy is increasing day by day. One way to cope up with the increase in energy requirement is to increase the generation of energy which requires more investment and the other way is to conserve the energy because energy saved is energy generated. Energy conservation means decreases in energy uses but not compromising with the quality or quantity of energy generation. Must require theoretical and practical knowledge about the concept of energy conservation, energy management, and different approaches of energy conservation in industries, and energy audit and its measuring instruments in commercial and industrial sector will be clear fundamental by this course.

Credits Earned: 6 Credits

Course Outcomes: After completion of this course, student will be able

1. Identify the gap between demand supplies of energy in Indian scenario.
2. List causes for limited growth of conventional energy sources and limitations of non-conventional sources of energy.
3. Uses Tools for energy audit and recommend measures for energy conservation.
4. Analysis of the energy flow diagram of an industry and identify the energy wasted or a waste stream.
5. Recommended methods of energy conservation for different load conditions.
6. Chose appropriate tariff system and methods for reducing electricity uses and save the energy.

Pre-requisite of course: Basic knowledge of D.C. Circuits, A.C. Circuits, Electrical Machine, Power system and Electrical measurement

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE	IA	CSE	Viva	Term work	
2	0	4	6	50	30	20	25	25	150



Contents:

Unit	Topics	Contact hours	Weightage (%)
1	Energy <ul style="list-style-type: none">• Introduction• Energy, Energy problem in India• Review of various energy sources• Need and concept of energy conservation• Energy conservation principle – maximum energy efficiency, maximum cost effectiveness• Power utilization in India, Scope of energy conservation indifferent area• Bureau of energy efficiency• Energy management concept and objectives• Principles of energy management, different approach of energy management, elements of energy management	03	11
2	Energy Conservation <ul style="list-style-type: none">• Introduction• Conservation of electric power• Lighting energy: methods/techniques of efficient lighting.• Heating: methods/techniques of energy saving in Furnaces, Ovens and Boilers. Energy conservation by area sealing, use of thermal insulation• Cooling: methods/techniques of energy saving in ventilating systems and air conditioners• Energy conservation in air compressor, pumps, fan & blower, welding equipment• Motive power• Use of energy efficient motors and efficient use of energy in motors with the help of voltage reducers, automatic star/ delta converters. Reduction of losses in MCC, effect of harmonics on motor, energy conservation by VSD and PAM• Power factor improvement devices and soft starters/variable frequency drives.• Amorphous core transformers• Energy conservation act	07	25
3	Tariff and Energy Conservation in Industries <ul style="list-style-type: none">• Introduction• Need of energy efficient devices• Energy cost and recent MSEB tariffs• Application of tariff system to reduce energy bill	03	11



	<ul style="list-style-type: none">• Energy conservation by improving load factor and power factor.• Calculation and costing of energy conservation project• Different cost of a project, interest cost, Depreciation, Risk analysis, modes of economic analysis, Case study		
4	Energy Conservation in Generation, Transmission and Distribution Systems <ul style="list-style-type: none">• Introduction• Energy conservation in power plant, main elements and equipment of power plants• Improvement in existing power plant• Combined cycle power plant• Cogeneration plants - types and advantages.• Small hydro power plants• Demand side management• Reactive power compensation• Promote renewable energy• System voltage optimization and phase current balancing• Losses in transmission and distribution system and its minimization	05	17
5	Energy and the Environment <ul style="list-style-type: none">• Introduction• Environment and social concerns related to energy utilization• The greenhouse effect, Global warming and its effect• Pollution, Acid Rains• Global Energy and environment Management	02	7
6	Energy Audit <ul style="list-style-type: none">• Introduction• Energy audit and its procedure, benefits and elements of energy audit• Energy Flow diagram and its importance• Types and methodology of energy audit• Measurements in energy audit and various measuring instruments• Questionnaires for the energy audit• Internal energy audit checklist• Equipment used for energy conservation• Calculation of payback period for energy conservation equipment.• Procedure to carryout energy audit of induction motor and transformer• IE rules and regulations for energy audit• Electricity act 2003(Numerical)	08	29



Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyse	Evaluate	Create
40%	40%	10%	10%	0%	0%

Suggested List of Experiments:

Sr. No.	Unit No.	Name of Topics	Contact Hours
1	1	State different energy management systems prevailing in a particular Organization and Industry	4
2	1	Organize an energy management programme in a given organization	4
3	2	Make a survey of one establishment to identify different methods used for energy conservation.	4
4	2	Identify the different areas where energy conservation is required	4
5	2	Find depreciation cost of any one given energy conservation project/equipment	4
6	3	Collect the Standard tariff rates and suggest suitable tariff for given industry/Lab/Institute/Commercial establishment.	4
7	4	State the different energy conservation methods useful in power generation, transmission and distribution	4
8	6	Identify various measuring tools/instruments used for energy audit	4
9	6	State importance of energy flow diagram and Draw the energy flow diagram for an industry/organization division	4
10	6	Find out the payback period for a given energy conservation equipment	4
11	6	Use various measuring instruments for carrying out energy audit	4
12	6	Prepare Energy audit report for Industry/workshop/	4



		Institute or any given premises and give suggestion for saving energy	
13	6	Prepare a technical report on energy conservation act 2003	4
14	6	List energy saving equipments for domestic and commercial applications	4

Instructional Method:

- a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses.

References:

1. C.L.Wadhawa, "*Generation Distribution and Utilization of Electrical Energy*", New Age. 2012.
2. Steven R. Patrick, Dale R. Patric and Stephen W. Fardo, "*Energy conservation Guide book*", Fairmont Press. 2011.
3. S Sivaganaraju, "*Electric Energy Generation, Utilization and Conservation*", Pearson, New Delhi, 2012.
4. H. Partab, "*Art and Science of utilization of Electrical Energy*", Dhanapat Rai and Sons, New Delhi. 2011.
5. Wayne C. Turner, "*Energy Management Handbook*", Fairmont Press. 2012.
6. Albert Thumann, Terry Niehus and William J. Younger, "*Handbook of Energy Audits*", Fairmont Press. 2013.
7. Y.P.Abhi, "*Handbook on Energy Audit and Environment Management*", Teri Press. 2014.

Supplementary Resources:

1. <https://nptel.ac.in/course.php>
2. www.bee.com
3. www.beeindia.in
4. <https://beeindia.gov.in/content/rules-and-regulations>
5. <http://www.cercind.gov.in/Act-with-amendment.pdf>
6. <https://powermin.nic.in/en/content/electricity-act-2003>