1.5 THERMAL COMFORT

It is the condition of mind that expresses satisfaction with the thermal environment and is assessed by subjective evaluation or it is the condition of mind when some one is not feeling either too hot or too cold.

Thermal comfort is a method of maintaining a constant air movement and removal of saturated air from inside

The factors that influence thermal comfort are

- Metabolic rate
- Clothing insulation
- Air temperature
- Mean radiant temperature
- Air speed
- Relative humidity

Metabolic rate

It is level of transformation of **chemical energy into heat** by metabolic activities. It is equal to the **energy produced per unit surface area** of an average person at rest.

Clothing insulation

Clothing insulation **prevents heat loss** and consequently the **thermal balance**. It can either help to keep a person as warm or lead to overheating.

Air temperature

It is the **average temperature** of the air surrounding to the occupant with respect to location and time.

Mean radiant temperature

It is the **amount of radiant heat transferred from a surface**. It depends upon ability to absorb or emit heat by the materials.

Air speed

It is defined as the **rate of the air movement at a point, without regard to direction.**

Relative humidity

It is the ratio of the **amount of water vapour in the air to the saturation pressure (or)**

Density of water vapor at the same temperature and pressure.

(or)

The amount of moisture in the air divided by the maximum amount of moisture that could exit in the air at the specific temperature.

INDICES OF THERMAL COMFORT Thermal Index (or)

Comfort Scale

A single scale which combines the effects of various thermal comforts such as air temperature, humidity, air movement and radiation is called a Thermal Index or Comfort Scale.

The effective temperature is adjusted by considering the loss or gain of heat by radiation to arrive at a **C**orrected **E**ffective **T**emperature (CET). It is determined by

- Air temperature
- Humidity
- Heat radiation

CET is measured using

- Globe thermometer : to measure air temperature adjusted for heat radiated
- Wet bulb thermometer: to measure humidity.

CLIMATE AND DESIGN OF SOLAR RADIATION

Solar radiation, often called the solar resource, is a general term for the electromagnetic radiation emitted by the sun. It is the intensity of sun rays falling per unit time per unit area and is usually expressed in watts per square metre

W/m^2. Solar radiation can be captured and turned into useful forms of energy, such as heat and electricity, using a variety of technologies.

Basic Principles

Every location on earth receives sunlight at least part of the year. The amount of solar radiation that reaches any one spot on the Earth's surface varies according to:

- Geographic location
- Time of day
- Season
- Local landscape
- Local weather

Because the earth is round, the sun strikes the surface at different angles, ranging from 0 to 90^0.When the sun's rays are vertical, the earth's surface gets all the energy possible. The more slanted the sun's rays are, the longer they travel through the atmosphere, becoming more scattered and diffuse.The earth is nearer the sun when it is summer in the southern hemisphere and winter in the northern hemisphere.

Diffuse and Direct solar Radiation

As sunlight passes through the atmosphere, some of it is absorbed, scattered, and reflected by:

- Air molecules
- Water vapor
- Clouds
- Dust
- Pollutants
- Forest fires
- Volcanoes.

This is called diffuse solar radiation. The solar radiation that reaches the earth's surface without being diffused is called direct beam solar radiation. The sum of the diffuse and direct solar radiation is called global solar radiation.

Solar Radiation: Solar radiation is the radiant energy received from the sun. It is the intensity of sun rays falling per unit time per unit area and is usually expressed in watts per square (w/m^2).

The instruments used for measuring of solar radiation are the pyranometer and the pyrheliometer. The duration of sunshine is measured using a sunshine recorder.

Distribution

The amount of power generated by any solar technology at a particular site depends on how much of the sun's energy reaches it.

Solar passive design

Solar passive buildings are designed to achieve thermal and visual comfort by using natural energy sources and sinks e.g. solar radiation, wet surfaces, outside air, vegetation, etc.Architects and designers can achieve energy efficiency in the buildings they design by studying the macro and micro climate of the site, applying solar passive and bio climatic design features ad taking advantage of the natural resources on site. Designer can achieve a solar passive building design by following the steps mentioned below:

- Modulating the micro climate of the site through landscaping
- Optimizing the orientation and building form.
- Optimizing the building envelope and windows
- Applying day light integration to reduce the artificial lighting demand.
- Adopting low energy passive cooling strategies.