

Program : Diploma in Electrical and Electronics Engineering	
Course Code : 6031A	Course Title: Energy Conservation & Audit (EE)
Semester : 6	Credits: 4
Course Category: Program Elective	
Periods per week: 4 (L:3 T:1 P:0)	Periods per semester: 60

Course Objectives:

- To make the students aware of global energy scenarios and environmental issues.
- To apply good engineering practices in energy conservation activities.
- To select suitable energy resources in view of sustainable development.
- To summarize the salient features of Energy Conservation Act.
- To familiarize with the energy auditing, data analysis and corrective actions.

Course Prerequisites:

Topic/Description	Course code	Course Title	Semester
Power and energy		Fundamentals of Electrical & Electronics Engineering	2

Course Outcomes

On completion of the course, the student will be able to:

CO _n	Description	Duration (Hours)	Cognitive Level
CO1	Explain the need of energy conservation and BEE star labelling	15	Understanding
CO2	Identify various energy management techniques in electrical systems	15	Applying

CO3	Illustrate energy conservation through cogeneration.	14	Understanding
CO4	Summarize the concept of energy audit in Electrical systems.	14	Understanding
	Series Test	2	

CO-PO Mapping:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2				3		
CO2	2				2		
CO3	2						
CO4	2	2			2		

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

Course Outline

Module Outcome	Description	Duration (Hours)	Cognitive level
CO1	Select suitable schemes for energy conservation and BEE star labelled devices		
M1.01	List various energy sources and compare global and national scenarios on energy consumption.	3	Remembering
M1.02	Explain energy conservation and its importance	5	Understanding
M1.03	Outline the schemes of BEE under Energy Conservation Act.	3	Understanding
M1.04	Interpret star labelling, needs and its benefits.	4	Understanding

Energy Scenario:energy resources-classification-sustainable energy resources-classification- features-current global energy scenario-coal, oil and natural gas reserve-statistical data- energy consumption in various sectors in India. (review in industrial, agriculture and residential sectors)

Energy conservation and its importance:

Energy intensity(definition only)-energy efficiency and its benefits-energy security -

definition -purpose of implementing national energy security policy. energy conservation - need of conservation -principles involved in energy conservation.

Schemes of BEE under the Energy Conservation Act-2001: Energy conservation building codes -standards and labelling-demand side management-Bachat Lamp Yojana (BLY)-promoting energy efficiency in small and medium enterprises-designated consumers-certification of energy auditors and energy managers (introduction only).

Star Labelling:Need and its benefits-energy efficiency standards-energy efficiency labels-types -comparative label-endorsement label.Minimum Energy Performance Standards (meps)-star ratings-list of appliances/equipments covered under Standards & Labelling program-compare a star rated device and non star rated device in terms of energy consumption-simple problems to estimate the energy saving by star rated device.

CO2	Identify various energy management techniques in electrical systems		
M2.01	Outline the various energy management techniques in lighting Systems	5	Understanding
M2.02	Identify various energy management techniques in electric motors and solve problems	4	Applying
M2.03	Summarize various energy m techniques in transformers.	5	Understanding
M2.04	Illustrate various energy conservation equipment.	4	Understanding
	Series Test I	1	

Contents:

Energy Management-Definition - objectives-energy conservation techniques in lighting systems-general energy saving opportunities in lighting-principles involved in energy conservation.

Energy Management techniques in motors-Energy efficient motor-significant features-advantages-applications and limitations-efficiency improvement techniques-star labelling of energy efficient induction motors(brief idea only)-simple problems to find energy saving with energy efficient motors.

Energy Management techniques in transformers-Energy efficient transformers - amorphous transformers-standards & labelling programme for distribution transformers.

Energy Conservation Equipments-Soft starters-Automatic star delta converter-Variable Frequency Drives-Automatic Power Factor Controller (APFC)-Intelligent Power Factor Controller (IPFC). (Schematic diagram representation and brief idea only).

CO3	Illustrate energy conservation through cogeneration.		
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M3.01	Summarize the need and principle of cogeneration.	2	Understanding
M3.02	Classify various technology based cogeneration systems.	4	Understanding
M3.03	Outline the selection criteria for cogeneration systems.	4	Understanding
M3.04	Explain the prime movers for cogeneration	4	Understanding

Contents:

Energy Conservation through Cogeneration: Cogeneration - definition - principle - need - advantages.

Types of Cogeneration on the basis of technology- Cogeneration systems –steam turbine -gas turbine -reciprocating engine (schematic diagram representation and brief idea only).

Factors governing the selection of a cogeneration system.

Prime Movers for Cogeneration- Steam turbine (back pressure turbine- extraction condensing turbine)-gas turbine -reciprocating engine.

CO4	Summarize the concept of energy audit in electrical systems.		
M4.01	Interpret the objectives of energy audit	4	Understanding
M4.02	List various instruments used for energy audit.	4	Remembering
M4.03	Explain the methodology for conducting energy audits.	4	Understanding
M4.04	Illustrate energy flow diagram(Sankey Diagram)	2	Understanding
	Series Test- 2	1	

Contents:

Energy Audit of Electrical systems-definition(as per EC Act)-need of energy audit-salient features of bureau of energy efficiency regulations(list the manner and intervals of time for conduct of energy audit only).types of energy audit -preliminary -targeted - detailed audit.

Instruments and metering for Energy Audit- name of instruments-purpose

Various stages for preparing energy audit- formation of energy audit team-energy audit forms and data sheets-various phases of energy audit-ten steps methodology(as per BIS standard)-energy audit report format (familiarization only).

Energy flow diagram (Sankey Diagram)-role and objective in energy analysis (brief idea only)

Text /Reference:

T/R	Book Title/Author
T1	Gks No. 1 and 3 for National Certification Examination for Energy Managers and Energy Auditors, Bureau of Energy Efficiency (BEE), Bureau of Energy Efficiency (A Statutory body under Ministry of Power, Government of India) (Fourth Edition 2015).
R1	O.P. Gupta, Energy Technology, Khanna Publishing House, New Delhi
R2	Dr. Sanjeev Singh et.al "Energy management" S K Kataria & Sons , New Delhi, ISBN:978-93-5014-101-4
R3	Henderson, P. D., India - The Energy Sector, University Press, Delhi, 2016. ISBN: 978-195606539
R4	Turner, W. C., Energy Management Handbook, Fairmount Press, 2012, ISBN 9781304520708
R5	Sharma, K. V., Venkataseshaiah; P., Energy Management and Conservation, I K International Publishing House Pvt. Ltd; 2011 ISBN 9789381141298
R6	Singh, Sanjeev; Rathore, Umesh, Energy Management, S K Kataria & Sons, New Delhi ISBN-13:

Online resources:

Sl.No	Website Link
1	https://beeindia.gov.in/
2	http://indianpowersector.com/
3	http://keralaenergy.gov.in/
4	https://powermin.nic.in/
5	https://www.anert.gov.in/