

Module No. 4: Energy Conservation and Management
No. of weeks / credits 7

Week 1

- **Energy Management and Audit**
 - Definition & Objectives of Energy Management
 - Types and Methodology of Energy Audit
 - Reporting Format of Energy Audit
 - Understanding Energy Costs
 - Benchmarking and Energy Performance
 - Matching Energy Usage to Requirement
 - Maximising System Efficiency
 - Fuel and Energy Substitution
 - Energy Audit Instruments

Week 2

- **Energy Action Planning**
 - Introduction
 - Energy Management System

- **Financial Management**
 - Introduction
 - Investment Need
 - Appraisal and Criteria
 - Financial Analysis
 - Financial Analysis Techniques
 - Sensitivity and Risk Analysis
 - Financing Options

Week 3

- **Project Management**
 - Introduction
 - Steps in Project Management

- **Energy Monitoring & Targeting**
 - Definition
 - Elements of Monitoring & Targeting System
 - Rationale for Monitoring
 - Targeting and Reporting
 - Data and Information Analysis
 - Relating Energy Consumption and Production
 - CUSUM
 - Case Study

Week 4

- **Fuels and Combustion**
 - Introduction to Fuels
 - Properties of Fuels Solid, Liquid & Gaseous Fuels
 - Properties of Agro Residues
 - Combustion of Oil, Coal and Gas
 - Draft System
 - Combustion Controls

- **Boilers**
 - Introduction
 - Boiler Systems
 - Types and Classifications
 - Performance Evaluation
 - Boiler Blow-down
 - Boiler Water Treatment
 - Energy Conservation Opportunities
 - Case Study

- **Steam System**
 - Introduction
 - Properties of Steam
 - Steam Distribution
 - Steam Pipe Sizing and Design
 - Proper Selection
 - Operation and Maintenance of Steam Traps
 - Performance Assessment Methods for Steam Traps
 - Energy Saving Opportunities

- **Furnaces**
 - Types and Classification
 - Performance Evaluation
 - Fuel Economy Measures
 - Case Study

Week 5

- **Insulation and Refractories**
 - Purpose of Insulation
 - Types and application
 - Calculation of Insulation Thickness

- Economic Thickness of Insulation (ETI)
- Formula for Heat Loss Calculation
- Refractories - Properties & Classification
- Typical Refractories in Industrial Use
- Selection of Refractories
- Heat Losses from Furnace Walls

- **FBC Boilers**
 - Introduction
 - Mechanism of Fluidised Bed Combustion
 - Types of FBC Boilers
 - Retrofitting FBC in Conventional Boilers
 - Advantages of FBC Boilers

- **Cogeneration**
 - Need for Cogeneration
 - Principle of Cogeneration
 - Technical Options for Cogeneration
 - Classification of Cogeneration Systems
 - Factors Influencing Cogeneration Systems
 - Important Technical Parameters
 - Prime Movers for Cogeneration
 - Typical Cogeneration Performance Parameters
 - Relative Merits of Cogeneration Systems
 - Case Study

- **Waste Heat Recovery**
 - Introduction
 - Classification and Application
 - Benefits of Waste Heat Recovery
 - Development of a Waste Heat Recovery System
 - Commercial Waste Heat Recovery Devices

Week 6

- **Electrical System**
 - Introduction to Electric Power Supply Systems
 - Electricity Billing
 - Electrical Load Management and Maximum Demand Control
 - Power Factor Improvement and Benefits
 - Transformers

- System Distribution Losses
- Harmonics
- Analysis of Electrical Power Systems

- **Electric Motors**
 - Introduction
 - Motor Types
 - Motor Characteristics
 - Motor Efficiency
 - Motor Selection
 - Energy-Efficient Motors
 - Factors Affecting Energy Efficiency & Minimising Motor Losses
 - Rewinding Effects on Energy Efficiency
 - Speed Control of AC Induction Motors
 - Methodology of Motor Load Survey

- **Compressed Air System**
 - Introduction
 - Compressor Types
 - Compressor Performance
 - Compressed Air System Components
 - Efficient Operation of Compressed Air Systems
 - Compressor Capacity Assessment
 - Checklist for Energy Efficiency in Compressed Air System

- **HVAC and refrigeration system**
 - Introduction
 - Types of Refrigeration System
 - Common Refrigerants and Properties
 - Compressor Types and Application
 - Selection of a Suitable Refrigeration System
 - Performance Assessment of Refrigeration Plants
 - Factors Affecting Performance & Energy Efficiency
 - Energy Saving Opportunities

Week 7

- **Fans and Blowers**
 - Introduction
 - Fan Types
 - Fan Performance

- Evaluation and Efficient System Operation
- Fan Design and Selection Criteria
- Flow Control Strategies
- Fan Performance Assessment
- Energy Saving Opportunities

- **Pumps and Pumping System**
 - Pump Types
 - System Characteristics
 - Pump Curves
 - Factors Affecting Pump Performance
 - Flow Control Strategies
 - Energy Conservation Opportunities in Pumping Systems

- **Cooling Tower**
 - Types and Performance Evaluation
 - Efficient System Operation
 - Flow control strategies
 - Energy Saving Opportunities
 - Assessment of cooling towers

- **Lighting System**
 - Light source
 - Choice of lighting
 - Luminance requirements
 - Energy Conservation Avenues

- **Energy Efficient Technologies in Electrical Systems**
 - Maximum Demand Controllers
 - Automatic Power Factor Controllers
 - Energy Efficient Motors
 - Soft Starter
 - Variable Speed Drives
 - Energy Efficient Transformers
 - Electronic Ballast
 - Energy Efficient Lighting Controls