GOVERNMENT OF TAMILNADU

DIRECTORATE OF TECHNICAL EDUCATION, CHENNAI-25

STATE PROJECT COORDINATION UNIT

(Established under Canada India Institutional Cooperation Project)

CURRICULUM

Course Name	**ENERGY AUDIT IN ELECTRICAL UTILITIES**
Course Code	**EE/2020/011**
Course Duration	40 Hours
Minimum Eligibility Criteria	10th/+2 /ITI/Diploma/Graduate
Pre-requisites (if any)	Knowledge of Electrical Machines
Course Objectives	Training module has been designed for the participants to • Provide the overview of Energy Management and Energy Audit • Concept of Energy Auditing of Induction Motors • Concept of Energy Auditing of Electric Lighting system. • Energy saving opportunities in Motors and Lighting system. • Understand the significance and procedure for energy conservation and audit.
Course Outcomes	At the end of training, the trainees will be able to • Understand energy scenario and policy • Explain the concept of Energy Management & Audit • Suggest Energy saving opportunities in Motors and Lighting system. • Carryout performance assessment and suggest methods to improve the overall efficiency for different energy intensive industries.
Expected Job Roles	Energy Auditor

TEACHING AND SCHEME OF EXAMINATION						
Course Code	Course Name	Hours		Assessment Marks		Duration of Examination
				Min	Max	
EE/2020/011	ENERGY AUDIT IN ELECTRICAL UTILITIES	Theory	16	10	20	3 Hours
		Practical	24	40	80	
		Total	40	50	100	

EE/2020/011- ENERGY AUDIT IN ELECTRICAL UTILITIES

DETAILED SYLLABUS

Unit No	Modules	No.of.Hours	
		Theory	Practical
I	**Introduction about Energy Audit:**	**12 Hours**	
1.1	Definition of Energy conservation	08	04
1.2	Definition of Energy Audit		
1.3	Energy Scenario of India		
1.4	Overview of Types of Energy Audits and Energy Audit Methodologies		
1.5	Electrical Measuring Instruments (Multimeter, Power Factor Meter – Power Analyzer)		
1.6	Temperature Measurement		
1.7	Measurement of Light		
1.8	Electrical Load Management		
1.9	Harmonics and Its Effects		
1.10	Power Factor		
1.11	Electricity Tariff and Electricity Bill		
II	**Energy Audit of Motors:**	**14 Hours**	
2.1	Types of Motors	04	10
2.2	Parameters related to Motors		
2.3	Various losses and Efficiency of Motors		
2.4	Energy Efficient Motors		
2.5	Variable Frequency Drive		
2.6	BEE star rating and Labelling		
2.7	Energy conservation in Motors		
2.8	Discussion about few case studies		
III	**Energy Audit of Lighting System:**	**14 Hours**	
3.1	Fundamentals of Lighting	04	10
3.2	Different Lighting scheme		
3.3	Ballasts – Reflectors		
3.4	Lighting control systems(Timers, Dimmer, Photocell, PIR Sensor, Ultrasonic sensor)		
3.5	Energy saving opportunities (Day lighting, Task lighting, solar powered lighting, De-lamping etc.,)		
3.6	Discussion about few case studies		
	Total Theory and Practical Hours	**16**	**24**
	Total hours	**40**	

HARDWARE REQUIREMENT

S.NO	LIST OF TOOLS /EQUIPMENTS
1	Multimeter, Clamp Meter
2	Energy meter
3	Power Analyse
4	Lux Meter
5	Harmonics Analyser

SOFTWARE REQUIREMENT

LIST OF SOFTWARE
NIL

REFERENCE BOOKS

S.NO	NAME OF THE BOOK	AUTHOR	PUBLISHER
1	Energy Auditing in Electrical Utilities	Rajiv Shankar	Viva Books Private Limited, 2015
2	Handbook of Energy Audits	Albert Thumann, William J. Younger	CRC Press
3	Energy Audit of Building Systems: An Engineering Approach	MoncefKrarti	CRC Press.
4	Handbook of Energy Audits	Albert Thumann, P.E., C.E.M., Terry Niehus, P.E., C.E.M., William Younger, C.E.	Lulu Press, Inc
5	Book I - General aspect of energy management and energy audit	Bureau of Energy Efficiency, Fourth Edition 2015	Ministry of Power, India.
6	Book III - Energy efficiency in electrical utilities	Fourth Edition 2015, By Bureau of Energy Efficiency	Ministry of Power, India.

ASSESSMENT AND CERTIFICATION

S.No	Criteria for assessment
1.	A trainee will be assessed based on the performance in End Examination for Theory and Practical conducted internally in the CIICP Project Polytechnic College for a duration of 3 hours
2.	A trainee must have 75% of attendance to appear for End examination in Theory and Practical.
3.	The assessment for theory part will be based on the marks scored in the end examination on the knowledge bank of questions (1 word/objective type questions)
4.	The assessment for practical part will be based on the marks scored in the end examination conducted by the CIICP Project Polytechnic and assessed by the Examiners approved by Strategic Plan Implementation Committee (SPIC) of the project polytechnic.
5.	The passing criteria for successful completion of training is every trainee should score 50% of marks in theory and practical examination.
6.	On successful completion of training, Certificate will be issued to the participants by the Directorate of Technical Education through the Project Polytechnics.

END EXAMINATION

ALLOCATION OF MARKS

S.NO	Description	Max. Marks
1.	Theory Examination	20
2.	Practical Examination	
	a)Objective and Circuit Diagram	20
	b)Procedure and Connections / Execution	20
	c)Result and Viva	20
	d) Record	20
	Total Marks	**100**

THEORY MODEL QUESTION PAPER

EE/2020/011 ENERGY AUDIT IN ELECTRICAL UTILITIES

(Maximum Marks: 20)

(N.B: Answer any Twenty questions) **20x1= 20 Marks**

1. Define Energy Conservation.
2. Define Energy Audit.
3. What are the types of Energy Audit?
4. List any two instruments which is used for Energy Auditing.
5. Suggest suitable type of instrument for contact less Temperature measurement.
6. Suggest suitable type of instrument for light measurement.
7. What is meant by Harmonics?
8. Write the formula for Power Factor.
9. What is meant by Two Part Tariff?
10. What are the advantages of Improved Power Factor?
11. What are the types of AC Motor?
12. List the losses occurred in AC Motor.
13. What is meant by Energy Efficient Motor?
14. What is meant by BEE Star?
15. What are the advantages of Star rated electrical appliances?
16. How will you reduce the Eddy Current losses in Induction Motor?
17. What is meant by Lux?
18. State any two types of lighting schemes?
19. What is use of Ballast?
20. What are the advantages of using Electronic Choke in Tube light?
21. State any two types of lighting control system.
22. What is meant by Task lighting?
23. What is meant by De-lamping?
24. State any two Energy saving avenues in Induction Motors?
25. State any two Energy saving avenues in Lighting system?