G. S. Mandal's
MARATHWADA INSTITUTE OF TECHNOLOGY, AURANGABAD
DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Name and Location: Heat Transfer, Room.No-217 B

Lab In-charge: Mr. Mandar V. Kulkarni (Assistant Professor)

Lab Area: 70.68 Sq. m **Total Investment (INR): 4,26,650/-**

List of Major Equipments:

Sr. No.	Name & Specifications of the Equipment	Photograph of the Equipment
1.	**Apparatus of determination of heat transfer coefficient for natural convection.** ➢ Enclosure size: 200 mm x 200 mm x 900 mm ➢ Tube size (test cylinder) 25 mm diameter x 400 mm length. ➢ Nichrome heater (cartridge type): ➢ 400 watt ➢ Digital Control Panel ➢ LCD Display. ➢ RTD (PT 100) for temperature measurement.	

2.	**Apparatus for determination of emissivity of metal surface.** ➢ Test plate and reference plate size 140 mm dia ➢ Enclosure size is 55 cm x 30 cm x 30 cm with one side of perspex sheet ➢ Heater: 200 V400 watt, Nichrome wire type, sandwiched between mica sheets . ➢ Digital Control Panel ➢ LCD Display. ➢ RTD (PT 100) for temperature measurement.	
3.	**Apparatus of determination of Stefan Boltzmann's constant.** ➢ Copper Hemisphere Dia 200 mm (approx.) ➢ Copper Jacket Dia 250 mm (approx.) ➢ Test disc size 20 mm dia. x 1.5 mm thickness. ➢ Hot water tank with a 1.0 KW immersion heater ➢ Control panel comprises of: ○ Supply for heater. ○ Digital temperature indicator 0 - 200 °C with 0. 1 ° C least count using Chormel - Alumel thermocouples. Provided with cold junction compensation. ➢ Built in timer with indicator for temperature readings at 5 seconds interval	

4.	**Apparatus for Unsteady State Heat Transfer.** ➢ Test piece -25 x 30 cm long, Copper and Mild Steel 01 each. ➢ Electric heater: Band Type Nichrome Heater. ➢ Digital Temperature Indicator. ➢ Stop Clock. ➢ Voltmeter: 0-100 ^{0}C. ➢ Ammeter: 0- 2 A	
5.	**Apparatus of Determination of Thermal Conductivity of given Metal Rod.** ➢ Copper rod, 25 mm OD and 430 mm long with insulation shell. ➢ Thermocouples: 10 nos, Chromel-Alumel ➢ Band Nichrome Heater. ➢ Dimmerstat: 2A, 230 V ➢ Multi channel Digital Temperature Indicator: 0-200 ^{0}C with 0.1 ^{0}C Least Count.	

6.	**Apparatus of Determination of Thermal Conductivity of composite wall.** ➢ Voltmeter: 0- 100 V. ➢ Ammeter: 0- 2 A ➢ Thickness of slab: 0.010 m each ➢ Diameter of slabs: 0.300 m each ➢ Wood, Mild Steel, Bakelite. ➢ Mica Heater: 400 W, 0.175 m Dia. .	
7.	**Apparatus of determination of heat transfer coefficient for forced convection.** ➢ Blower: 1 HP Motor ➢ Temperature Indicator: 0-300˚C ➢ Thermocouple: Chromel-Alumel ➢ Voltmeter: 0- 100 V ➢ Ammeter: 0- 2 A ➢ Nichrome Wire band type heater ➢ Dimmerstat: 0-2 A, 260 V A.C.	

8.	**Trial on Parallel and Counter Flow Heat Exchanger** ➢ Length of Heat Exchanger: 2 m, ➢ Thermometers: ➢ Hot Water: 0-100˚C, 02 nos ➢ Cold Water: 0-50˚C, 02 nos ➢ Geyser: Single Phase ➢ Measuring Flask: 0-1000 CC, ➢ Inner Tube: GI/Cu I.D.: 10 mm O.D.: 12 mm ➢ Outer Tube: GI I.D.: 27.5 mm O.D.: 33.5 mm	

Significance of the course: This course is intended to give students a distinct understanding between various modes of heat transfer, the application of heat transfer in engineering and methods to quantify amount of heat transfer.

List of Experiments	COs
Experiment No.1: Determination of thermal conductivity of given metal rod. Aim & Objective: To determine thermal conductivity of metal. Outcomes: Understanding of heat transfer in cylindrical configuration. Experimentation: Supply heat and flow it in controlled radial manner through setup. Results & Discussions: Thermal conductivity of metals is calculated.	CO1,CO3, CO4
Experiment No.2: Determination of thermal conductivity of insulating powder. Aim & Objective: To determine thermal conductivity of insulator. Outcomes: Understanding of Heat transfer in spherical configuration. Experimentation: Supply heat and flow it in controlled spherical manner through setup. Results & Discussions: Thermal conductivity of insulating powder is calculated.	CO1,CO3, CO4
Experiment No.3: Determination of thermal conductivity of composite slab. Aim & Objective: To determine thermal conductivity of non-metal. Outcomes: Understanding of Heat transfer in wall type configuration. Experimentation: Supply heat and flow it in controlled axial manner through setup. Results & Discussions: Thermal conductivity of slab material is calculated.	CO1,CO3, CO4
Experiment No.4: Determination of heat transfer coefficient in natural convection from cylinder. Aim & Objective: To determine heat transfer coefficient of air with natural flow. Outcomes: Apply nondimensional correlations for calculation of heat transfer coefficient through natural convection. Experimentation: Air is derived to flow due to density difference because of heating. Results & Discussions: Actual and Theoretical heat transfer coefficients are compared.	CO1,CO4, CO5
Experiment No.5: Determination of heat transfer coefficient in forced convection	

from cylinder. Aim & Objective: To determine effect of forced flow of air on convective heat transfer. Outcomes: Apply nondimensional correlations for calculation of heat transfer coefficient through forced convection. Experimentation: Heated surface is studied under forced flow of air, for temperature variation at different locations. Results & Discussions: Actual and Theoretical heat transfer coefficients are compared.	CO1,CO4, CO5
Experiment No.6: Determination of critical heat flux. Aim & Objective: To observe boiling regimes and burning point in pool boiling. Outcomes: To determine critical heat flux for given metal. Experimentation: Water at saturated temperature is heated further using Nichrome coil. And boiling situations are observed till burning point. Results & Discussions: Critical heat flux causes rapid heat accumulation resulting in burning.	CO1,CO4
Experiment No.7: Experimentation on drop wise and film wise condensation. Aim & Objective: To determine heat transfer coefficients in drop wise and film wise condensation phenomenon.. Outcomes: To differentiate and observe the phenomenon of film wise and drop wise condensation. Experimentation: Steam from pressure cooker enters in to glass cylinder and drop wise and film wise condensation phenomenon can be observed. Results & Discussions: Heat transfer coefficients in drop wise and film wise condensation are compared.	CO1,CO3
Experiment No.8: Trial on parallel and counter flow heat exchanger. Aim & Objective: To compare performance of heat exchanger in parallel and counter flow conditions. Outcomes: Calculate heat transfer rates for parallel and counter flow in heat exchanger. Experimentation: Hot and cold water is flown in concentric pipes in same and opposite directions to exchange heat, then temperatures are measured for calculation.	CO1,CO6

Results & Discussions: Calculation of LMTD and effectiveness for parallel and counter flow.	
Experiment No.9: Determination of the emissivity of the given surface. Aim & Objective: Determination of emissivity of given material in comparison with black surface. Outcomes: Comparative emissivity of given material is determined. Experimentation: Heated black and test plates are measured for surface temperature. Results & Discussions: Emissivity of test plate is calculated using Stefan Boltzmann's law.	CO1, CO4
Experiment No.10: Determination of Stefan -Boltzmann's constant. Aim & Objective: Validation of Stefan Boltzmann's constant Outcomes: Calculation of Stefan Boltzmann's constant and relation of emissive power with absolute temperature. Experimentation: Water is heated and then the heat is transferred to a copper disc. Results & Discussions: Temperature gradient is plotted, and Stefan Boltzmann's constant's value is calculated	CO1, CO4
Experiment No.11: Determination of thermal conductivity of given liquid. Aim & Objective: To determine thermal conductivity of given liquid. Outcomes: Understanding of Heat transfer in liquids. Experimentation: Supply heat and flow it in controlled manner through liquid. Results & Discussions: Thermal conductivity of liquid is calculated.	CO1,CO3, CO4
Experiment No.12: Study of design & analysis of heat pipe. Aim & Objective: Study construction and working of heat pipes. Outcomes: Application of heat pipes in heat evacuation from internally heated systems. Experimentation: Study types of heat pipes and their working principle. Results & Discussions: Heat pipes help in enhancement of rate of heat transfer.	CO1,CO3