

In addition to Part-I (a general handout for all courses appended to the time-table), this handout provides the specific details of this course.

**Course No. : ME G516**  
**Course Title : ENERGY SYSTEMS ENGINEERING**  
**Instructor-in-charge : SANDIP DESHMUKH**

**1. Course Description**

Basic concepts of energy conversion, generation of electrical and thermal energy, transmission and distribution of electrical energy, load management, detailed analysis of utilization of thermal energy in: boilers, furnaces, compressors, heat transfer equipments, and HVAC systems, energy audit, waste heat recovery systems, cogeneration, demand side management, and management and organization of energy saving projects.

**2. Scope and Objective**

The purpose of this course is to provide introductory knowledge and a state-of-the-art learning of thermal and electrical energy systems including their design aspects pertaining to the real-world applications. Besides the theoretical knowledge, interactive approach to analyze the aspects of a variety of thermal energy and heat recovery systems will be emphasized. The course will certainly interest students aiming to build-up professional and research career in the field of energy systems engineering.

**3. Text Books:**

T1. Amlan Chakrabarti, Energy Engineering and Management, Prentice Hall India Learning Private Limited, (2011).

**Reference Books:**

- R1. Giovanni Petrecca, "Energy Conversion and Management: Principles and Applications", Springer, International Publishing Switzerland, 2014.  
R2. Clive Beggs, Energy: Management, Supply and Conservation, Butterworth-Heinemann, 2009.  
R3. Francis M. Vanek, Louis D. Albright, Energy Systems Engineering: Evaluation and Implementation, The McGraw-Hill Companies, Inc, 2008.  
R4. WR Murphy & G McKay, "Energy Management", Butterworth Heinemann, 2011.

**4. Course Plan**

| Lecture No. | Learning objectives                        | Topics to be covered  | Chapter                    |
|-------------|--|---|----------------------------|
| 1-3         | Energy scenario, conversion and management | Energy resources, energy sources, global energy scenario, general principles of energy conversion and management, energy transformations in factories and buildings.                    | T1: 1, R4: 2               |
| 4-6         | Energy demand and consumption              | Energy end users, energy consumption and environmental issues.  | T1: 1, R1: 3, R2: 1        |
| 7-9         | Energy supply and utility plants           | Electricity supply: Evolution, generation, transmission, distribution, electrical substations, transformer selection, efficiency and losses, motive power and power factor improvement. | T1: 2, R1: 5, 7, R2: 2     |
| 10-13       | Energy and fuels                           | Energy prices, important fuels, fuel production and processing, stoichiometry, choice of fuels, essentials of combustion systems.   | T1: 2, R4: 2, R1: 6        |
| 14-17       | Energy analysis of industrial systems      | Power cycles, analysis on efficiency of different cycles and efficiency improvements, furnaces, compressed air systems, heat exchangers, electrical system optimization, cogeneration.  | T1: 4, 5, R4: 6, 7, R1: 11 |

|       |   |   |                              |
|-------|---|---|------------------------------|
| 18-20 | Energy analysis of transportation systems | Energy conservation in transportation, new technologies, progress in clean technologies for transportation.   | T1: 6, R2: 4, R3: 13         |
| 21-24 | Energy analysis of buildings              | Energy in buildings, building construction, HVAC systems, lighting systems, waste heat recovery   | T1: 7, R4: 9, R1: 16, R2: 13 |
| 25-27 | Energy management aspects                 | Energy management approach, energy planning, energy staffing, feasibility studies and financing, evaluation of alternative energy sources.              | T1: 8, R1: 17                |
| 28-31 | Energy management programmes design       | Principles, energy management cycle, role of energy manager, energy conservation schemes, supply side and demand side management, control and planning. | T1: 9, R4: 1, R1: 17, R2: 3  |
| 32-34 | Energy auditing                           | Energy, categories and types of energy audit, audit procedures.   | T1: 10, R4: 1                |
| 35-37 | Energy economics                          | Costing techniques, financial appraisal and profitability, life cycle cost, energy pricing and cost optimization.                                       | T1: 11, R4: 3                |
| 38-41 | Energy savings potential opportunities    | Boilers, compressors, heat exchangers, HVAC systems, lighting systems, motors and transformers  | T1: 12, R4: 11               |

## 5. Evaluation Scheme

| Evaluation Component            | Duration (minute) | Weightage (%) | Date & Time                  | Nature of Component |
|---------------------------------|-------------------|---------------|------------------------------|---------------------|
| Mid Semester Test               | 90                | 20            | 28/9 , 11:00 – 12:30 pm      | CB                  |
| Presentations/Seminars          | ---               | 10            | To be announced in the Class | OB                  |
| Lab-based experiential learning | ---               | 20            |                              |                     |
| Assignments                     | ---               | 10            |                              |                     |
| Comprehensive Exam <sup>#</sup> | 180               | 40            | 02/12 AN                     | CB                  |

6. **Chamber Consultancy Hour:** To be announced in the class room.

7. **Notices:** All notices concerning this course shall be displayed on the CMS (the Institute's web based course management system). Besides this, students are advised to visit regularly CMS for latest updates.

8. **Make-up Policy:** Make-up shall be given only to the genuine cases with prior confirmation. Request for the make-up tests, duly signed by the students, should reach the under signed well before the scheduled test.

9. **Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**Instructor-in-Charge**  
**ME G516**