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| Course Title | FUNDAMENTALS OF THERMAL ENGINEERING |
| Course Code | ME117 |
| Course Credit | Theory :03 |
| | Practical :01 |
| | Tutorial :00 |
| | Credits :04 |

Course Learning Outcomes:

After Successful completion of the above course, students will be able to:

- **Define** the fundamentals laws of Thermodynamics and **describe** their application in thermal systems like air standard cycles of IC engines and analyzing the gas processes.
- **Sketch & explain** the schematic diagram of various steam generators and compressors.
- **Solve** the examples based on properties of steam and **apply** the same concepts to **analyze** the steam generator performance using steam tables.
- **Apply** the theoretical and mathematical concepts to **solve** the primary problems on air compressors and IC engines.

Detailed Syllabus

| Sr. No. | Name of chapter & details | Hours Allotted |
|------------------|---|-----------------------|
| SECTION-I | | |
| 1. | Introduction to Mechanical Engineering: Overview of Mechanical Branch, Different main branches of mechanical Engineering-Thermal, Design and Production | 01 |
| 2 | Basics of Thermal Engineering: Prime Movers, sources of energy, Different terminology, Internal Energy and Enthalpy, Zeroth Law, First Law and Second Law of Thermodynamics | 06 |
| 3 | Properties of Steam: Introduction: Steam formation, Types of Steam, Enthalpy and dryness fraction of steam, Measurement of dryness fraction: Throttling calorimeter, Separating calorimeter, Combined calorimeter | 10 |

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|--------------|---|-----------|
| 4 | Steam Generator: Definition, Classification, General study of Cochran, Babcock Wilcox, Lancashire and locomotive boilers. Boilers mountings and accessories, Boiler efficiency and numerical. | 04 |
| Total | | 21 |

SECTION-II

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|--------------|---|-----------|
| 5 | Internal Combustion Engines: Definition, Classification and Components, Various efficiencies, Working of the two stroke and Four-stroke cycle engines, S.I. and C.I. Engines, Air standard cycles – Otto, diesel & dual cycle & numerical. | 07 |
| 6 | Properties of gases: Gas laws, Boyle's law, Charles's law, Combined gas law, Gas constant, Internal energy, Relation between Cp and Cv, Enthalpy, Non flow process, Constant volume process, Constant pressure process, Isothermal process, Poly- Tropic process, Adiabatic process. | 08 |
| 7 | Air Compressors and Pumps: Introduction and uses of compressed air, Reciprocating compressors, Operation of a compressor, Work for compression, Power required, Reciprocating compressor efficiency, Multistage reciprocating compressors, Rotary compressors, Reciprocating pump, types and operation, Bucket pump, Air Chamber, Centrifugal pumps, Types and Priming, Rotary pumps. | 06 |
| Total | | 21 |

Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory. Minimum two internal exams will be conducted and average of two will be considered as a part of overall evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
- Surprise tests/Quizzes/Seminar/Tutorials will be conducted.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures. Minimum eight experiments shall be there in the laboratory related to course contents.
- Minimum six tutorials which includes solution of minimum five numerical under each head.



SYLLABUS

Reference Books:

1. K.P. Roy, S.K. Hajra Chaudhri, A.K. Hajra, Nirjhar Roy, "Elements of Mechanical Engineering"
2. S.B. Mathur & S. Domkundwar, "Elements of Mechanical Engineering", Dhanpatrai & Co.
3. R.K. Rajput, "Thermal Engineering", Laxmi Publications.
4. T.S. Rajan, "Basic Mechanical Engineering", Wiley Eastern Ltd.
5. H.R. Kapoor, "Thermal Engineering, VOL-I & II", Tata McGraw Hill Co. Ltd.
6. G.S. Sawhney, "Fundamentals of Mechanical Engineering", Prentice Hall of India Publication. New Delhi.
7. Dr. D.S. Kumar, "Thermal Science and Engineering", S.K. Kataria & sons Publication New Delhi.

Additional Resources

- <http://cquestionbank.blogspot.com>
- www.intelligentedu.com/
- www.hermetic.ch/cfunlib.html.
- www.cprogramming.com/
- www.c-program.com/
- Steam Tables

List of Experiments

1. **Recognize** the parts and **analyze** the working of four-stroke diesel and petrol engine.
2. **Recognize** the parts and **analyze** the working of two-stroke petrol engine.
3. **Recognize** the parts and **Demonstrate** of the working of the Vapor Compression Refrigeration system.
4. **Demonstrate** the working of an air-conditioning system and system components.
5. **Perform** practical test on combined separating and throttling calorimeter and **calculate** the dryness fraction of the steam.
6. **Recognize** the parts and **analyze** the working and applications of rotary and reciprocating air compressors.
7. **Understand & demonstrate** the construction and working of industrial boilers using miniature models.
8. **Understand** the construction and working of boiler mountings and accessories using miniature models.
9. **Perform** practical and **understand** the working of centrifugal and reciprocating pumps.
10. **Perform** the test and **analyze** the working of four strokes, single cylinder, water cooled diesel engine.
11. **Practice & Analyze** the numerical on Boiler performance.
12. **Practice & Analyze** the numerical on IC engine performance.
13. **Practice & Analyze** the numerical on compressor performance.
14. **Practice & Analyze** the numerical on properties of gases.
15. **Practice & Analyze** the numerical on properties of steam.