

SEMESTER 3

ENGINEERING THERMODYNAMICS

Course Code	PCAOT302	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs .30 Min.
Prerequisites (if any)	Nil	Course Type	Theory

Course Objectives:

1. To understand the concepts of Engineering Thermodynamics.
2. To discuss various thermodynamic cycles and processes.
3. To understand laws of thermodynamics that quantify energy and its interactions with surroundings.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Basic Concepts: Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic system and Control Volume, Thermodynamic Equilibrium, State, Properties, Specific heat, Path function and point Function, Process-types, Cycle, Zeroth Law of Thermodynamics, First law of Thermodynamics, Internal Energy, Enthalpy, PMM I - Joule's Experiment, First law applied to Non-flow process and Flow processes- Steady Flow Energy Equation. (Numerical on work done and heat transformation)	9
2	Heat Engine Concepts: Limitations of the First Law, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements, PMM II, Heat Engine, Heat pump, Carnot's principle, Clausius Inequality, Entropy, Availability and Irreversibility, Thermodynamic Potentials- Gibbs and Helmholtz Functions, Third Law of Thermodynamics. (Numerical)	10
3	Thermodynamic cycles: Power cycles, Otto cycle, Diesel cycle, Dual Combustion cycle, Brayton cycle P-V and T-S diagram, Thermal Efficiency, Comparison of Cycles, Reheat and Regeneration cycle (Numerical).	14

	Refrigeration cycles- reverse Carnot cycle, reverse Brayton cycle, Air refrigeration cycles(T-S diagram and Description only) Psychrometric Properties-Dry & Wet Bulb Temperature, Specific Humidity, Relative Humidity, Degree of saturation – Adiabatic Saturation – Psychrometric chart.	
4	General thermodynamic relations: Combined First and Second law equations Maxwell relations, T-ds equations, Clapeyron Equations equation, equation for internal energy, enthalpy and entropy, specific heat, Throttling and Free Expansion Processes Joule Thomson coefficient and inversion curve. Perfect Gas Laws – Equation of State, Deviations from perfect Gas Model – Vander Waals Equation of State.	11

Course Assessment Method
(CIE: 40 marks , ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks (8x3 =24marks)	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. (4x9 = 36 marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the basic concepts of conversion of heat into work.	K2
CO2	Apply the thermodynamics laws for efficiency and COP calculations of heat engines and heat pumps.	K3
CO3	Apply the relations of various thermodynamics cycles for obtaining thermal efficiency.	K3
CO4	Understand the thermodynamic relations.	K2
CO5	Understand the basic concepts of conversion of heat into work.	K2

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	2
CO2	3	3	1	-	-	-	-	-	-	-	-	2
CO3	3	3	1	-	-	-	-	-	-	-	-	2
CO4	3	2	1	-	-	-	-	-	-	-	-	2

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Engineering Thermodynamics	Nag.P.K	Tata McGraw-Hill, New Delhi	2013
2	Thermodynamics: An Engineering Approach	Yunus A. Cengel and Michael A. Boles	McGraw-Hill book Co	7 th edition, 2010
3	Engineering Thermodynamics through examples	YVC Rao	Universities Press	2011

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Thermodynamics	Arora C.P	Tata McGraw-Hil	2003
2	Thermodynamics	Holman.J.P	McGraw-Hill	3 rd edition, 2007
3	Thermodynamics for Engineers	Merala C, Pother, Craig W, Somerton	Schaum Outline Series,Tata McGraw-Hill	2004
4	Fundamentals of Engineering Thermodynamics	Rathakrishnan E	Prentice-Hall India	2005

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://archive.nptel.ac.in/courses/112/106/112106310/
2	https://archive.nptel.ac.in/courses/112/106/112106310
3	https://archive.nptel.ac.in/courses/112/106/112106310
4	https://archive.nptel.ac.in/courses/112/106/112106310