B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME51 – THERMAL ENGINEERING

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To familiarize the developments in IC engines.
- To teach combustion process in SI and CI engines.
- To introduce different types of compressors.
- To familiarize concepts of thermodynamics cycles used in steam power plants and gas turbines
- To impart knowledge on the working of nozzles, turbines, refrigeration and air conditioning.

UNIT – 1: IC Engines 10 Hrs

IC Engines: Working and classification of IC engines, comparison of two stroke and four stroke engines, comparison of SI and CI Engines.

Combustion in IC Engines: SI engine: stages of combustion, normal combustion, abnormal combustion, variables effecting delay period and knocking, pre-ignition. CI engine: stages of combustion, normal combustion, abnormal combustion, variables effecting delay period and knocking. Fuel requirements and fuel rating.

Testing and Performance of IC Engines: Methods of testing IC Engines, performance analysis of IC Engines.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand working of IC engines on the basis of thermodynamic cycles. **L2**
- Estimate engine performance. **L5**
- Identify the effects of abnormal combustion in IC engines. **L3**

UNIT – II: Classification of Air compressors 8 Hrs

Reciprocating Compressor: Single stage reciprocating compressors, work done, effect of clearance in compressors, volumetric efficiency, multi stage compressor, effect of inter cooling in multi stage compressors, compressor performance.

Rotary Compressor: Working principle of a rolling piston type compressor (fixed vane type), multi vane type compressors, characteristics of rotary vane type compressor.

Learning Outcomes:

At the end of this unit, the student will be able to

- Classify different types of air compressors. **L2**
- Compare the performance of different types of air compressors **L2**

UNIT – III: Vapour Power Cycles & Gas power Cycle 8 Hrs

Vapour Power Cycles: Vapour power cycle, simple Rankine cycle, mean temp of heat addition thermodynamic variables effecting efficiency and output of Rankine cycle

Gas power Cycle: Simple gas turbine plant, Brayton cycle, closed cycle and open cycle for gas turbines, condition for maximum pressure ratio and optimum pressure ratio, actual cycle. Methods to improve performance: regeneration, intercooling and reheating. Introduction to jet propulsion: working principle of ramjet, turbojet, turbofan, turboprop and pulse jet engines,

Head
Mechanical Engineering Department,
JNTUA College of Engineering,
PULIVENDULA - 516 390.

Learning Outcomes:
At the end of this unit, the student will be able to

- Explain concepts of vapour power cycle used in steam power plant. **L2**
- Evaluate the cycles used in gas turbine **L5**
- Outline the jet propulsion system. **L2**

UNIT – IV: Nozzles & Steam Turbines **10 Hrs**

Nozzles: Type of nozzles - air and steam nozzles. Compressible flow through nozzle- condition for maximum discharge - nozzle efficiency.

Steam Turbines: Classification of steam turbines -impulse turbine and reaction turbine - compounding in turbines - velocity diagrams in impulse and reaction turbines, efficiency, degree of reaction - governing of turbines.

Learning Outcomes:
At the end of this unit, the student will be able to

- Compare the performance of nozzles, used in turbines. **L2**
- Classify steam turbines and applications. **L4**
- Analyze the performance of steam turbines under different operating conditions. **L5**

UNIT – V: Refrigeration **8 Hrs**

Refrigeration: Bell-Coleman cycle - vapour compression cycle, effect of vapour condition on COP of VCR, - vapour absorption cycle, properties of common refrigerants

Principles of Psychrometry and Air Conditioning: Psychometric terms, psychometric processes and air conditioning systems.

Learning Outcomes:
At the end of this unit, the student will be able to

- Outline the operation of refrigerators. **L2**
- Identify different refrigerants and applications. **L3**
- Use properties of moist air in calculations for air-conditioning system. **L3**

Text Books:

1. Ganesan V, Internal Combustion Engines, Tata McGraw Hill, 2017.
2. M.L.Mathur and F.S.Mehta, Thermal Engineering, Jain brothers,2014.
3. K.K.Ramalingam, Thermal Engineering, 2/e, Scitech Publications (India) Pvt Ltd,2011

Reference Books:

1. Cengal Y.A and Boles M.A, Thermodynamics: An Engineering Approach, 5/e, McGraw Hill, 2006.
2. Yahya, S. M., Turbines, Compressors and Fans, 4/e, Tata McGraw Hill, 2010.
3. Nag P.K, Engineering Thermodynamics, 4/e, Tata McGraw-Hill, 2008.
4. Onkar Singh, Thermal Turbomachines, 3/e, Wiley India, 2014.
5. P.L.Ballaney, Thermal Engineering, 2/e, Khanna, 2005.

Course Outcomes:
At the end of this Course the student will be able to

- Explain working of IC engines with combustion process. **L2**
- Select compressors for different applications. **L1**
- Use T-s diagram in vapour power and gas power cycles. **L3**
- Explain the basic principles of steam turbines. **L2**
- Explain the basic principles of steam turbines. **L2**
- Select appropriate refrigerant for different applications **L1**

Head
Mechanical Engineering Department,
JNTUA College of Engineering,
PULIVENDULA - 516 390.