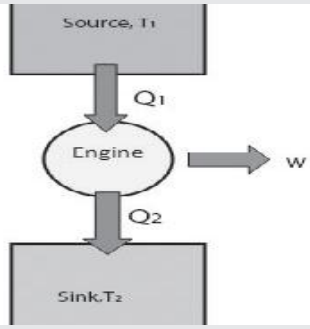
19ME203 ENGINEERING THERMODYNAMICS



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Hours Per Week :

L	T	P	C
3	1	-	4

Total Hours :

L	T	P
45	15	-

WA/RA	SSH/HSH	CS	SA	S	BS
5	45	-	10	-	10

PRE-REQUISITE COURSES: Engineering Physics (B),
Engineering Mathematics - I (F)

COURSE DESCRIPTION AND OBJECTIVES:

This course offers a basic understanding of heat and work interactions for various thermodynamic processes. The objective of this course is to impart knowledge on different forms of energy and restrictions imposed by the first and second law of Thermodynamics on conversion from one form to another.

COURSE OUTCOMES:

Upon completion of the course the student will be able to achieve the following outcomes

COs	Course Outcomes	POs
1	Detail the influence of various processes on the thermodynamic properties.	1,2,3,4
2	Apply the thermodynamic laws in practical applications.	1,4,5,7,12
3	Evaluate the efficiencies and properties of thermodynamic systems.	4,5,7,12
4	Explore the practical applications of thermodynamics.	2,6,7,12
5	Formulate thermodynamic solutions for emerging technologies.	1,2,3,4

SKILLS:

- ✓ *Classify thermodynamic systems based on mass and energy interactions.*
- ✓ *Apply thermodynamic laws to analyze performance of various devices and cycles.*
- ✓ *Evaluate properties of steam for subcooled, super-heated and wet conditions.*
- ✓ *Evaluate thermodynamic property data from various property tables and charts.*
- ✓ *Calculate efficiencies of various air standard cycles.*

UNIT - I **L-9 T-3**

BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS: Concept of Continuum, Thermodynamic equilibrium, System, Boundary and surroundings, State, Property, Process, Cycle, Reversibility, Quasi-static Process, Irreversible Process, Causes of Irreversibility, Work and Heat, Point and Path function, Zeroth Law of Thermodynamics, Concept of quality of Temperature, PMM- I, Joule's Experiments, First law of Thermodynamics - Corollaries, First law applied to a Process, Applied to a flow system, Steady Flow Energy Equation.

UNIT - II **L-9 T-3**

SECOND LAW OF THERMODYNAMICS, ENTROPY AND AVAILABILITY: Limitations of the First Law, Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements - Corollaries, PMM-II, Carnot's principle, Carnot cycle, Clausius Inequality, Entropy, Principle of Entropy Increase, Availability and Irreversibility, Thermodynamic Potentials, Gibbs and Helmholtz Functions, Elementary Treatment of the Third Law of Thermodynamics, Exergy balance equation and Exergy analysis.

UNIT - III **L-9 T-3**

PROPERTIES OF PURE SUBSTANCES: Pure Substances, P-v-T- surfaces, T-S and h-s diagrams, Phase transformations, Triple point at critical state properties during change of phase, Dryness Fraction, Mollier charts, Various thermodynamic processes and energy transfer.

UNIT - IV **L-9 T-3**

IDEAL AND REAL GASES: Perfect Gas Law, Equation of State, Specific and Universal Gas constants, Vander Waals Equation of State, Compressibility charts, Variable specific heats, Gas tables.

GAS MIXTURES: Avagadro's law, Dalton's law of partial pressure, T-dS relations, Maxwell relations, Clausius Clapeyron equations, Joule Thomson Coefficient.

UNIT - V **L-9 T-3**

POWER CYCLES: Otto cycle, Diesel cycle, Dual cycle, Thermal Efficiency, Mean Effective Pressures on Air standard basis, Comparison of cycles, Stirling cycle, Atkinson cycle and Ericsson cycle.

TEXT BOOKS:

1. P.K Nag, "Engineering Thermodynamics", 3rd edition, Tata McGraw-Hill, 2015.
2. Yunus A.Cengel and Micheal A. Boles, "Thermodynamics - An Engineering Approach", 7th edition, Tata McGraw-Hill, 2011.

REFERENCE BOOKS :

1. Robert T Balmer, "Modern Engineering Thermodynamics", Elsevier, 2011.
2. R.Yadav, "Thermodynamics and Heat Engines", 6th edition, Central Publishing House, 2012.
3. Bill Poirier, "A Conceptual Guide to Thermodynamics", 2nd edition, Wiley Publishers, 2014.