Module
4

Lighting Application

Lesson
15

Interior Lighting

Instructional Objectives

- List the factors responsible for interior lighting.

- State recommended requirements for Good Lighting

- List Factors governing light output

- State Maintenance procedures for proper interior lighting

- Enumerate recommended Illuminance levels

Interior Lighting

Interior Lighting is a complex problem depending on various factors such as

- Purpose intended service,
- Class of Interiors.
- Luminaire best suited,
- Color effect and
- Reflection from ceiling, walls, floors.

Good Lighting means intensity should be ample to see clearly and distinctly. The light distribution should be nearly uniform over a part of the room at least. It should be diffused that is soft and well diffused. Color depends on purpose and taste source but should approach daylight / yellow. Source location should be well above range of vision. To avoid glare intrinsic brightness is reduced by diffused glass ware and by remaining objects of secular reflection from range of vision. Shadows are a must for accentuating depth but should not too apparent abruptly or dense, they are not to be harsh and should toned down.

Standard practice is to have general lighting in all areas at a level comfortable to eye. It should eliminate dark shadows and avoid sharp contrast. In order to emphasize on parts that should be shown. Light sources located such that visual importance of object is kept in mind. Lamp may be concealed or counter lighted with a very low attention value to itself. Glare minimized by diffusing.

American Institute of Architects Recommends for Good Illumination.

1. General. Lighting – effectively illuminate all objects/areas with due regard to relative importance in the interior composition. Adequate for eye comfort throughout the room elimination of dark shadows and sharp contrasts – preserve soft shadows for roundness/relief – lighting emphasis on those parts that need first attention.

2. Light sources be subordinated in visual importance to the things intended to illuminate, except rarely when itself is a dominant decorative element. Unless – concealed/counter lighted, that they are not apparent they have extremely high attention value – dominate the scheme. If visible – so disposed – to attract eye to major feature of room than themselves.

3. Glare must be eliminated. Result of intense brightness in concentrated areas within the line of vision. Produced by excess brightness of visible light.

reflection of bright lights from – Polished – low diffused surfaces - extreme contrast of light/shade

Employ – means of diffusing – at source or finish the room - with Diffusing/Absorbing materials rather than reflecting material.

4. Level of illumination to be adequate for the type of eye work. Local lighting to supplement general lighting adequate illumination – working at m/cs – desks – reading tables High level local lighting is always to be accompanied by general lighting to avoid eye strain and minimize controls. If glare is avoided there is no over illumination. Natural light limits are for outdoor 107600 lux and 1076 lux for indoor. Level should be adequate for eye task expected.

5. General lighting is to be related and controlled to suit the mood. While worship, meditation, introspection need low levels. Gaiety, mental activity, physical activity or intense activity needs high levels. Theaters, homes and restaurants may need levels varied according to mood. Shops level should be appropriate to woo customers through psychological reaction. Offices, factories and schools adequate illumination to work w/o eye strain**.**

6. Light source must suit interior in style, shape and finish in all architectural aspects.

Trends

It is always taken care to keep brightest surface not greater than 3 – 4 times brightness of task on hand whereas brightness of task not greater than 3 – 4 times darkest surface. That is to say luminance ratio from brightest to darkest is 10:3:1. Eliminating glare results in good visibility, eases viewing, and creates pleasing psychological effect. All the calls for large light sources covering entire ceiling approaching sheet of light. This ensures good uniform illumination all over the room! Commonly white ceiling with semi indirect luminaires. One may employ false ceiling (white or off white) with translucent diffusing material on top of which an array of lamps are located. Major defects in lighting design are too bright luminaires, too dark floors and furniture. Preferred scheme is to have light color interiors with large sources of low brightness. Day light illumination or natural illumination, constantly changes, varies with weather, time of the day or season. Typically lower daylight levels on upper levels. This required looking into openings or windows. It is observed that at 20 – 25' from window, daylight falls below 10lx under these conditions artificial general lighting needs to be turned on. Common technique is to partially screen them, thus makes uniform general lighting. Top section of window should be as close to ceiling as possible. It controls the light to the deepest end of the room. Normally height to top window not less than ½ the depth of the room. Window area is responsible for glare. Hence termed glare are. Glare area = 1/5th the floor space. Shades, baffles, louver, diffusers are employed to control glare

If 'X' be the artificial illuminance that is sufficient for the task on hand: natural daylight illuminance (minimum) = 2X. Say windows are located only on one wall. Width of the room less than 2 times height to top of the window is preferred. Say windows are located on the opposite walls, width between the walls not greater than 6 times height to top of the window.

Location of lamps based on candle power, maximum allowable spacing, height at which located. Too great a spacing introduces dark shadows and dark spaces. Preferably lamps closer to ceiling, clear of obstructions are useful. They may be mounted on surface, suspended or recessed in the

ceiling. Typically tasks of great visual acuity are at a plane 1.2m above floor low hanging light units are used for local lighting. In using a matrix of lamps spacing not greater than mounting height.

Remembering that a plane source of light gives out light flux which produces illuminance independent of distance, mounting height is redundant when approaching a sheet of light.

Interior Finish

It is an important issue in interior lighting. Color reflectance – affects utilization white or off white or yellow are preferred. Typical reflectance for Ceiling is 70 – 85%, for Walls is 45 – 60%, for Floor is 10 – 20%. In addition systems need to be maintained regular by Periodic check preferably when lux levels fall by 20 – 25%, time to replace lamps. Usually luminaires are likely to collect direct light. 1½ times of minimum requirement is taken to take care of this. If voltage is maintained properly energy costs will be optimum. If voltage greater than labeled voltage, life is shortened. If voltage is less than labeled voltage, less light output results. Lamps and Luminaires are washed, cleaned. Direct lamps have less dirt, indirect lamps have more dirt. Luminaries are wiped with brush/dry cloth if necessary with a damp cloth. Grease removed by washing. Painting walls/ceiling – every 1½ - 2 years ensures good lighting levels. Clean offices may be lit using direct/indirect fluorescent lamps. Dusty smoky factory lit by mercury vapor direct or sodium vapor lamps. Replacement strategy should be related to large no. of lamps reach 70% of life preferably in a group.

This lesson covered issues pertaining to interior lighting. Best thing is to approach near plane source of light. Reflectance's of Walls, Ceiling and Floor also matter. Last but not least a good maintenance strategy is required.

Lecture Summary

- Good interior lighting is governed by :
  - intensity (ample to see clearly & distinctly)
  - distribution (nearly uniform)
  - soft & well diffused light
  - color (depending on taste / purpose)
  - source location should be above plane of vision (to avoid glare)
- Shadows are required for actuating depth of object. It shouldn't be too apparent abruptly or dense. Also it shouldn't be harsh & needs to be toned down
- General lighting controlled to suit psychological moods
- Natural / daylight illumination constantly varies with weather, time of day & season
- We design the window opening such that the minimum daylight illuminance is twice the artificial illuminance that is sufficient for the required task
- Location of lamps depends on :
  - candle power
  - maximum allowable spacing
  - height at which located
  - should be clear of obstruction
  - distribution of light required

- Color reflectance from the interior finishing affects utilization
- Interior lighting needs to be periodically checked & maintained
- Lamps should be replaced when they reach 70% of its life or illumination level falls below standard. Moreover it is preferred to change lamps in groups rather than individually.

Tutorial Questions

- What are the factors which need to be considered while designing interior lighting?
    - purpose of lighting or intended service
    - class of interiors
    - luminaires best suited
    - color effect
    - reflection from ceiling, walls & floor
- Why are shadows important while designing interior lighting?

    Shadows are important for actuating the depth of object to be perceived

- What are the defects in interior lighting considering from brightness point of view?

    Major defects from lighting systems arise due to too bright luminaires & too dark floor & interiors. So we should have light color interiors with large sources of low brightness

- What is the criteria for deciding the height of window?

    If windows are located on only one wall then the height to the top of window should be greater than half of the width of room. If windows are located on the opposite walls then the height to the top of window shouldn't be less than one-sixth of the distance between the walls.

- Why is periodic check of the interior lamps required?

    Periodic check is required because the lamps need to be replaced when they reach 70% of its life or illumination level falls below standard. Moreover regular maintenance is required to clean any accumulated dust / grease / moisture.

Source:http://www.nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Illumination%20Engg/Illumination%20%20Engineering/Lesson-15/pdf/L-15(NKK)(IE)%20((EE)NPTEL).pdf