

### 3.10 PRINCIPLES OF ARTIFICIAL LIGHT

Light can be produced by nature or by humans. “Artificial” light is typically produced by lighting systems that transform electrical energy into light.

Nearly all lighting systems do so either by passing an electrical current or through gases until they excited to and produce light energy.

Incandescent light sources are an example of the first method, called incandescence. Current is passed through a filament, which heats until it glows. This method is considered wasteful (most of the energy entering the lamp leaves it as heat instead of visible light. Other light sources were pioneered that relay on the gaseous discharge method, including fluorescent, high-intensity discharge (HID) and low-pressure sodium light sources.

A typical lighting system is comprised of one or more of these light sources, called the lamps. Fluorescent, HID and low-pressure sodium lamps operate with a ballast, a device that starts the lamp and regulates its operation. Lamps and ballasts in turn are part of the luminaire, or light fixture, which houses the system and includes other components that distribute the light in a controlled pattern.

**Artificial lighting is the lighting which is man-made such as fluorescent, tungsten, sodium and mercury vapour lamp etc.,** It may be used as a supplement to natural light as natural light is not available.

#### CATEGORIES OF LIGHT

##### DIRECT

Direct light is light travelling unimpeded from the light source to the subject, not filtered, diffused, reflected or altered. Direct light is like full sun on a clear day.

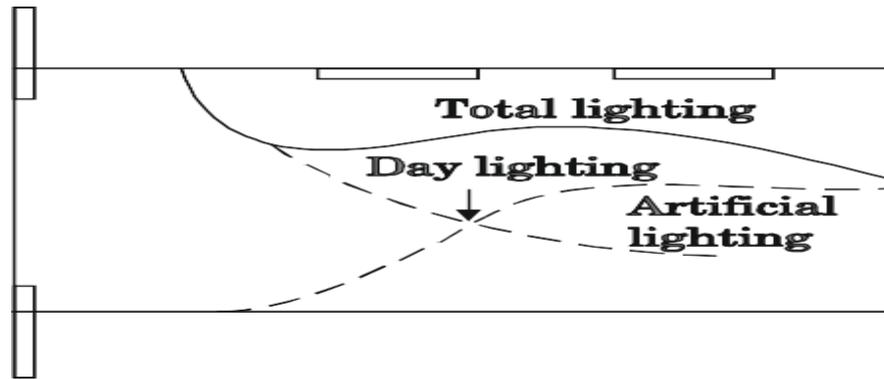


Fig. 3.10.1- CATEGORIES OF LIGHT

The effect of extensive use of lighting is direct, impressive and active both ambient light and artificial light. (as in the use of flash fill illumination; or in a studio environment where two or more light sources are used).

### **REFLECTED**

Second type is **Semidirect (or) Reflected lighting**. It is visible but brightness will be less.

Reflected light is light proceeding from a light source and bouncing off a remote surface and reflecting onto an object. Light reflected into an umbrella with a black backing is an example of reflected light.

Light can also be reflected off a white wall or a silver or white card and directed toward a subject. Reflected light is less directional than an unimpeded source light.

The third type is **Indirect lighting**. It is invisible but it falls on working area.

The combination of 3 types of lighting can be used on any lighting systems. All the methods gives pain to the eyes, if proper lighting is not set in. Table lamp is useful but it is harmful to the eyes.

### **First: Artificial light sources**

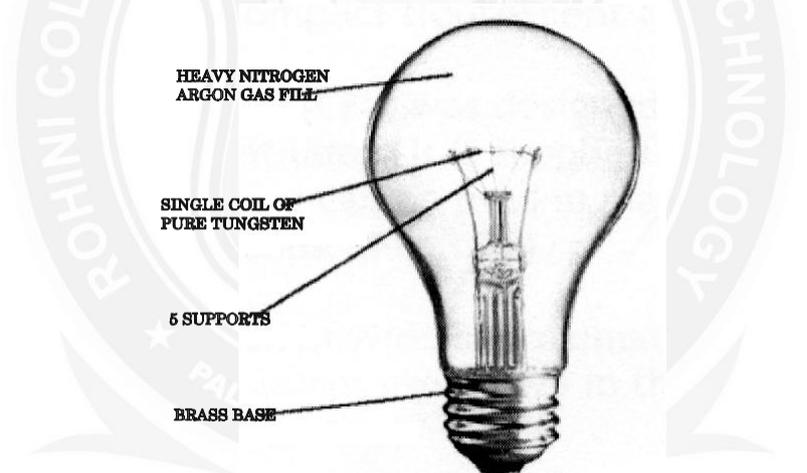
Artificial light sources are categorized by the technology used to produce the light. The five most common light sources are as follows:

1. Incandescent lamp

2. Compact fluorescent lamp
3. Fluorescent tube
4. Discharge lamps
5. Light Emitting Diode (LED)

### 1-Incandescent lamp

Until recently the most common electric light source is the incandescent lamp. This is still widely used, although it has relatively low energy efficiency. It leads to replacement by other more efficient lamps such as the CFL. (fig. 3.10.2).



*Fig. 3.10.2- Incandescent lamp*

A larger variety of shapes, sizes and power is available, as well as different colour ranges. Typical lamps for household use range from about 40 to 100 W.

### 2. Compact fluorescent lamp

The Compact Fluorescent Lamp (CFL) is designed as a more efficient replacement for incandescent lamp. It can be used in many light fittings designed for incandescent lamps. (Fig. 3.10.3)

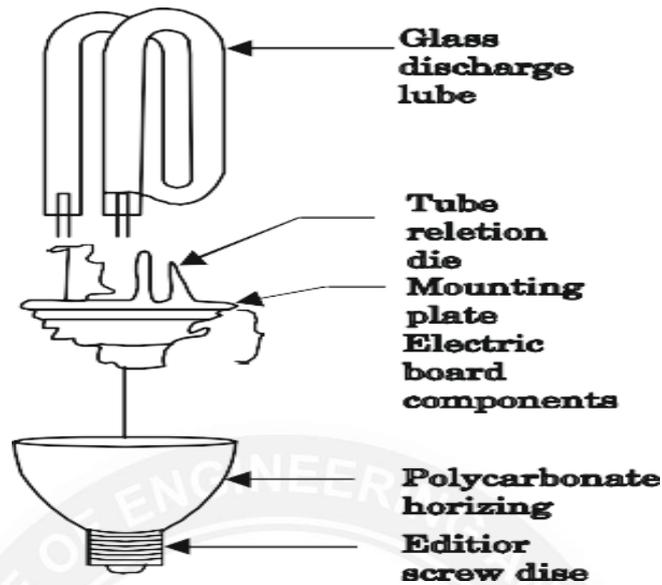


Fig. 3.10.3 Compact fluorescent lamp

### 3. Fluorescent tube

Fluorescent tubes are the main form of lighting for offices and commercial buildings.

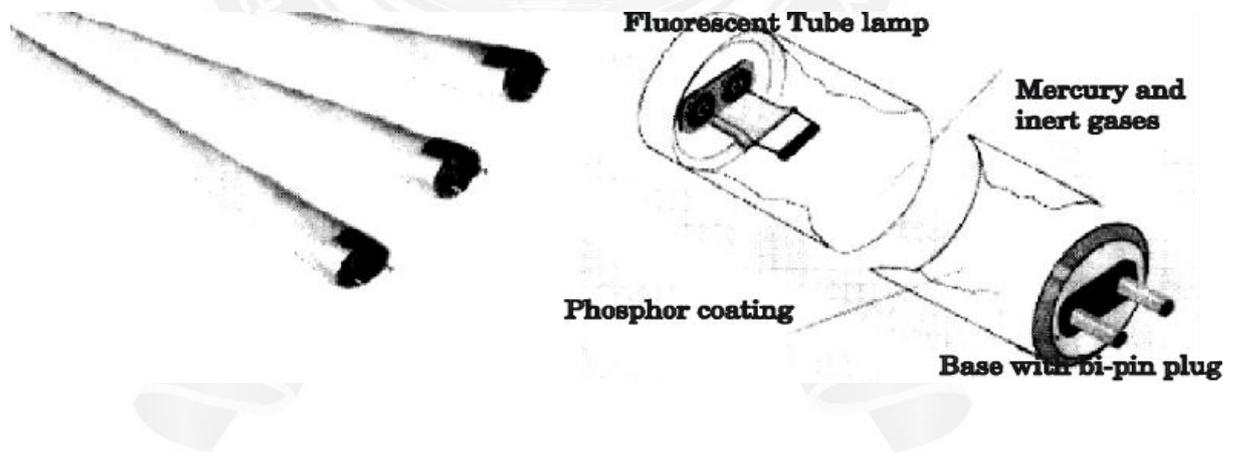


Fig. 3.10.4- Fluorescent tube

They are a form of gas discharge lamp. They are formed in a long thin glass cylinder. These lights have contacts at either end that secure them to the fitting (or luminaire) and provide the electrical connection.

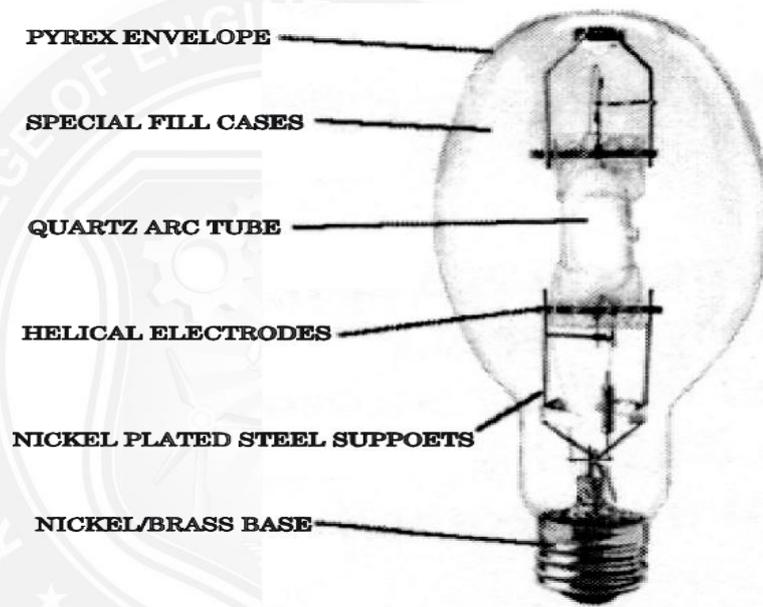
The tube contains mercury vapour at low pressure. The inner wall of the

glass is coated with a phosphor that reacts to ultra-violet radiation. When electricity is passed through the vapour it emits UV radiation that is converted by the phosphor to visible light. (Fig. 3.10.4).

#### 4. Discharge lamps

Discharge lamps work by striking an electrical arc between two electrodes, causing a filler gas to give off light.

Different metals and filler gasses can be used to provide a range of colour



and brightness. (Fig. 3.10.5)

*Fig. 3.10.5 Discharge lamps*

Discharge lamps provide high luminous efficacy combined with long life, resulting in the most economical light source available.

#### 5. Light Emitting Diode (LED)

LEDs use semi-conductors to convert electrical energy directly into light. They are only recently becoming available as a light source for lighting purposes. They are highly efficient and long lasting. (Fig. 3.10.6)

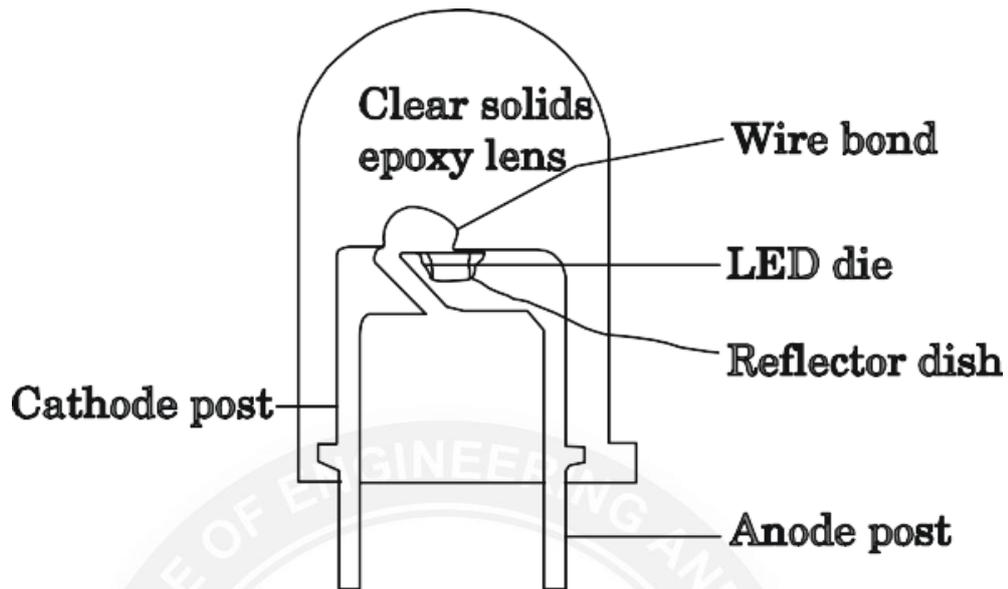


Fig. 3.10.6 Light Emitting Diode (LED)

LED torches are becoming very popular, as they provide a far longer battery life than other types of light source.

### **Second: Forms of Artificial lighting**

There are two forms for Artificial lighting as follows:

1. **Indoor lighting**
2. **Outdoor lighting**

#### **1. Indoor lighting**

Indoor lighting is usually accomplished using light fixtures, and it is a key part of interior design.

Luminaire is a device that distributes filters or transforms the light emitted from one or more lamps. The luminaire includes all the parts necessary for fixing and protecting the lamps, except the lamps themselves.

In some cases, luminaries also include the necessary circuit auxiliaries, together with the means for connecting them to the electric supply. The basic physical principles used in optical luminaire are reflection, absorption, transmission and refraction.

## **Types of Indoor Light fixtures/luminaries**

Light fixtures/Luminaries are classified according to the following:

1. The light function.
2. Lamp type.
3. Installation method.
4. The percentage of light output above and below the horizontal.

## **Types of Light fixtures according to light function**

There are five basic types of light fixtures according to the function of aim of using it as follows:

- Ambient (general lighting).
- Task
- Accent
- Informational lighting/Guidance Lighting
- Decorative lighting

Ambient lighting provides an area with overall illumination. Also known as general lighting, it radiates a comfortable level of brightness without glare and allows you to see and walk about safely.

Ambient lighting is often provided by traditional pendant type fixtures, down lights, chandeliers, or ceiling mounted fixtures etc.

Task lighting should be free of distracting glare and shadows and should be bright enough to prevent eye strain.

### **Informational lighting (Guidance lighting)**

It is designed to help us see our way safely. The light in your closet, the

light by your door bell, and night lights, as well as path lighting and motion lights, are all good examples of informational lighting.

### Decorative lighting

Light strips, pendants, chandeliers, and sconces are all examples of light fixtures that draw attention to themselves and add character to the place being lighted. Many are also used for general lighting. (Fig. 3.10.7)

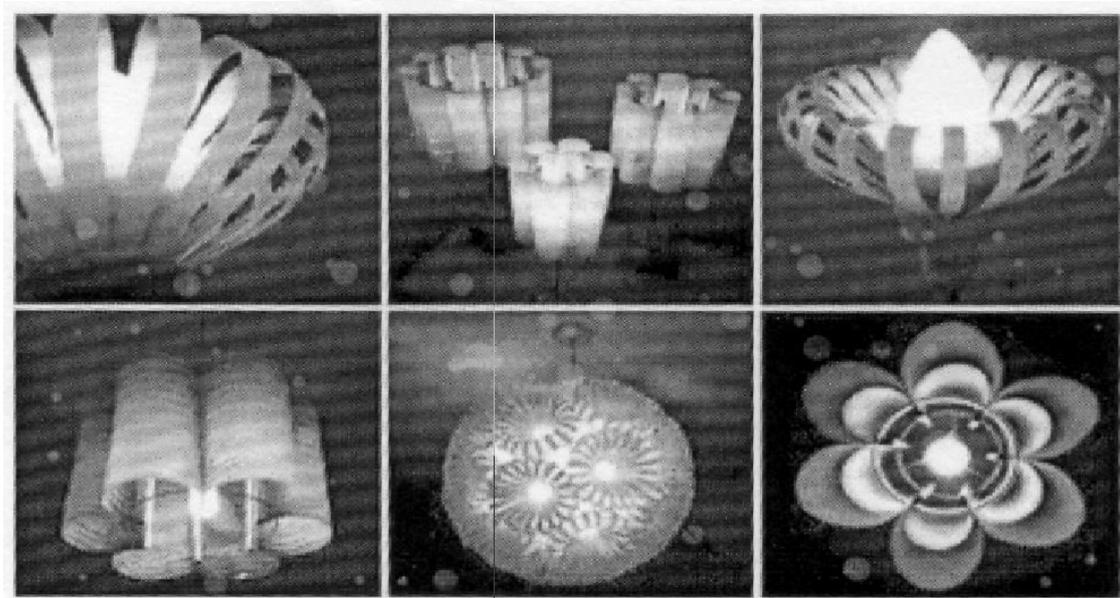


Fig. 3.10.7 Decorative lighting