## SEMESTER S7

# ENERGY MANAGEMENT & AUDITING

| Course Code | PEMRT746 | CIE Marks | 40 |
|---|---|---|---|
| Teaching Hours/Week (L: T:P: R) | 3:0:0:0 | ESE Marks | 60 |
| Credits | 3 | Exam Hours | 2 Hrs. 30 Min. |
| Prerequisites (if any) | None/ (Course code) | Course Type | Theory |

**Course Objectives:**

1. This course introduces basic knowledge about energy management and audit
2. Energy management opportunities in electrical and mechanical systems are discussed.
3. Economic analysis of different energy conservation measures is also described.

## SYLLABUS

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| Module No. | Syllabus Description | Contact Hours |
|---|---|---|
| 1 | **Energy Management - General Principles and Planning:** General principles of energy management and energy management planning<br>**Energy Audit:** Definition, need, types and methodologies. Instruments for energy audit, Energy audit report - Power quality audit. Energy conservation in buildings: ECBC code (basic aspects), Building Management System (BMS). | 9 |
| 2 | **Energy management in Electricity Utilization**: Energy management opportunities in Lighting and Motors, Electrolytic Process and Electric heating. Types of industrial loads. Peak demand controls and methodologies | 9 |
| 3 | **Energy management in HVAC systems**: HVAC system: Coefficient of performance, Capacity, Factors affecting Refrigeration and Air conditioning system performance and savings opportunities. Classification and Advantages of Waste Heat Recovery system, analysis of waste heat recovery for Energy saving opportunities Cogeneration-Types and Schemes, Optimal operation of cogeneration plants- Case study. Computer | 9 |

| | | |
|---|---|---|
| | aided energy management | |
| **4** | **Energy Economics:** Economic analysis methods-cash flow model, time value of money, evaluation of proposals, payback method, average rate of return method, internal rate of return method, present value method, life cycle costing approach, Case studies. | **9** |

**Course Assessment Method**
**(CIE: 40 marks, ESE: 60 marks)**

**Continuous Internal Evaluation Marks (CIE):**

| Attendance | Assignment/ Microproject | Internal Examination-1 (Written) | Internal Examination- 2 (Written) | Total |
|---|---|---|---|---|
| **5** | **15** | **10** | **10** | **40** |

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**End Semester Examination Marks (ESE)**

*In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions*

| Part A | Part B | Total |
|---|---|---|
| • 2 Questions from each module.<br>• Total of 8 Questions, each carrying 3 marks<br>**(8x3 =24marks)** | • Each question carries 9 marks.<br>• Two questions will be given from each module, out of which 1 question should be answered.<br>• Each question can have a maximum of 3 sub divisions.<br>**(4x9 = 36 marks)** | **60** |

## Course Outcomes (COs)

At the end of the course students should be able to:

| Course Outcome | | Bloom's Knowledge Level (KL) |
|---|---|---|
| **CO1** | Explain the significance and procedure for energy management and audit. | **K2** |
| **CO2** | Discuss the energy efficiency and management of electrical loads. | **K2** |
| **CO3** | Explain the energy management opportunities in HVAC systems | **K2** |
| **CO4** | Compute the economic feasibility of the energy conservation measures. | **K2** |

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

## CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | | | | | 1 | 1 | | | | | 2 |
| **CO2** | 2 | | | | | 1 | 1 | | | | | 2 |
| **CO3** | 2 | | | | | 1 | 1 | | | | | 2 |
| **CO4** | 2 | | | | | 1 | 1 | | | | | 2 |
| **CO5** | | | | | | | | | | | | |

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

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| Text Books | | | | |
|---|---|---|---|---|
| **Sl. No** | **Title of the Book** | **Name of the Author/s** | **Name of the Publisher** | **Edition and Year** |
| 1 | Energy management principles | Craig B. Smith | Pergamon Press | 2007 |
| 2 | Optimizing energy efficiencies in industry | G.G. Rajan | Tata McGraw Hill | 2001 |
| 3 | Handbook of Energy Audits | Albert Thumann, William J. Younger, | CRC Press | 2003 |
| 4 | Intro to Energy Conservation and manag. | M Jayaraju and Premlet, | Phasor Books | 2008 |

| Reference Books | | | | |
|---|---|---|---|---|
| **Sl. No** | **Title of the Book** | **Name of the Author/s** | **Name of the Publisher** | **Edition and Year** |
| 1 | Industrial energy conservation | Charles M. Gottschalk | John Wiley & Sons | 1996 |
| 2 | Energy management Hand Book | Wayne C. Turner | The Fairmount Press | 1997 |

| Video Links (NPTEL, SWAYAM…) | |
|---|---|
| **Module No.** | **Link ID** |
| **1** | https://www.youtube.com/watch?v=WwBquDjDGOA&list=PLImNQubhYtnAmyPNwO-nPU-VQIlXH0xqM |
| **2** | https://www.youtube.com/watch?v=WwBquDjDGOA&list=PLImNQubhYtnAmyPNwO-nPU-VQIlXH0xqM |
| **3** | https://www.youtube.com/watch?v=WwBquDjDGOA&list=PLImNQubhYtnAmyPNwO-nPU-VQIlXH0xqM |
| **4** | https://www.youtube.com/watch?v=WwBquDjDGOA&list=PLImNQubhYtnAmyPNwO-nPU-VQIlXH0xqM |

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