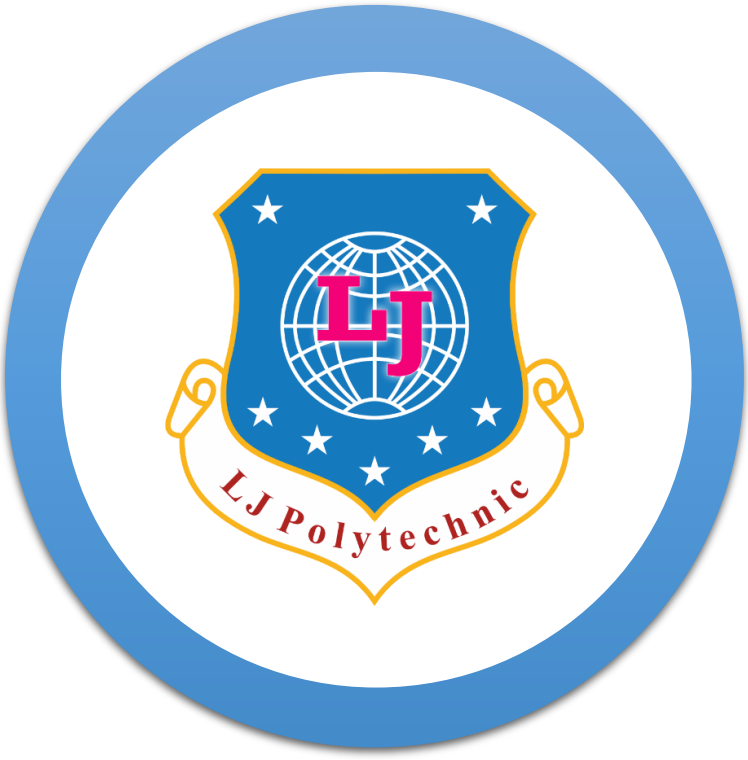
Lok Jagruti Kendra University
University with a Difference

Diploma
in
Electrical Engineering



Course Code: 025070501
Energy Conservation & Audit

Programme / Branch Name	Diploma in Electrical Engineering					
Course Name	Energy Conservation & Audit				**Course Code**	025070501
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses BSC: Basic Science Courses
ESC: Engineering Science Courses PCC: Program Core Courses
OEC: Open Elective Courses PEC: Program Elective Courses

1. Teaching and Evaluation Scheme

Teaching Hours / Week / Credits				**Evaluation Scheme**			
L	**T**	**P**	**Total Credit**	**CCE**	**SEE (Th)**	**SEE (Pr)**	**Total Marks**
4	0	2	5	50	50	50	150

Legends:
L: Lectures T: Tutorial P: Practical
CCE: Continuous & Comprehensive Evaluation
SEE (Th): Semester End Evaluation (Theory)
SEE (Pr): Semester End Evaluation (Practical)

2. Prerequisite

- ✓ Knowledge about Fundamentals of Electrical and Electronics Engineering.
- ✓ Electrical Machines.
- ✓ Electrical Power Generation, Transmission and Distribution.

3. Rationale

The consumption of energy is increasing day by day. One way to cope up with the increase in energy demand is to increase the production of energy which demands more investment and the other way is to conserve the energy because energy conserved/saved is energy generated. Energy conservation means reduction in energy consumption but not compromising with the quality or quantity of energy production. Essential theoretical and practical knowledge about the concept of energy conservation, energy management, different approaches of energy conservation in industries, economic aspects of energy conservation project and energy audit and measuring instruments in commercial and industrial sector will be achieved by this course.

4. Objectives

The course content should be taught and with the aim to develop different types of skills so that students are able to acquire following competency:

- Identify the demand supply gap of energy in Indian scenario.
- Carry out energy audit of an industry/Organization.

5. Contents

Unit No.	Unit Name	Topics	Learning Outcome	% Weightage	Hours
1	**Elements of Energy Conservation and Management**	1.1. General energy problem, Sector wise Energy consumption, demand supply gap, Scope for energy conservation and its benefits. 1.2. Energy conservation Principle – Maximum energy efficiency, Maximum cost effectiveness. 1.3. Mandatory provisions of EC act. 1.4. Features of EC act- Standards and labeling, designated consumers, Energy Conservation Building Codes (ECBC). 1.5. Energy management concept and objectives. 1.6. Initializing Planning, Leading, Controlling, Promoting, Monitoring and Reporting. energy management programmes.	• General energy problem in India • Identify the scope for energy conservation • Explain the Concept of energy conservation and its benefits • Explain Energy conservation act 2001 and with its Mandatory provisions and features • Explain the concept of energy management and its objectives • Describe the initialization and organizing energy management program	15	8
2	**Energy Conservation Approaches in Industries**	2.1. Energy saving opportunities in electric motors. 2.2. Benefits of Power factor improvement and its techniques-Shunt capacitor, Synchronous Condenser etc. 2.3. Effects of harmonics on Motors, and remedies leading to energy conservation. 2.4. Energy conservation by VSD. 2.5. Methods and techniques of energy conservation in ventilation and air conditioners- compressors pumps,	• Identify energy conservation opportunities in various electrical systems in industries • List the energy saving opportunities in electric motors Explain conservation of energy achieved by improving pf and harmonics • Explain benefits of the listed methods and techniques aiding to conserve energy in lighting systems, heating and Cooling systems, Variable speed drive (VSD)	25	16

		fans and blowers Area Sealing, Insulating the Heating / cooling fluid pipes, automatic door closing- Air curtain, Thermostat / Control 2.6. Energy conservation in electric furnaces, ovens and boilers. 2.7. Lighting techniques – Natural, CFL, LED lighting sources and fittings.	• State the energy conservation strategies in furnaces, ovens and boilers • State the energy conservation strategies in electric lighting		
3	**Energy Conservation Approaches in Industries**	3.1. New equipment, technology, staffing, training. 3.2. Calculation and costing of energy conservation project. 3.3. Depreciation cost, sinking fund method. 3.4. Cost evaluation by Return on Investment (ROI) and pay back method etc. 3.5. Risk analysis.	• Describe circumstances that need capital investments for energy conservation in any plan. • Calculate the cost of energy conservation project. • Calculate the depreciation cost using sinking fund method • Calculate the payback period for a given energy conservation equipment • Evaluate an energy conservation project based on risk analysis	20	12
4	**Energy Conservation in Power Generation, Transmission and Distribution**	4.1. Performance improvement of existing power plant: cogeneration, small hydro, DG Set. 4.2. Demand side management. 4.3. Load response programmes. 4.4. Types of tariffs and restructuring of electric tariff. 4.5. Technical measures to optimize T and D losses.	• Identify scope of energy conservation in Generation. • Explain Demand side management and its significance in energy conservation. • Explain Energy conservation measures to optimize Transmission and distribution losses.	20	10
5	**Energy Audit**	5.1. Energy audit and its benefits. 5.2. Energy flow diagram	• Explain the concept of energy audit and its benefits.	20	10

		5.3. Preliminary, Detailed energy audit. 5.4. Methodology of - preliminary energy audit and Detailed energy audit – Phase I, Pre audit, Phase II- Audit and Phase III- Post audit 5.5. Energy audit report. 5.6. Electrical Measuring Instruments - Power Analyzer, Combustion analyzer, fuel efficiency monitor, thermometer-contact, infrared, pitot tube and manometer, water flowmeter, leak detector, tachometer and luxmeter. 5.7. IE rules and regulations for energy audit Electricity act.	• Draw energy flow diagram to identify waste stream and energy wastage. • State the types of energy audits. • Describe the methodology for preliminary & detailed energy audit. • Describe energy audit report with a simple example • Enlist the Measurements and measuring instruments used in energy audit • Describe IE rules and regulations for energy audit Describe Electricity act 2003		
				Total Hours	**56**

6. List of Practical's / Exercises

The practical/exercises should be properly designed and implemented in an attempt to develop different types of skills that students can acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

Sr. No	Practical / Exercises	Key Competency	Hours
1	To study about Energy Conservation in Various Industries.	Energy Conservation.	2
2	To study about Modern Technology of Energy Conservation.	Modern Technology.	2
3	To study about Energy Conservation Act 2001 and its mandatory provisions and features.	EC Act 2001.	2
4	To study about Energy Conservation by Power factor improvement.	Power-factor Improvement.	2
5	To study about Energy Conservation in Electric Arc Furnaces and Welding.	Arc Furnaces and Welding.	2
6	To study about Energy Conservation in Fans and Blowers.	Fans and Blowers.	2
7	Calculate the depreciation cost using Sinking Fund method and Straight-line method.	Depreciation.	2
8	To study Energy Conservation in Power Station by Combined Cycle method and Co-generation method.	Combined Cycle and Co-generation.	2
9	To study about different types of Tariff.	Tariff.	2

10	To study about Energy Conservation by Energy Audit and Techniques.	Energy Audit Techniques.	2
11	To study about Tools used in Energy Audit.	Tools of Energy Audit.	2
12	Prepare an Energy Audit Report.	Energy Audit Report.	2

7. Suggested Specification Table for Evaluation Scheme

Unit No.	Unit Name	Teaching Hours	Distribution of Topics According to Bloom's Taxonomy					
			R %	U %	App %	C %	E %	An %
1	Elements of Energy Conservation and Management	8	30	20	30	5	5	10
2	Energy Conservation Approaches in Industries	16	30	30	10	10	10	10
3	Technoeconomic Evaluation of Energy Conservation Option	12	30	30	10	10	10	10
4	Energy Conservation in Power Generation, Transmission and Distribution	10	20	30	20	5	5	20
5	Energy Audit	10	40	20	10	10	10	10

Legends: R - Remembering App – Applying E- Evaluating
U - Understanding C – Creating An- Analyzing

8. Textbooks

1) Electric Energy Generation, Utilization and Conservation by S. Sivaganaraju Pearson, Latest Edition
2) Principles Power System by V. K. Mehta and Rohit Mehta, S. Chand and Company Ltd., Latest Edition

9. Reference Books

1) Electrical Power by S. L. Uppal Khanna Publications, Latest Edition
2) Electrical Machines by J.B. Gupta S.K. Kataria and Sons, Latest Edition

10. Open Sources (Website, Video, Movie)

1) https://www.bee.com/
2) https://www.electrical4u.com/
3) https://www.nptelvideos.in/electrical power
4) https://enwikipedia.org/wiki/Electric_power_transmission
5) https://www.powergridindia.com/