Introduction to Energy Conservation & Waste Heat Recovery

Programme: B.Tech. (Mechanical Engineering) **Course type:** Program Elective

Credits: 3

Course Context and Overview (100 words):

The objective of the course is to provide the knowledge on the fundamental concepts and processes of Energy conservation and waste heat recovery

1. Learning the fundamental principles concept of waste heat and waste heat recovery
2. Learning the basics of power cycles
3. Understand the methods for recovery of waste heat using HXs
4. Energy conservation techniques and energy storage and energy economics

Prerequisite: Basic Thermodynamics, Laws of thermodynamics

Course outcomes (COs):

On completion of this course, the students will have the ability to:
CO1: Illustrate and identify waste heat and need for waste heat recovery.
C02: Efficiently use the heat in power cycles
C03: Develop Heat Exchanger network for waste heat recovery
C04: Understanding the energy storage techniques.
C05: Demonstrate an understanding energy economics

Course Topics:

UNIT - I Introduction to Waste Heat, Importance of Waste Heat Recovery, Review of Thermodynamics Introduction to First and Second Laws, Review of Thermodynamics – Entropy, Entropy Generation, First and Second Law efficiency.	6
Unit – II	7

Power Plant Cycles – Energy Cascading, Rankine Cycle, modification of Rankine cycle, examples, Gas Turbine Cycle, Combined Cycle, Combined Gas Turbine-Steam Turbine Power Plant, Heat Recovery Steam Generators.	
Unit - III Thermodynamic cycles for low temperature application, Cogenerations, Introduction to Heat Exchangers, Analysis – LMTD and ε-NTU method Analysis of Heat Exchanger – continued, Problem solving, Special Heat Exchangers for Waste Heat Recovery, Synthesis of Heat Exchanger Network.	7
Unit – IV Heat pipes & Vapor Chambers, Direct conversion technologies – Thermoelectric Generators. Thermoionic conversion, Thermo-PV, MHD	4
UNIT – V Heat Pump; Heat Recovery from Incinerators, Energy Storage – Introduction. Energy Storage Techniques – Pumped hydro, Compressed Air, Flywheel, and Superconducting Magnetic storage.	6
Unit – VI Energy Storage Techniques – Thermal storage (Sensible & Latent), Battery, Chemical Energy Storage, Fuel cells. Energy Economics	6

Textbook References:

1. Energy Conversion by D Yogi Goswami and Frank Kreith, CRC Press
2. Principles of Sustainable Energy Systems by Charles F. Kutscher, Jana B. Milford, Frank Kreith, CRC Press.

Additional Resources (NPTEL, MIT Video Lectures, Web resources etc.):

Evaluation Methods:

Item	Weightage
Midterm exam	30
Teacher's assessment (Assignment/ Presentation/ Project/ Quiz/ etc)	20
End term	50

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