

10. HOUSEHOLD LIGHTING

10.1 Concept of Lighting

10.2 Sources of Lighting

10.3 Principles of Lighting

10.4 Types and Methods of Lighting

Let's Discuss :

10.1 Concept of Lighting :

Light is the basic requirement of house. Light is necessary to create visibility, brightness, beauty and aesthetics in interior. It helps to create cheerful atmosphere. Light can enhance the colour, design, textures of material and various surfaces in the interior of a home. The quantity of light within a room depends on two factors- colour and texture. The colour scheme and the texture of walls, ceilings and objects determine the quantity of light being reflected and thus decide the illumination level in the room. A dull, dark or black colour and coarse texture will absorb more light. Another basic factor of lighting involves the colour of the light itself. Natural light appears to be bright, warm and has yellowish glow. The colour of daylight varies throughout the day. Artificial light is available in various colour.

10.2 Sources of Lighting :

Do you know ?

Natural and artificial lighting are the two main and commonly used sources of lighting.

1. **Natural lighting** : Natural light is available naturally. The most common source of natural light on earth is the sun. Natural light or day light is an important factor in the appearance of a room. The amount of light that enters a room depends on the number, size and location of doors and windows of

the house. The area occupied by the doors and windows should be equivalent to one-seventh to one-tenth of the total floor area of the room. Natural light helps a person to perform household tasks easily, without having any strain on the eyes and helps to save electricity.



Fig. 10.1 (a) Natural lighting in the room

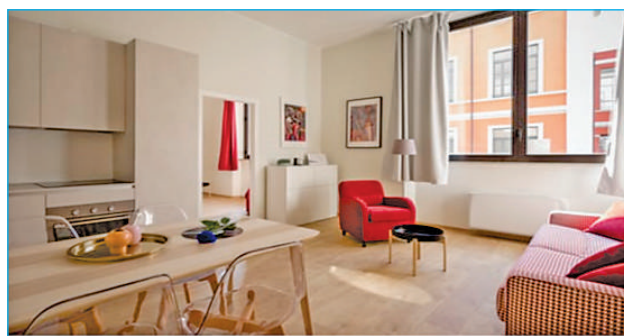


Fig. 10.1 (b) Natural lighting in the room

2. **Artificial lighting** : When day light or natural light is inadequate, artificial lighting becomes essential. Artificial light can be provided with the help of non-electrical and electrical lighting devices. Non-electrical lighting devices are candles,

oil lamps and gas lamps. Commonly used electrical lighting devices are incandescent bulbs, fluorescent tubes and bulbs, CFLs (Compact Fluorescent lamps), LED (Light Emitting Diode) and solar lighting. Now days artificial lights are available in various colour, size and shape and are becoming more popular day by day.

Always remember : The incandescent lamp or bulb was invented by Thomas Edison in 1879.

Sources of Artificial Lighting : Most common sources of artificial light are Incandescent Lighting, Fluorescent Lighting, CFLs, LED and solar lighting.

- **Incandescent Lighting :** Incandescent bulbs are available in the market. Incandescent bulbs produce light by heating a filament. The filaments are made of double coils of tungsten metal. It has high electrical resistance. It can sustain high temperature upto 2300°C at which it glows and becomes incandescent and emits white light. The bulb is sealed glass tube which is filled with Argon gas. When the electric current flows through the bulbs and lamps, it results in heating of filament tungsten and giving out the visible light. The incandescent bulb lasts for 750 to 1000 hours.

Advantages :

1. The installation cost is less in comparison to other lighting sources.
2. The cost of the bulbs is less than other fixtures of lighting.
3. There is no flicker in incandescent lighting.

Disadvantages :

1. It has warm and bright glow.
2. It produces more heat and less light.
3. It increases the temperature of a room.
4. It creates shadow, making it difficult to work.



Fig. 10.2 Incandescent Bulb

- **Fluorescent Lighting :** Fluorescent tubes and bulbs are available in the market in different shapes like linear, circline and u-bend etc. The standard length of fluorescent tubes is 48 to 84 inches.

It is a glass tube sealed at both the ends which is coated with phosphorus from inside and is filled with very small amount of mercury mixed and an inert gas Argon. When electric current flows through the gas between the electrodes, the gas is ionized and emits ultraviolet radiation, which cause the phosphorus substance to produce visible light. The colour of the light depends on the colour of the fluorescent phosphor powder coated inside the tube.

Advantages :

1. It gives soft and shadow free light.
2. It is economical and easy to use.
3. There is no stress on eyes and makes it easy to complete task.
4. It produces less heat in comparison to incandescent lamps.
5. It produces more light in less electric current, thus turns out to be cheaper.
6. The life of tubes is generally 7500 hours

Disadvantages :

1. It gives more flicker than incandescent bulbs.
2. Initial cost of installation is more as compared to incandescent bulb.

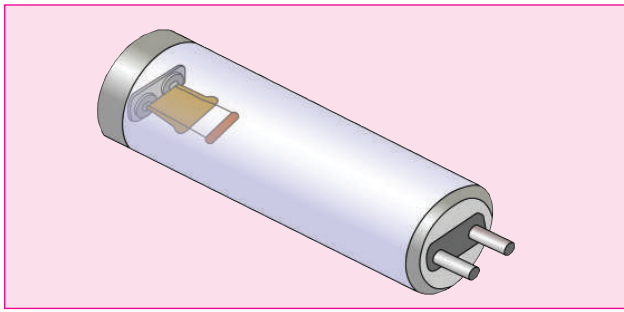


Fig. 10.3 Fluorescent Tube

- **CFL Lighting :** These are available in the market and are becoming more popular day by day than fluorescent tubes. The standard shapes of CFLs are single turn, double turn, triple turn, quad turn, circular and butterfly. The full form of CFL is “**Compact Fluorescent Lamps**”. These lamps are much smaller than other sources of lighting and are used for household and commercial lighting. They are designed to replace incandescent bulbs. They have 25% less energy consumption. They are more efficient and longer lasting as compared to incandescent bulbs. The average life of these lamps is 750 hours. CFL is a tube containing Argon gas and small amount of mercury vapor. When an electric current passes through it, invisible ultraviolet light is generated inside the tube. The tube is coated with phosphors that emit visible light. It has 75% less energy than incandescent bulbs. CFL produces 1170 lumens and uses only 20-21 watts of electricity.

Advantages :

1. CFL lamps and tubes consume 20 to 33% less electricity than Incandescent bulbs.
2. Filaments are not used in CFL.
3. CFLs are safe as they do not emit UV radiation.
4. They produce 70% less heat than Incandescent bulbs. The risk of home fire is less and hence they are safer to use.

5. The cost of these lamps is less than LED bulbs.

Disadvantages :

1. They produce full brightness of light.
2. The cost of CFL lamps is more than standard Incandescent bulbs.
3. These lamps don't work with dimmer switches.
4. CFL lamps contain a small amount of mercury, which is toxic.



Fig. 10.4 CFLs

- **LED Lighting :** LED bulbs are available in different sizes and shapes in market. LED stand for “**Light Emitting Diode**”. A diode is an electrical device or component with two electrodes. One is Anode and the other one is Cathode, through which electricity flows in one direction only. Diodes are made from semi-conductor material such as Silicon or Selenium. When current passes through the semi-conductor material the device emits visible light.

Advantages :

1. LED bulb is more durable than other lighting fixtures. It lasts up to 50,000 to 1,00,000 hours or more.
2. It has more energy efficiency than other lighting fixtures.
3. The light received from these bulbs has good quality.
4. It has low maintenance cost.

5. The size of LED bulb is very small than other lighting fixtures.
6. It starts very fast like Incandescent bulbs.
7. It does not increase the temperature of the room.
8. The average life of LED is five times more than CFLs.
9. It is environmentally friendly as it does not contain mercury or other hazardous substances.

Disadvantages :

1. LED fixtures are costlier than other lighting fixtures.
2. It cannot give a point source of light and hence it is not suitable where spherical light field is required.
3. Some LED lamps start with dimmer switch.



Fig. 10.5 LED Lamps

- **Solar Lighting :** Home lighting system is powered by solar energy using solar cells that convert solar energy (sunlight) directly to electricity. The electricity is stored in battery and used for the purpose of lighting whenever required.

The solar home lighting system is also known as photovoltaic system or solar power system. It is generally a fixed installation designed for domestic application. It can be installed virtually in any place.



Fig. 10.6 (a) Solar Lighting Panels



Fig. 10.6 (b) Solar Lighting Panels

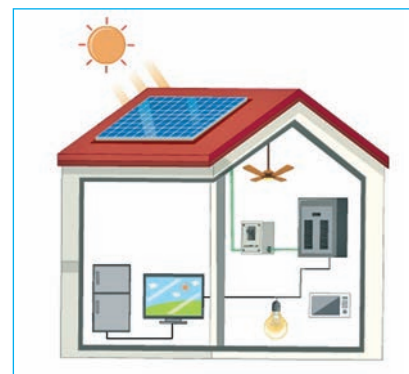


Fig. 10.6 (c) Solar Lighting System

The Solar Lighting system consists of the following :

1. Solar photovoltaic panel or solar cells
2. Solar Inverter
3. Battery
4. Fixtures like lamp, fan, etc.

The solar photovoltaic panel is installed on the roof or terrace and it is exposed to sunlight. The solar inverter and battery are kept inside and in a protected place of the house. The solar photovoltaic panel requires periodic cleaning for effective performance.

Solar panels absorb the solar energy which is then converted into electricity. The solar inverter converts this electricity from direct to alternating current. Light is received through the lighting fixture. The solar energy collected, is usually stored in chargeable battery and used later on when there is no sunlight to produce lighting.

Advantages :

1. Solar power is available every day.
2. Solar light is free from pollution and there is no emission of greenhouse gases.
3. It saves use of conventional energy sources.
4. Saves payment of utility bills and generates funds by selling the extra energy to the power company.
5. The maintenance cost is minimal.
6. It is safe to use than traditional lighting methods.

Disadvantages :

1. The initial cost of material and installation is very high.
2. This lighting system needs lot of space for installation.
3. Since there is no solar power available at night, the battery should have more capacity for storage of energy.
4. On cloudy and winter days less energy is produced.

Always Remember :

10.3 Principles of Lighting :

There are some principles to be considered while adopting light in a home.

- 1. Intensity of light :** The intensity of light must be considered while performing any household task. Right amount of intensity is required to do household tasks. If the intensity of light is in excess amount, it is harmful to eyesight or inconvenient to do proper work.

- 2. Steady or steadiness :** Steady or steadiness of light is essential in-home lighting. Household tasks can be performed easily, quickly and properly and without any stress on eyes if the light is steady.

- 3. Glare :** Glare is a condition of vision in which there is discomfort or a reduction in the ability to see the significant objects. Excessive contrast or large changes in brightness produce the effect of glare. When glare is present the efficiency of the vision is reduced and small details or subtle changes in tone cannot be perceived.

- 4. Light colour and colour rendering :** Lamps are assigned a colour temperature based on their “coolness” or “warmness”. Cool light is preferred for visual tasks because it produces higher contrast than warm light. Warm light is preferred for living spaces because it is more flattering to skin tones. Tubes or white glow light are used for daily household activities. Coloured bulbs are used for decorative purpose.

- 5. Safety :** Light is required in the interiors for safe movement and work by making the traffic lanes visible. To avoid accidents, adopt good lighting system in the home. Good lighting is helpful to increase beauty, and attractiveness that would enhance the aesthetic appeal of the room.

- 6. Architectural framework :** Construction of each house may be different according to needs of the family. While constructing home, first decide the placement of windows and doors. Natural light is helpful to do household tasks and also helpful for arrangement of artificial light.

- 7. Improvement of decoration :** Home decoration will get affected or enhanced due to proper lighting. Light is one of the essential elements of art. It enhances the beauty of the room, textured walls, furniture, furnishings and different decorative articles.

10.4 Types and methods of Lighting :

Know this :

• Types of Lighting :

This is an important aspect to be considered in construction of a house. The experts have given the three types of lighting based on purpose and the effect produced.

1. General or Ambient lighting
2. Task or Local or Specific lighting
3. Accent or Decorative lighting

1. General or Ambient lighting : General lighting is equivalent to day light or sunlight. It is an overall illumination which lights up the entire room evenly and allows people to see objects and surfaces. It produces safety for people to move in a room. It produces comfortable brightness; one can do work properly and quickly. General lighting can be direct, when the light shines directly on objects to be illuminated or indirect when the light is thrown against a surface usually the ceiling, from which some of the light is reflected. General lighting is also called as Ambient Lighting.

2. Task Lighting : Task lighting is used for specific area or specific task. It is necessary to remember that it is used along with general lighting. Task lighting provides more pleasant illumination, helps to avoid harsh lights and troublesome shadows. It helps to increase productivity by visual comfort and decrease stress level. It is also called as local or specific or directional lighting. Some of the simple examples of task lighting commonly found in household lighting methods are table or desk lamps, lamps at the dressing table etc.

3. Decorative Lighting : Decorative lighting is used to emphasize objects or areas. Decorative lighting is used to enhance the beauty of the room and to create different focal points to create different effect for giving attractiveness to the room. It is more frequently used to highlight decorative objects in a room. It can act as a decorative device. It is also called as “Accent” or “Architectural” lighting. Commonly observed examples are lighting above Sculpture, Painting, textured wall, outdoor landscapes etc.

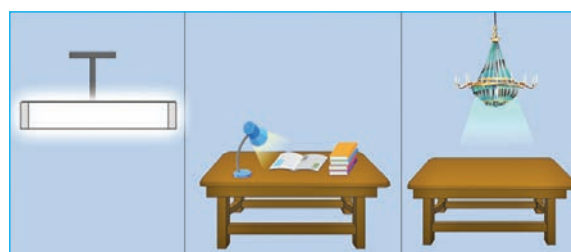


Fig. 10.7 Types of Lighting

List out various types of lighting observed in various areas of the house. Take a note of one example given below :

Area of the house	Type of lighting
Study table	Task lighting-Table lamp

• Methods of Lighting :

There are five lighting methods used in every home. Lighting methods are classified according to the direction of light, activity carried in a room and selection of fixture.

1. Direct lighting.
2. Indirect lighting.
3. Semi direct lighting.

4. Semi indirect lighting.

5. Diffused lighting.

1. Direct Lighting : In direct lighting system, 90 to 100% of light is projected downwards or towards the working area. This is the most common type of lighting and is used for many types of tasks. Direct lighting spreads light evenly all over the area. It tends to create glare, shadow and reflect light harshly. It is generally used in all the room in a house

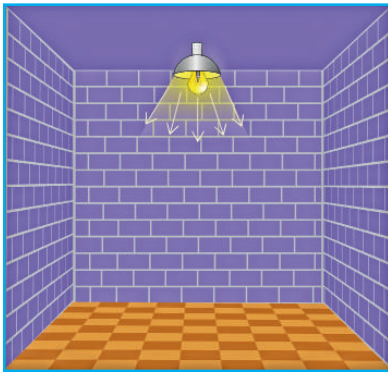


Fig. 10.8 Direct Lighting

2. indirect Lighting : In indirect lighting system, 90 to 100% of light is directed towards ceiling and or walls from where it is reflected back towards the object or in the working area. For effectiveness of this lighting method, the surface finishes of walls and ceiling in the room should be light or have cool colours and they should be highly reflective and must be kept clean. This method of lighting, minimizes glare, shadow and reflection. It is generally used in bedrooms.

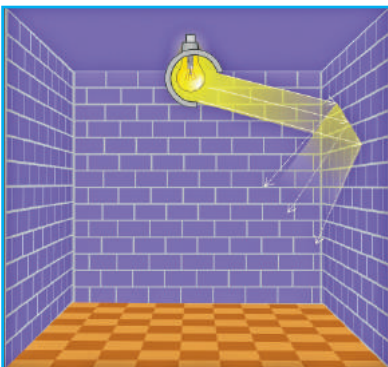


Fig. 10.9 (a) Indirect Lighting

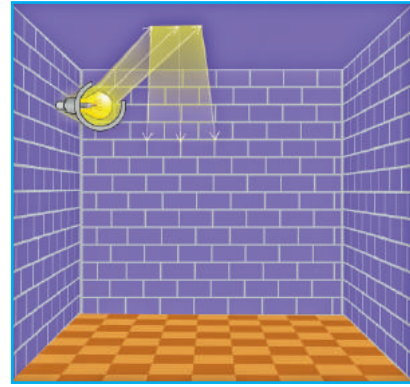


Fig. 10.9 (b) Indirect Lighting

3. Semi direct Lighting : In semi direct lighting system, 60 to 90% of the light is directed downwards; in the working area or object and remaining light upwards i.e. towards ceiling and walls is reflected back in the working area or on the object. This lighting system softens shadows and produces even lighting all over the room. It is generally used in kitchen room.



Fig. 10.10 Semi direct Lighting

4. Semi indirect Lighting : In semi indirect lighting system, 60 to 90% of light from the luminaires reflects towards the ceiling and walls from where it is reflected back in the working area. The remaining 10 to 40% of the light is received directly by the working area or the object. This method of lighting produces pleasant atmosphere in the room. It is generally used in dining room.

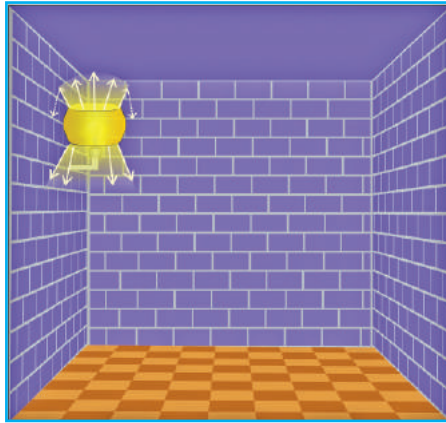


Fig. 10.11 Semi indirect Lighting

5. Diffused Lighting : In diffused lighting system, light is distributed equally in both upward and downward areas of the room. That means 50% of light is directed upwards that is, towards ceiling and walls and from there it is reflected back in the working area or on the object. Remaining 50% of light is directed downwards in the working area or on the object. It produces pleasing effect to the eye. It is generally used in all the room.

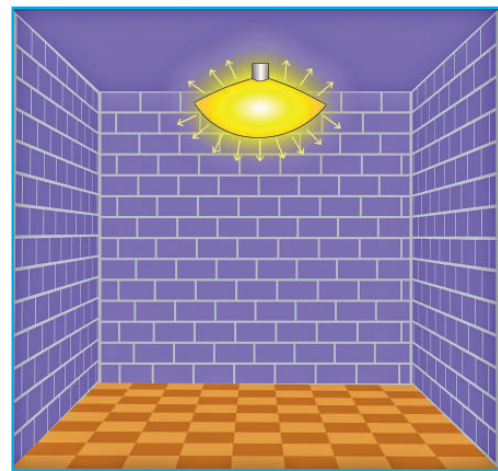
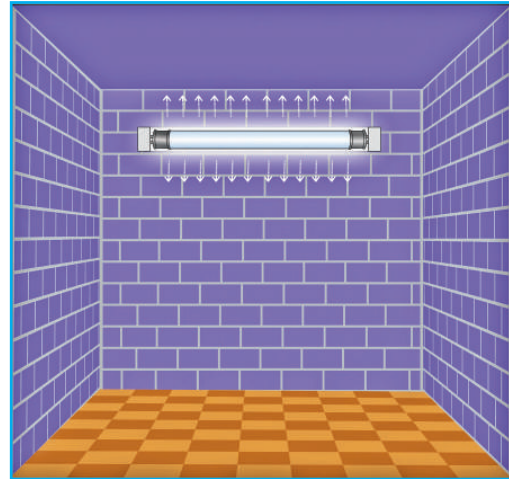


Fig. 10.12 Diffused Lighting

Can you recall ?

- Light is the basic requirement of house. Light is necessary to create visibility, brightness, beauty and aesthetics in interior.
- The purpose of lighting in a house is to provide visibility, create cheerful atmosphere and also give light to carry out various tasks in a room.
- Natural and artificial lighting are the sources of lighting.
- Nonelectrical lighting devices are candles, oil lamps and gas lamps.
- Electrical lighting devices are incandescent bulbs, fluorescent tubes and bulbs, CFLs lamps (Compact Fluorescent lamps), LED (Light Emitting Diode) and solar lighting.
- The incandescent lamp or bulb was invented by Thomas Edison in 1879.
- Intensity of light, steadiness, glare, light colour and colour rendering, safety, architectural framework and improvement of decoration are the principles of lighting.
- General lighting, Task lighting, and decorative lighting are the three types of lighting.
- Direct lighting, indirect lighting, semi direct lighting, semi indirect lighting and diffused lighting are the methods of lighting.

Exercises

• Objective questions :

1) Multiple choice questions :

1. The incandescent bulb was invented by _____ in 1879.
a) Thomas Edison b) James Maxwell
c) Michael Faraday d) Benjamin Franklin
2. Incandescent bulbs use _____ filament to produce light.
a) copper b) brass
c) tungsten d) steel
3. The standard size of fluorescent tube is _____ inches.
a) 28-38 b) 38-48
c) 48-84 d) 84 to 90
4. The full form of CFL is _____.
a) Common fluorescent lamps
b) Compact fluorescent lamps
c) Compound fluorescent lamps
d) Common filament lamps
5. Bulbs create _____ and makes it difficult to work.
a) shadow b) light
c) rays d) reflection

2) Match the following pairs :

A	B
i) General lighting	a) For specific ask
ii) Task lighting	b) To enhance the objects
iii) Decorative lighting	c) Light up the entire room

3) Identify whether the following statements are true or false :

- a) Filament tungsten metal is used in CFLs bulbs.
- b) LED stands for Light Emitting Diode.

- c) CFL bulbs are more durable than incandescent bulbs.
- d) The life of LED lamps is five times more than CFL.
- e) LED has more energy efficiency than other lighting sources.

• Short answer Questions :

1) Define the following terms :

- a) Natural lighting
- b) Task lighting
- c) Diffused lighting

2) Differentiate between the following :

- a) Incandescent lighting and Fluorescent lighting
- b) CFL and LED
- c) Direct lighting and Indirect lighting

3) Write short notes on the following :

- a) Incandescent bulbs
- b) Fluorescent tubes
- c) CFL
- d) LED
- e) Solar lighting

• Long answer Questions :

- a) Explain any two types of artificial lighting sources.
- b) Write general, task and decorative lighting.
- c) Describe the methods of lighting.
- d) Write about the principles of lighting.

Projects / Assignment :

- a. Observe the methods of lighting used in your home and analyze.
- b. Observe the types of lighting used in your college and list them out.
- c. Identify houses with solar lighting system in your locality and collect pictures.

