

## 1.0 FENESTRATION

Any opening in a building's envelope including windows, doors, curtain walls and skylights designed to permit the passage of air, light, vehicles, or people. Fenestrations **transmit solar radiation** into the building (normally filled with glazing).

### Fenestration Systems

There are various fenestration systems like,

- i) **Glazing**
  - ii) **Windows**
  - iii) **Curtain walls**
  - iv) **Sloped glazing**
  - v) **Exterior doors**
- i) **Glazing:** Glass which serves the purpose of allowing natural light into a building has been in use. This has led to glazing of majority of the new windows and curtain walls for commercial building construction.
- ii) **Windows:** We use wood frame, with some metal windows in institutional construction. Later, steel windows and aluminum windows were introduced.
- iii) **Curtain Walls:** A curtain wall is any exterior wall that is attached to the building structure.
- iv) **Sloped Glazing:** Skylights have been used to provide interior lighting.
- v) **Exterior Doors:** These include entrance and exit doors, as well as industrial loading dock doors.

### Main Components of Fenestration system

The Main components of fenestration system are **Glazing, Framing and Shading devices.**

1. **Glazing** :It is the main part of fenestration that lets the light through and it is usually glass. Occasionally plastic. A layer is called a glaze or a pane.
2. **Framing:** It is the material that holds the glazing in place and attaches it to the rest of the enclosure and it is usually wood, metal, and plastic or fiberglass.
3. **Shading devices and/or screens** :A unit may or may not have shading. From other building components that either may or may not be an integral part of the overall assembly.

## FUNDAMENTAL MODES OF HEAT TRANSFER

- ❖ **Conduction is the process of transmission of heat from one point to another through substance without the actual motion of the particles. Conduction always requires some material medium. The material medium may be solid, liquid, gas.**
- ❖ **The transfer of heat energy between an object and its environment, due to fluid motion is called as convection**
- ❖ **The transfer of heat energy by the means of electromagnetic radiation without any original contact between the bodies is called as radiation.**

## HEAT TRANSFER THROUGH FENESTRATIONS

Energy flows through fenestration via

- ❖ **Conductive and convective heat transfer caused by the temperature difference between outdoor and indoor air,**
- ❖ **Net long-wave (above 2500 nm) radiative exchange between the fenestration and its surrounding and between glazing layers, and**
- ❖ **Short-wave (below 2500 nm) solar radiation incident on the fenestration product, either directly from the sun or reflected from the ground or adjacent objects**
- ❖ **Part of the incident solar energy is transmitted and eventually absorbed by the room surfaces.**
- ❖ **Part of the incident solar energy is absorbed by the fenestration and reradiated as thermal energy towards inside.**

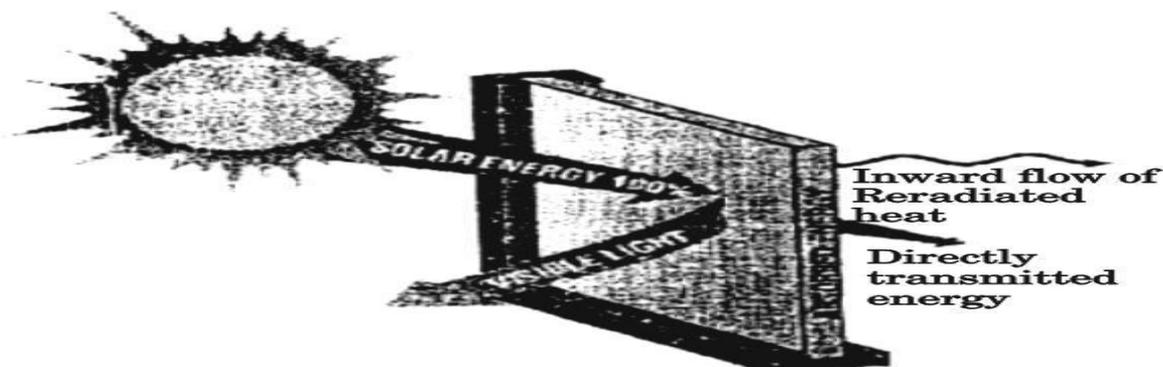


Fig 1.1- Heat transfer through fenestration

## Total heat transfer

The heat gain through fenestration consists of two main components:

- **$Q_{\text{thermal}}$** = Heat transfer between indoor and outdoor air. This is positive or negative depending on temperature.
- **$Q_{\text{solar}}$** = Heat transfer from solar radiation. This is always a positive number.
- $Q_{\text{total}} = Q_{\text{thermal}} + Q_{\text{solar}}$

