Heat & Mass Transfer Lab

Subject overview:

Heat transfer is the study of energy movement in the form of heat which occurs in many types of processes. The transfer occurs from the high to the low temperature regions. Therefore a temperature gradient has to exist between the two regions for heat transfer to happen. It can be done by conduction (within one solid or between two solids in contact), by convection (between two fluids or a fluid and a solid in direct contact with the fluid), by radiation (transmission by electromagnetic waves through space) or by combination of the above three methods.

Composite Wall Apparatus:

In this system; walls have a layer of bricks, a layer of thick insulation and plaster of both the sides. The treatment of conductive heat flow in such structures is the extension of single wall structures and known as composite walls or composite structures.

Heat Flux Apparatus :

Apparatus consists of a wire which is surrounded by water in a trough. The surface temperature of test wire is heated by passing current through it. Due to the temperature difference between the wire surface and surroundings the different regimes are observed till the burn out point.

Thermal Conductivity of Metal Rod :

Thermal conductivity is an important thermo - physical property of conducting materials, by virtue of which the material conducts the heat energy through it.

Pin Fin Apparatus :

Extended surfaces or fins are used to increase the heat transfer rates from a surface to the surrounding fluid wherever it is not possible to increase the value of the surface heat transfer coefficient or the temperature difference between the surface and the fluid.

Thermal Conductivity of Insulating Powder :

Conductivity Instrument consisting of Two Concentric Spheres, Insulating Powder and Control Panel with Voltmeter, Ampere meter, Digital Temperature Controller-cum-Indicator with selector switch, Dimerstat and Main On/ Off Switch.

Critical Radius of Insulating Material :

The most important characteristics of any insulation material include a low thermal conductivity, low tendency toward absorbing water, and of course the material should be inexpensive. With the help of this setup; can understand the perfect insulation thickness in terms of radial thickness.

Thermal Conductivity of Liquid by Guarded Hot Plate Method :

For the measurement of thermal conductivity; requirement is to have a one dimensional heat flow through the flat specimen, an arrangement for maintaining its faces at constant temperature and some metering method to measure the heat flow through a known area. To eliminate the distortion caused by edge losses in unidirectional heat flow, the central plate is surrounded by a guard which is separately heated.

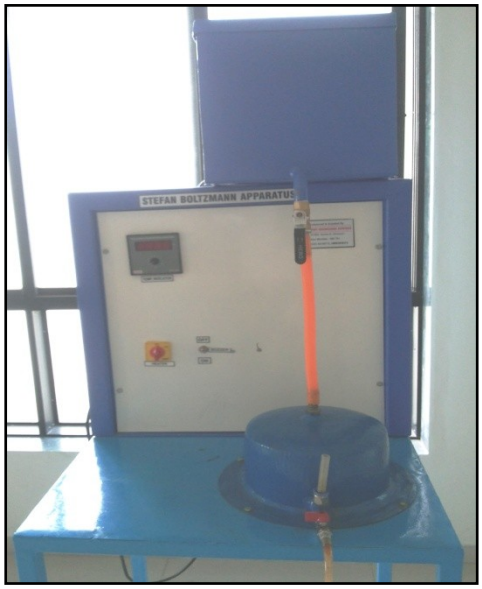
Heat transfer in Natural convection :

The present experimental set up is designed and fabricated to study the natural convection phenomenon from a vertical cylinder in terms of the variation of local heat transfer coefficient along the length and also the average heat transfer coefficient and its comparison with the value obtained by using an appropriate correlation.

Heat transfer in Forced convection :

The apparatus consists of a circular pipe, through which cold fluid, air is being forced. Pipe is heated by a band heater outside the pipe. Temperature of pipe is measured with thermocouples attached to pipe surface. Heater input is measured by a Voltmeter and Ammeter. Thus, heat transfer rate and heat transfer co-efficient can be calculated.

Stefan Boltzman Apparatus :



A copper test disc is fitted at the center of jacket. The hot water is obtained from a hot water tank, fitted to the panel, in which water is heated by an electric immersion heater. The test disc is then inserted at the center with thermocouple. Thermocouples are fitted inside hemisphere to average out hemisphere temperature. A timer with a small buzzer is provided to note down the disc temperatures at the time intervals of 5 seconds.

Shell & Tube Heat Exchanger :

Shell & Tube heat exchangers are built of round tubes mounted in a cylindrical shell with the tubes parallel to the shell. One fluid flows inside the tubes, while the other fluid flows across and along the axis of the exchanger. The major components of this setup are tube bundles, shell rear end head, front end head, shell, baffles and tube sheets.

Parallel & Counter Flow Heat Exchanger :

The simplest type of heat exchanger consists of two concentric pipes of different diameters known as double pipe heat exchanger. In parallel, both hot and cold fluids enter the heat exchanger at the same end and move in the same direction. In Counter flow, on the other hand, hot and cold fluids enter the heat exchanger at the opposite end and move in the opposite direction.

Plat Heat Exchanger :

An innovative type of heat exchanger that has found widespread use is the plate heat exchanger, which consists of series of plates with corrugated flat flow passages. The hot and cold fluids flow in alternate passages and thus each cold fluid stream is surrounded by two hot fluid streams, resulting in very effective heat transfer.

Cross Flow Heat Exchanger :

In this type of heat exchanger, fluids move usually perpendicular to each other and such flow configuration is known as cross flow heat exchanger. In compact heat exchangers, cross flow arrangement is used. It is further classified in two ways: mixed and unmixed cross flow heat exchanger.

Forced Drought Cooling Tower :

The primary task of a cooling tower is to reject heat into the atmosphere. The make-up water source is used to replenish water lost to evaporation. Hot water from heat exchangers is sent to the cooling tower. The water exits the cooling tower and is sent back to the exchangers or to other units for further cooling.