GUJARAT TECHNOLOGICAL UNIVERSITY

M.E. Semester: 1
Advance Thermodynamics and Heat Transfer
Subject code:3711101

Type of course: Core course

Prerequisite: Zeal to learn the subject

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	C	Theory Marks		Practical Marks		
				ESE(E)	PA (M)	PA (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content	Total Hrs.	% weightage
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 **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 **Law of Corresponding States**	**11**	**25**
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 Unsteady State Conduction: Lumped Parameter Analysis, Numerical Solutions, Heisler and Semi Analytical Analysis	**12**	**28**
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 **Heat Transfer during Phase Transformation:** Boiling: Pool Boiling and its Correlations, Forced Convection Boiling**,** Condensation: Laminar and Turbulent Film Condensation, Film Condensation in Radial Surfaces and Horizontal Tubes, Heat Pipe	**12**	**28**
Radiation: Radiation Intensity, Blackbody Radiation, Emission from Real Surfaces Radiation Combine with Conduction and Convection, Radiation Exchange with	**7**	**19**

Participating Media, Radiative exchange and overall heat transfer in furnaces		

Some of the topics from each unit may be covered during laboratory sessions.

Course Learning Outcome:

After successful completion of the course, student should be able to

- Apply entropy principle to various thermal engineering applications
- Apply the concept of second law efficiency and exergy principle to various thermal engineering applications
- Analyze steady state and transient heat conduction problems of real life Thermal systems
- Analyze extended surface heat transfer problems and problems of phase change heat transfer like boiling and condensation
- Analyze radiation heat transfer problems of various thermal systems
- Use of software (like EES) for solving thermodynamic and heat transfer problems

References:

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