

# GUJARAT TECHNOLOGICAL UNIVERSITY

## ENERGY ENGINEERING (39)

ENERGY AUDIT AND MANAGEMENT

SUBJECT CODE: 3713903

SEMESTER: I

**Type of course:** Elective I

**Prerequisite:** Basic knowledge of Thermal and Electrical Systems

**Rationale:** The course provides basic understanding of energy audit and management.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE(E)	PA (M)	PA (V)	PA (I)	
3	0	2	4	70	30	30	20	150

**Content:**

Sr. No.	Content	Total Hrs	% Weightage
<b>Module I</b>			
1	<p><b>Energy Audit Methodology and recent trends.</b>                      General Philosophy, need of Energy Audit and Management.                      Definition and Objective of Energy Management, General Principles of Energy Management. Energy Management Skills, Energy Management Strategy. Economics of implementation of energy optimization projects, it's constraints, barriers and limitations, Report-writing, preparations and presentations of energy audit reports ,Post monitoring of energy conservation projects, MIS , Case-studies / Report studies of Energy Audits. Guidelines for writing energy audit report, data presentation in report, findings recommendations, impact of renewable energy on energy audit recommendations. Case studies of implemented energy cost optimization projects in electrical utilities as well as thermal utilities. Instruments for Audit and Monitoring Energy and Energy Savings, Types and Accuracy.</p>	<b>9</b>	20%
2	<p><b>Electrical Distribution and Utilization</b>                      Electrical Systems, Transformers loss reductions, parallel operations, T &amp; D losses, P.F. improvements, Demand Side management (DSM), Load Management, Harmonics &amp; its improvements, Energy efficient motors and Soft starters, Automatic power factor Controllers, Variable speed drivers, Electronic Lighting ballasts for Lighting, LED Lighting, Trends and Approaches. Study of 4 to 6 cases of Electrical Energy audit and management (Power factor improvement, Electric motors, Fans and blowers, Cooling Towers, Industrial/Commercial Lighting system, etc.)</p>	<b>11</b>	25%

3	<p><b>Thermal Systems</b>  Boilers- performance evaluation, Loss analysis, Water treatment and its impact on boiler losses, integration of different systems in boiler operation. Advances in boiler technologies, FBC and PFBC boilers, Heat recovery Boilers- it's limitations and constraints .Furnaces- Types and classifications, applications, economics and quality aspects, heat distributions, draft controls, waste heat recovering options, Furnaces refractory- types and sections. Thermic Fluid heaters, need and applications, Heat recovery and its limitations. Insulators- Hot and Cold applications, Economic thickness of insulation, Heat saving and application criteria. Steam Utilization- Properties, steam distribution and losses, steam trapping, Condensate, Flash steam recovery.</p>	15	30%
4	<p><b>System Audit of Mechanical Utilities</b>  Pumps, types and application, unit's assessment, improvement option, parallel and series operating pump performance. Energy Saving in Pumps &amp; Pumping Systems. Bloomers (Blowers) types &amp; application, its performance assessment, series &amp; parallel operation applications &amp; advantages. Energy Saving in Blowers Compressors, types &amp; applications, specific power consumption, compressed air system,&amp; economic of system changes. Energy Saving in Compressors &amp; Compressed Air Systems Cooling towers, its types and performance assessment &amp; limitations, water loss in cooling tower. Energy Saving in Cooling Towers .Study of 4 to 6 cases of Energy Audit &amp; Management in Industries (Boilers, Steam System, Furnaces, Insulation and Refractory, Refrigeration and Air conditioning, Cogeneration, Waste Heat recovery etc.)Study of Energy Audit reports for various Industries and Organizations</p>	11	25%

**Reference Books:**

1. Energy Audit and Management volume-I IECC Press
2. Energy Efficiency in Electrical systems volume-II IECC Press
3. Energy Management: W.R.Murphy, G.Mckay (Butterworths).
4. Energy Management Principles: C.B.Smith (Pergamon Press)
5. Efficient Use of Energy: I.G.C.Dryden (Butterworth Scientific)
6. Industrial Energy Conservation: D.A. Reay (Pergammon Press)
7. Energy Management Handbook – W.C. Turner (John Wiley and Sons, A Wiley Interscience publication)
8. Industrial Energy Management and Utilization –L.C. Witte, P.S. Schmidt, D.R. Brown (Hemisphere Publication, Washington, 1988)
9. Hand Book of Energy Audits, Albert Thumann, P.E., C.E.M. William J. Younger, C.E.M., (CRC Press)

**Course Outcome:** After learning the course the students should be able:

1. Understand the basic knowledge of Different terms & principles of energy audit and management.
2. Assess the energy saving & conservation in different electric system
3. Understand about heat utilization, saving and recovery in different thermal system
4. Learn the preparation of energy audit report & Different cases related to industries.

**List of Open Source Software/learning website:**  
[www.nptel.iitm.ac.in/courses/](http://www.nptel.iitm.ac.in/courses/);  
<http://ocw.mit.edu/courses/energy-courses/>