**Proposed syllabus**

# NIRMA UNIVERSITY
# INSTITUTE OF TECHNOLOGY, SCHOOL OF ENGINEERING
# B Tech in Mechanical Engineering
# Semester VI

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| **Course Code** | **2ME601** |
| **Course Title** | **Energy Systems- I** |

**Course Outcomes (CO):**

At the end of the course, students will be able to –

1. infer various refrigeration systems and analyze their performance,
2. make use of basics of psychrometry and apply it to related processes,
3. explain various subsystems of IC engine and analyze the performance,
4. evaluate the performance of various compressors.

**Syllabus** **Teaching**

**Hours: 45**

**UNIT - I** **Refrigeration** **08 hours**

Reverse Carnot cycle, vapour compression refrigeration (VCR), refrigerants and their desirable properties, ODP and GWP of refrigerants, effects of various operating parameters on performance of VCR cycle, simple vapour absorption refrigeration, air cycle refrigeration, unconventional refrigeration systems.

**UNIT - II** **Psychrometry and HVAC Systems** **10 hours**

Psychrometric terms, use of psychrometric charts and tables, various psychrometric processes and its analysis using psychrometric charts, HVAC systems and its psychrometric analysis.

**UNIT - III** **IC Engine and its Sub Systems** **11 hours**

Operation and construction of two/four stroke petrol and diesel engines, fuel-air cycle, actual cycle, valve timing diagram, fuels and its properties, subsystems of IC engine- fuel supply system, ignition system, cooling system, lubricating system, supercharging and turbocharging. Performance tests of petrol and diesel engines, performance curves for constant and variable speed engines,

heat balance sheet, tests to determine mechanical efficiency, emissions- its standards and control.

**UNIT - IV** **Compressors** **16 hours**

**Reciprocating compressor**

Introduction, single stage compression without and with clearance, power requirement and condition for minimum work, free air delivery, need for multi staging, condition of minimum work for multi-staging, indicated power, mechanical efficiency, isothermal efficiency

**Centrifugal compressor** Construction and operation, ideal energy transfer, velocity diagram, isentropic efficiency, power input factor, slip and slip factor, pressure coefficient, pre-whirl, effect of blade shapes on performance, surging and choking

**Axial flow compressor** Construction and operation, velocity diagram and work done factor, pressure ratio, static pressure rise, degree of reaction, selection, blade loading and flow coefficient, performance characteristics

**Rotary compressors:** Types, salient features, applications

**Self - Study** The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

**Laboratory Work:**

Laboratory work will be based on above syllabus with minimum 10 experiments/exercise to be incorporated.

## Suggested Readings:


1. Stoecker W., Jones J.W., Refrigeration and Air Conditioning, McGraw Hill Publication
2. Arora C.P., Refrigeration and Air Conditioning, Tata McGraw Hill Publication
3. Kreith F., Wang S.K., Norton P., Air Conditioning and Refrigeration Engineering, CRC Press
4. Heywood J.B., Internal Combustion Engine Fundamentals, McGraw Hill Publication
5. Ganesan V., Internal Combustion Engines, Tata McGraw Hill Publication
6. Mathur M.L., Sharma F.S., Thermal Science and Engineering, Jain Brothers
7. Yadav, R., Applied Thermodynamics, Central Publishing House.


L=Lecture T= Tutorial P=Practical, C=Credit