Course no.:	ENR 186
Course title:	**Heat Transfer Laboratory**
Core or elective:	Core
Number of credits:	2
Number of lectures-tutorials-practicals:	0-0-60
Course coordinator:	Dr. Najmur Rahman

Course Objectives:

Heat Transfer is one of the important subjects which is commonly applied in renewable energy, industrial, commercial and domestic systems. The experiments are designed to provide exposure of practical aspects of the various theoretical concepts developed under the course, Heat and Mass Transfer. The laboratory consists of experiments on various conductive, convective, radiative, boiling and condensing mechanisms of heat transfer.

Evaluation procedure:

- Practical records: 20 %
- Viva voce: 30 %
- Practical: 50 %

Details of course content and allotted time

S. No.	Topic	Allotted time (hrs)		
		L	**T**	**P**
1	***Conduction:***			
	i. Measurement of thermal conductivity of an insulating slab			4
2	***Natural Convection:***			
	i. Measurement of heat transfer coefficient in natural convection on vertical cylinder			4
	ii. Measurement of heat transfer coefficient in natural convection between two vertical parallel plates			4
	iii. Measurement of overall heat loss coefficient of an inclined solar collector			4
3	***Forced Convection:***			
	i. Measurement of convective heat transfer coefficient in a pipe by forced convection			4
4	***Radiation:***			
	i. Measurement of emissivity of a gray surface			4
	ii. Estimation of view factors between two long surfaces using crossed-strings method			4
5	***Heat Exchangers:***			
	i. Estimation of overall heat transfer coefficient for tube in tube type heat exchanger in parallel flow mode			4
	ii. Estimation of overall heat transfer coefficient for tube in tube type heat exchanger in counter flow mode			4
	iii. Estimation of overall heat transfer coefficient of parallel plate heat exchanger			4
	iv. Estimation of overall heat transfer coefficient for shell and tube heat exchanger with water on both sides			4
	v. Estimation of overall heat transfer coefficient for shell and tube heat exchanger with thermic fluid on one and water on the other side			4

6	***Fins:*** i. Estimation of fin efficiency and fin effectiveness			4
7	***Boiling and Condensation:*** i. Measurement of heat transfer coefficient in a boiling process of water ii. Measurement of heat transfer coefficient in a condensing process of saturated steam			4 4
	Note: Uncertainty of measurement in all the above experiments is also to be estimated			
	Total	**0**	**0**	**60**

Note: From the above, only 14 experiments (56 hours) are required to be completed.

Recommended readings

Books:

1. *YA Cengel, AJ Ghajar*. Heat and Mass Transfer: Fundamentals and Applications. 4th edition (2011). Tata McGraw Hill
2. *Robert Alan Granger*. Experiments in Heat Transfer and Thermodynamics (1994) Cambridge University Press.

This course has been commented upon by:

1. Dr Pradyumna Ghosh, Associate Professor, IIT – BHU, Varanasi
2. Dr Dharam Buddhi, Professor, Shivalik College of Engineering, Dehradun