HEAT AND MASS TRANSFER

List of Experiments:

Conduction Heat Transfer Unit

1. Investigation of Fourier Law for linear conduction of heat along a simple bar.
2. Study the conduction of heat along a composite bar and evaluate the overall heat transfer coefficient.
3. Investigate the effect of change in cross sectional area on the temperature profile along a thermal conductor.
4. Examine the temperature profile and determine the rate of heat transfer resulting from radial steady conduction through the wall of a cylinder.
5. Determine the effect of surface contact on thermal conduction between adjacent slabs of material.
6. Investigate the influence of thermal insulation upon the conduction of heat between the adjacent metals.

Convection Heat Transfer Unit

1. Demonstrate the relationship between power input and surface temperature in free convection.
2. Demonstrate the relationship between power input and surface temperature in forced convection.
3. Demonstrate the use of extended surfaces to improve the heat transfer from the surface.
4. Determine the temperature distribution along an extended surface.
5. Comparison of a vertical and horizontal flat plate in free convection.

Concentric Tube Heat Exchanger

1. Demonstrate the working principles of a concentric tube heat exchanger operating under parallel flow condition.
2. Demonstrate the working principles of a concentric tube heat exchanger operating under counter flow condition.
3. Demonstrate the effect of hot water temperature variation on the performance characteristic of a concentric tube heat exchanger operating under parallel & counter flow conditions.
4. Demonstrate the effect of flow rate variation on the performance characteristic of a concentric tube heat exchanger operating under parallel & counter flow conditions.

Water to Water Turbulent flow heat exchanger

1. Determination of heat transfer rate, LMTD, and overall heat transfer coefficient.
2. Determination of surface heat transfer coefficients inside & outside the tube and the effect of fluid velocity on these.
3. Comparison of con-current and counter current flow in a heat exchanger.
4. Investigation of the relationship between Nusselt Number, Reynolds Number & Prandtl Number.

Boiling Heat Transfer Unit

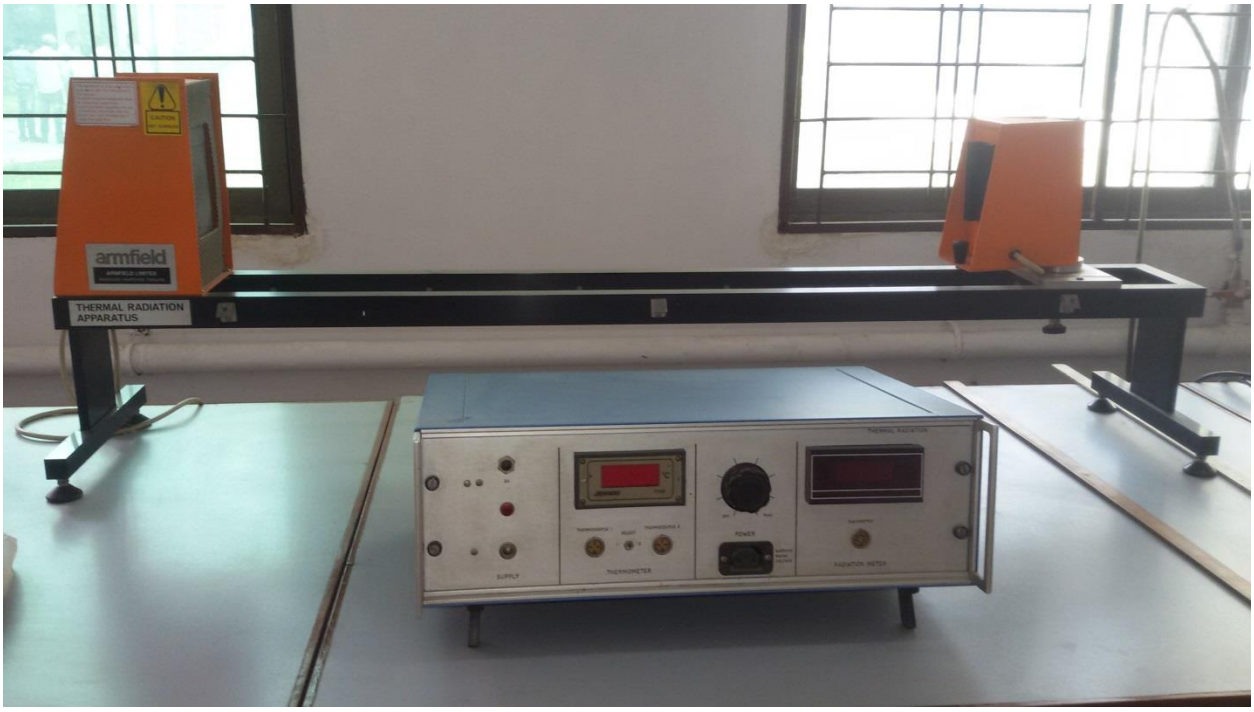
1. Visual demonstration of Convective, Nucleate, and film boiling.
2. Determination of heat flux and surface heat transfer coefficient up to and beyond the critical condition at constant pressure.
3. Investigation of the effect of pressure on critical heat flux.
4. Demonstration of film wise condensation and measurement of overall heat transfer coefficient.
5. Demonstration of the cause of liquid carry over or priming in boilers.
6. Determination of the pressure temperature relationship of a pure substance.
7. Investigation of the effect of air in a condenser.
8. Demonstration of the law of partial pressures.

Radiation Heat Transfer Unit

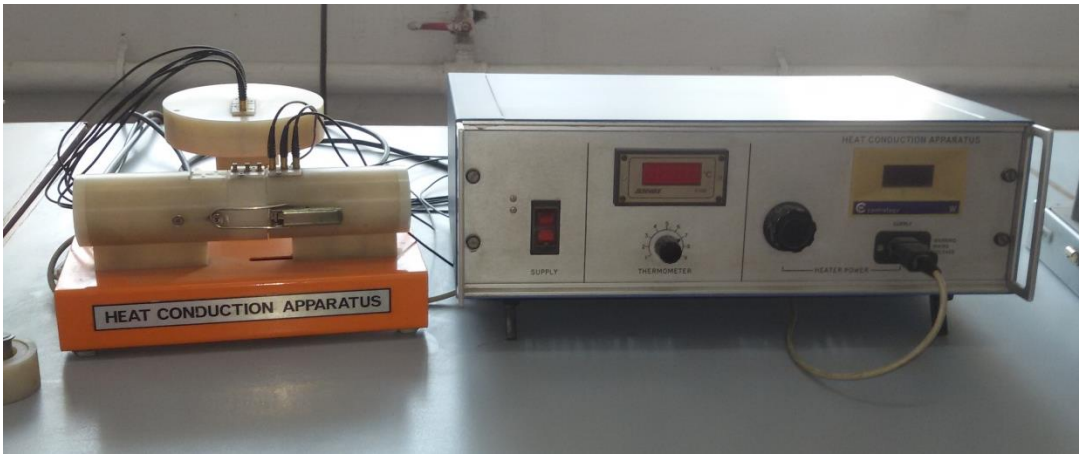
1. Show that the intensity of radiation on a surface is inversely proportional to the square of the distance of the surface from the radiation source.
2. Show that the intensity of radiation varies as the fourth power of the source temperature.
3. To determine the emissivity of different surfaces. (Polished and silver anodised compared with matt black).
4. To demonstrate how the emissivity of radiating surfaces in proximity to each other will affect the surface temperatures and the heat emitted.
5. To determine the validity of Kirchhoff's Law which states that the emissivity of a grey surface is equal to its absorptivity of radiation received from another surface when in a condition of thermal equilibrium.
6. To demonstrate that the exchange of radiant energy from one surface to another is dependent upon their interconnecting geometry, i.e. a function of the amount that each surface can 'see' of the other.
7. To show that the illuminance of a surface is inversely proportional to the square of the distance of the surface from the light source.
8. To show that the energy radiated in any direction at an angle with a surface is equal to the normal radiation multiplied by the cosine of the angle between the direction of radiation and the normal to the surface.
9. To show that light passing through non-opaque matter is reduced in intensity in proportion to the thickness and absorptivity of the material.

THERMAL CONDUCTIVITY OF LIQUID & GAS APPARATUS

THERMAL RADIATION APPARATUS



HEAT CONDUCTION APPARATUS



FREE & FORCED CONVECTION HEAT TRANSFER APPARATUS

COCENTRIC TUBE HEAT EXCHANGER UNIT

WATER TO WATER TURBULENT HEAT TRANSFER UNIT

BOILING HEAT TRANSFER UNIT