

Examination Syllabus

Paper-1: General Aspects of Energy Management and Energy Audit

- 1. Energy Scenario:** Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, re-structuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features.
- 2. Basics of Energy and its various forms:** Electricity basics- DC & AC currents, electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.
- 3. Energy Management & Audit:** Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.
- 4. Material and Energy balance:** Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.
- 5. Energy Action Planning:** Key elements, force field analysis, Energy policy purpose, perspective, contents, formulation, ratification, Organizing - location of energy management, top management support, managerial function, roles and responsibilities of energy manager, accountability. Motivating-motivation of employees: Information system-designing barriers, strategies; Marketing and communicating-training and planning.
- 6. Financial Management:** Investment-need, appraisal and criteria, financial analysis techniques-simple pay back period, return on investment, net present value, internal rate of return, cash flows, risk and sensitivity analysis; financing options, energy performance contracts and role of ESCOs.
- 7. Project Management:** Definition and scope of project, technical design, financing, contracting, implementation and performance monitoring. Implementation plan for top management, Planning Budget, Procurement Procedures, Construction, Measurement & Verification.
- 8. Energy Monitoring and Targeting:** Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques -energy consumption, production, cumulative sum of differences (CUSUM).
- 9. Global environmental concerns:** United Nations Framework Convention on Climate Change (UNFCCC), sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), Prototype Carbon fund (PCF).

Paper 2: ENERGY EFFICIENCY IN THERMAL UTILITIES

1. **Boilers:** Types, combustion in boilers, performances evaluation, analysis of losses, feed water treatment, blow down, energy conservation opportunities.
2. **Steam System:** Properties of steam, assessment of steam distribution losses, steam leakages, steam trapping, condensate and flash steam recovery system, identifying opportunities for energy savings.
3. **Furnaces:** Classification, general fuel economy measures in furnaces, excess air, heat distribution, temperature control, draft control, waste heat recovery.
4. **Insulation and Refractories:** Insulation-types and application, economic thickness of insulation, heat savings and application criteria, Refractory-types, selection and application of refractories, heat loss.
5. **FBC boilers:** Introduction, mechanism of fluidized bed combustion, advantages, types of FBC boilers, operational features, retrofitting FBC system to conventional boilers, saving potential.
6. **Cogeneration:** Definition, need, application, advantages, classification, saving potentials.
7. **Waste Heat Recovery:** Classification, advantages and applications, commercially viable waste heat recovery devices, saving potential.

Paper 3: ENERGY EFFICIENCY IN ELECTRICAL UTILITIES

1. **Electrical system:** Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses.
2. **Electric motors:** Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.
3. **Compressed Air System:** Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test, factors affecting the performance and savings opportunities
4. **HVAC and Refrigeration System:** Vapor compression refrigeration cycle, refrigerants, coefficient of performance, capacity, factors affecting Refrigeration and Air conditioning system performance and savings opportunities. Vapor absorption refrigeration system: Working principle, types and comparison with vapor compression system, saving potential.
5. **Fans and blowers:** Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities.
6. **Pumps and Pumping System:** Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities.
7. **Cooling Tower:** Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities assessment of cooling towers.
8. **Lighting System:** Light source, choice of lighting, luminance requirements, and energy conservation avenues.
9. **Diesel Generating system:** Factors affecting selection, energy performance assessment of diesel conservation avenues.
10. **Energy Efficient Technologies in Electrical Systems:** Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology.

Paper-4:**ENERGY PERFORMANCE ASSESSMENT FOR EQUIPMENT AND UTILITY SYSTEMS**

Open Book examination on the following energy performance assessments for equipment and utility systems:

1. Boilers, Furnaces
2. Cogeneration, Turbines (gas, steam)
3. Heat Exchangers
4. Electric Motors, Variable Speed Drives
5. Fans and Blowers, Water Pumps, Compressors
6. HVAC systems
7. Lighting Systems
8. Performing Financial Analysis
9. Applications of Non-conventional & Renewable Energy Sources (NRES).
10. Waste minimization and resource conservation.

a) **For Certification of Energy Managers**

Paper No	Name of the Paper	Duration	Max Marks
EM-1	General Aspects of Energy Management & Energy Audit.	3 Hrs	150
EM-2	Energy Efficiency in Thermal Utilities	3Hrs	150
EM-3	Energy Efficiency in Electrical Utilities	3 Hrs	150
Total Marks			450

b) **For Certification of Energy Auditors**

Paper No	Name of the Paper	Duration	Max Marks
EA-1	General Aspects of Energy Management & Energy Audit.	3 Hrs	150
EA-2	Energy Efficiency in Thermal Utilities	3 Hrs	150
EA-3	Energy Efficiency in Electrical Utilities	3 Hrs	150
EA-4	Energy Performance Assessment for Equipment and Utility systems (Open Book Examination)	2 Hrs.	100
	Viva Voce	15 Mts.	50
Total Marks			600