

GUJARAT TECHNOLOGICAL UNIVERSITY

ADVANCED THERMODYNAMICS & HEAT TRANSFER

SUBJECT CODE: 2711101

M.E. 1st SEMESTER

Type of course: Core course

Prerequisite: Nil

Rationale: The course is prepared to provide the detailed understanding of laws and principles of Thermodynamics and Heat Transfer

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	PA (V)		PA (I)			
					ESE	OEP	PA	RP		
4	2#	0	5	70	30	30	0	10	10	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	<p>Unit 1: Entropy: A Measure of Disorder: Increases of entropy principle and its application, Tds relation, entropy change of solid, liquid and ideal gas, entropy transfer with heat transfer, entropy generation in open and closed system, entropy balance</p> <p>Exergy: A Measure of Work Potential: Exergy transfer by heat, work & mass, decrease of exergy principle and exergy destruction, applications of Gouy–Stodola theorem, exergy balance for steady flow and closed processes, second law efficiency</p> <p>Law of Corresponding States</p>	14	25
2	<p>Unit 2: Basics of Heat Transfer:</p> <p>Conduction: Conduction Rate Equation, Heat Diffusion Equation, Boundary and Initial Conditions, General conduction Equation, Conduction with Heat Generation, Extended Surfaces with Uniform and Non Uniform Cross Sections, Two Dimensional Steady State Conduction: Mathematical, Graphical and Numerical Analysis of Two Dimensional Heat Conduction</p> <p>Unsteady State Conduction: Lumped Parameter Analysis, Numerical Solutions, Heisler and Semi Analytical Analysis</p>	16	28
3	<p>Unit 3: Convection: Different Types of Flow and Boundary Layers, Flow Through Tubes, Flow Over Flat Plates, Cylinders, Spheres and Tube Blanks, Free Convection on Flat Surfaces, Cylinders, Spheres and Enclosed Spaces</p> <p>Heat Transfer during Phase Transformation: Boiling: Pool Boiling and its Correlations, Forced Convection Boiling, Condensation: Laminar and Turbulent Film Contestation, Film Condensation in Radial Surfaces and Horizontal Tubes, Heat Pipe</p>	16	28
4	<p>Unit 4: Radiation: Radiation Intensity, Blackbody Radiation, Emission from Real Surfaces</p> <p>Radiation: Combine with Conduction and Convection, Radiation Exchange with Participating Media, Radiative exchange and overall</p>	10	19

heat transfer in furnaces		
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Reference Books:

1. Thermodynamics – An Engineering Approach by Yunus Cengel & Boles, McGraw-Hill Publication, New Delhi
2. Fundamentals of Thermodynamics by Sonntag, Borgnakke & Van Wylen, John Wiley & Sons (Asia) Pvt. Ltd.
3. Engineering Thermodynamics by P.K. Nag, McGraw-Hill , New Delhi
4. Fundamentals of Heat and Mass Transfer, by Incropera, Dewitt, John Wiley & Sons (Asia) Pvt. Ltd.
5. Heat Transfer by J P Holman, McGraw-Hill Publication, New Delhi
6. A Heat Transfer Textbook by J H Lienhard, Phlogiston Press

Course Outcome:

After learning the course the students should be able to

1. Apply entropy principle to various thermal engineering applications
2. Apply the concept of second law efficiency and exergy principle to various thermal engineering applications
3. Analyze steady state and transient heat conduction problems of real life Thermal systems
4. Analyze extended surface heat transfer problems and problems of phase change heat transfer like boiling and condensation
5. Analyze radiation heat transfer problems of various thermal systems