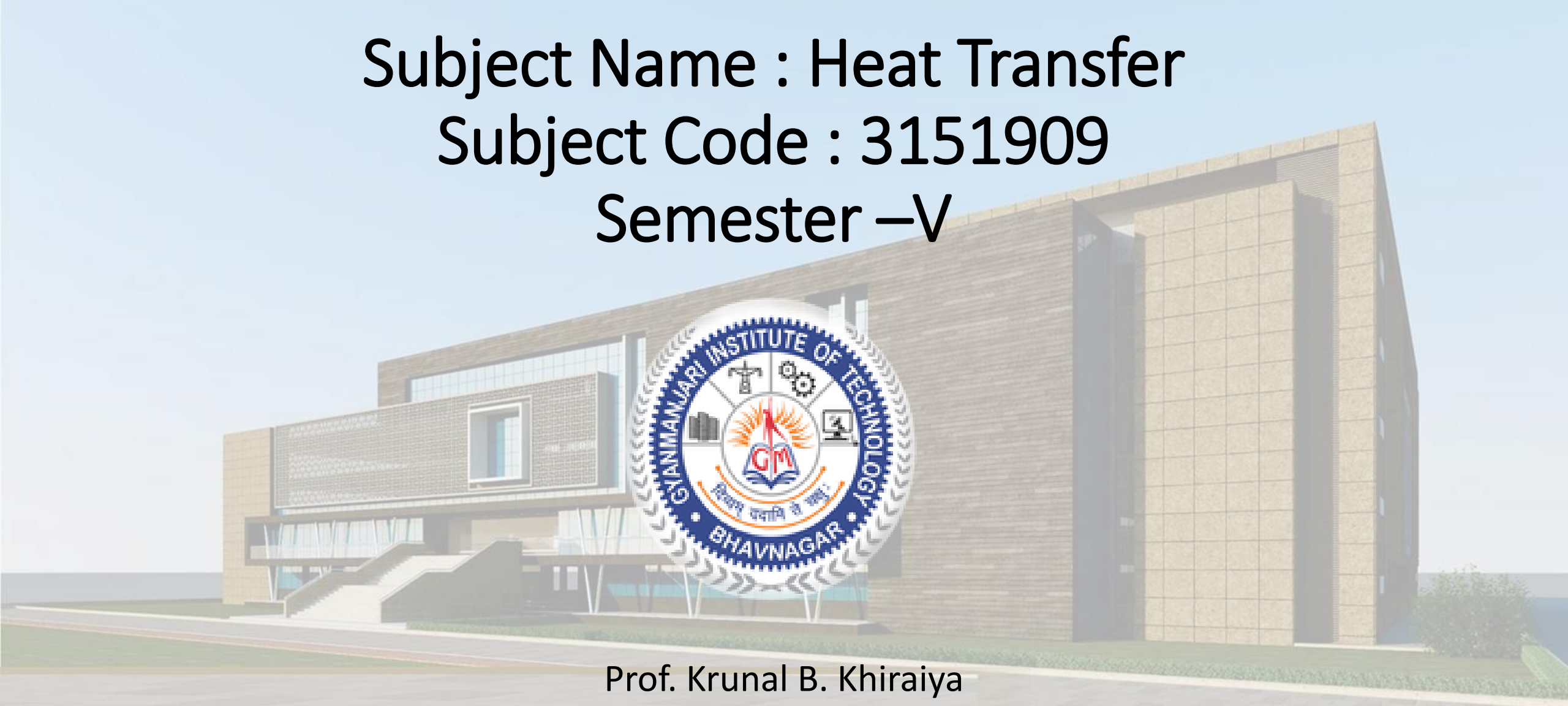
Subject Name : Heat Transfer
Subject Code : 3151909
Semester –V



Prof. Krunal B. Khiraiya

Assistant Professor and Head

Mechanical Engineering Department

Gyanmanjari Institute of Technology, Bhavnagar

Learning Objective

- **Motivation for Course**
- **Highlights of Course syllabus**

GTU Syllabus

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code:3151909
Semester –V
Subject Name:Heat Transfer

Type of course: Professional Core Course

Prerequisite: Nil

Rationale: The course is prepared to provide the detailed understating of various modes of heat transfer andits applications in Mechanical Engineering. The course also provides the basic technical knowledge related to heat exchangers.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Course Content

Content:

Sr. No.	Course Content
1	**Conduction:** Fourier's law, effect of temperature on thermal conductivity of different solids, liquids and gases,generalized equation in Cartesian, cylindrical and spherical coordinates and its reduction to specific cases,One dimensional steady state conduction, heat conduction through plane and composite walls, cylinders and spheres, electrical analogy, critical radius of insulation for cylinder and sphere, overall heat transfer coefficient **Heat transfer from extended surface:** Types of fin, heat flow through uniform cross-sectional area fin for various cases like infinitely long fin, fin insulated at the tip and fin losing heat at the tip, efficiency and effectiveness of fin, Estimation of error in temperature measurement in a thermometer well **Transient heat conduction:** lumped capacitance method for bodies of infinite thermal conductivity, time constant, one dimensional transient heat conduction in plane wall with finite conduction and convective resistances

Course Content

2	**Convection:** Newton's law of cooling, dimensional analysis applied to forced and free convection, dimensionless numbers and their physical significance, empirical correlations for free and forced convection,Continuity, momentum and energy equations, thermal and hydrodynamic boundary layer, Blasius solution for laminar boundary layer, General solution for Von-Karman integral momentum equation
3	**Radiation:** Absorptivity, reflectivity and transmissivity, black, white and grey body, emissive power, emissivity, Kirchhoff's law,Planck's law, Rayleigh-Jeans' law, Wien's law, Wien's displacement law, Stefan-Boltzmann law, intensity of radiation, radiation heat exchange between black bodies, shape factor, electrical analogy, radiation heat exchange between gray bodies, radiosity, irradiation, radiation shields
4	**Heat exchanger:** Classification, heat exchanger analysis, LMTD for parallel and counter flow exchanger, condenser and evaporator, overall heat transfer coefficient, fouling factor, correction factors for multi pass arrangement, effectiveness-NTU method for parallel and counter flow heat exchanger, introduction of heat pipe and compact heat exchanger

Course Content

5	**Two-phase heat transfer:** Boiling of liquids, Pool boiling curve, modes of pool boiling, correlation for pool boiling, condensation of vapor, film wise and drop wise condensation, condensation on flat surfaces and horizontal tubes

Specification Table

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	20	60	10	0	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Book

1. Heat and Mass Transfer by P.K. Nag, McGraw Hill

2. Heat and Mass Transfer: Fundamentals and Application by YunusCengel, McGraw Hill

3. Fundamental of Heat and Mass Transfer by Incropera and Dewitt, Wiley Publication

4. Heat Transfer by Mills and Ganesan, Pearson Education

5. Heat Transfer by J P Holman , McGraw Hill

6. Heat and Mass Transfer by R K Rajput, S.Chand Publication

Course outcome

Sr. No.	CO statement	Marks % weightage
CO-1	To classify the heat transfer problems and to apply the principles of steady state one dimensional heat transfer, extended surface and unsteady state conduction for commonly encountered Mechanical engineering problems.	32
CO-2	To identify the type of convection problems and to apply concepts of natural and forced convection for related problems	22
CO-3	To explain various laws of radiation heat transfer and to determine the radiation heat transfer between black and grey surfaces of simple Mechanical systems	20
CO-4	To practice LMTD and effectiveness-NTU method for simple heat exchange device	16
CO-5	To identify types of boiling and condensation heat transfer process and to use the same to estimate heat transfer coefficient for simple cases	10

List of Experiments

1. To determine the thermal conductivity of given metal rod
2. To determine the thermal conductivity of the given composite walls.
3. To determine Stephan Boltzmann constant experimentally.
4. To determine heat transfer co-efficient by forced convection.
5. To determine heat transfer co-efficient by natural convection.
6. To determine the overall heat transfer co-efficient of shell and tube type heat exchangers.
7. To determine the emissivity of gray body.
8. To study film and drop wise condensation and to determine the film co-efficient

List of Experiments

9. To measure convective heat transfer co-efficient and effectiveness of the fin under forced convection.

10. To measure convective heat transfer co-efficient and effectiveness of the fin under natural convection.

11. To determine heat transfer co-efficient for hair pin heat exchanger.

12. To determine heat transfer co-efficient for transient heat transfer process.

13. To determine critical radius of insulation.

Application of Heat Transfer

Application of Heat Transfer

THANK YOU

Prof. Krunal Khiraiya
Assistatnt Professor,
Department of Mechanical Engineering,
Gyanmanjari Institute of Technology,
Bhavnagar– 364001.
kbkhiraiya@gmail.com
Mo.9913388991