

**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE – PILANI, HYDERABAD CAMPUS**  
**AGSRD, FIRST SEMESTER 2021-2022**  
**(COURSE HANDOUT: PART-II)**

**Date: 20/08/2021**

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**  
**Lab. Instructors** : **Sama Sanghamitra, 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
10-12	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
13-14	<b>Research Seminar -1</b>		

15-17	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
21-23	Energy analysis of buildings	Energy in buildings, building construction, HVAC systems, lighting systems, waste heat recovery	T1: 7, R4: 9, R1: 16, R2: 13
24-25	<b>Research Seminar - 2</b>		
26-28	Energy management aspects	Energy management approach, energy planning, energy staffing, feasibility studies and financing, evaluation of alternative energy sources.	T1: 8, R1: 17
29-31	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 Term Test	90	25		Open Book
Literature Survey Seminars (2 Nos)	-	10	To be announced in the class	Open Book
Lab Report	-	10		
Lab Viva	-	10		
Lab Quiz	-	5		
Comprehensive Exam	120	40	27/12 FN	Open Book

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