



SUMMER – 13 EXAMINATION

Subject Code: 12148

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Important Instruction to examiners:

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more importance. (Not applicable for subject English and Communication Skills)
- 4) While assessing figures, examiner may give credit for principle components indicated in a figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case some questions credit may be given by judgment on part of examiner of relevant answer based on candidate understands.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q.1 A Attempt any three of the following

12 Marks

a) State advantages of good illumination scheme. (Any four points expected each point- 1 Mark)

1. Good illumination scheme encourage the personnel for better working.
2. In commercial, correctly planned scheme promote the sale.
3. In a factory lighting arrangements are planned to increase productivity & to improve the quality of production.
4. Correct & good illumination scheme avoid the accidents.
5. Adequate & glare free illumination provides pleasant atmosphere for staff.
6. Good lighting in schools & colleges helps in raising the average grades of the students.
7. In short good illumination scheme increases overall efficiency.
8. By proper illumination scheme energy saving will be effective & with cost saving also.

b) Why CFL Lamps are becoming more popular, nowadays? Discuss technically.

Because of following Advantages CFL lamps becomes more popular:-

(2 Marks)

- 1) Available in any shape



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- 2) Power consumption is less
- 3) Illumination efficiency is high
- 4) Life in working hours is large as compare to incandescent lamp.
- 5) Compact tube size as compare to fluorescent tube.
- 6) Maintenance cost is less
- 7) Can be available in various colours.

Discussion of technical points of CFL:

(2 Marks)

Compact florescent lamp(CFL) is available in various shapes. Bar type, U shaped or twisted form.

The working principal of CFL depends upon high frequency emission whenever 1-ph, 230 volt AC voltage is applied then that 230v AC supply is converted into low voltage 6V, 12V, or 24V. AC by step down transformer, This low AC voltage is converted into corresponding DC voltage by using rectifier. This d.c. voltage is converted into high frequency high voltage supply (for example 80v, 1 KHZ frequency) by using Inverter circuit. That high frequency supply is applied to that two terminals of CFL so that due to high frequency emission light will be emitted through CFL.

c) Explain the recommended illumination level required for any areas of Hospitals.

(Any four point expected- 1 Marks each)

S.No	Areas	Recommended illumination level
1	Reception & Nursing	250 to 300 lux station
2	Corridors & circulation	40 to 60 lux areas
3	Patient wards -	100 to 200 lux
4	Operation theatres -	600 to 1000 lux
5	ICU -	500 to 700 lux
6	General ward	100 to 200 lux
7	Special ward	150 to 250 lux etc

d) What are the standards for various situations of interior illuminations?

The Standards for various situations of interior illuminations:

(Any Four point expected Each point 1 Mark)

S.No	Location	Illumination Level
1	Entrances, Hallways	100
2	Living room	300



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3	Dining room	150
4	Bedroom: a) General b) Dressing tables, bed heads	300 200
5	Games or recreation room	100
6	Table games	300
7	Kitchen	200
8	Kitchen sink	300
9	Laundry	200
10	Bathroom	100
11	Bathroom mirror	300
12	Sewing	700
13	Workshop	200
14	Stairs Garage	100
15	Garage	70
16	Study	300

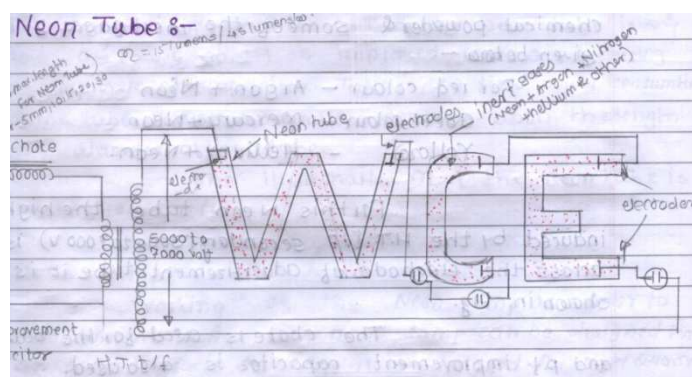
Q.1 B Attempt any one of the following

06 Marks

- a) State different types of lamps and explain construction and working principle with neat sketch of any one of lamps. **(Explanation of Any one similar lamp Expected Figure-3**

Marks & Explanation- 3 Marks)

i) Neon tubes:-



or equivalent figure

The construction & circuit diagram for neon tube is as shown in fig. Basically neon tube is used for advertisement or decoration purpose. The maximum length of tube is 8m. The available diameter for neon tubes are 5mm, 10mm, 15mm, 20mm, 30mm, etc.

In the neon tube we can achieve various colours with addition of the chemical powders & some of the inter gases. For this neon tube the high voltage induced by H.T. transformer secondary (5000 to 7000V) is applied across the electrodes of advertisement tube.



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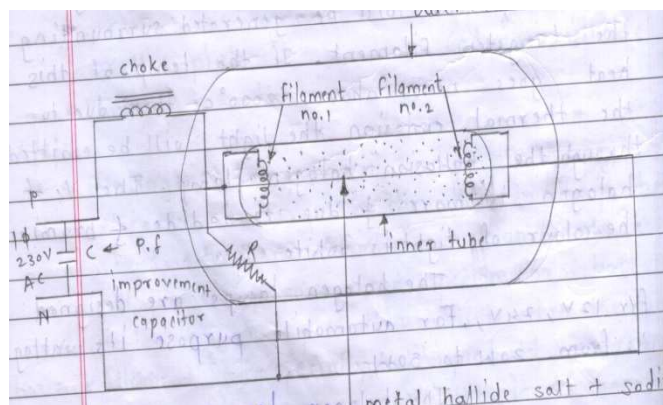
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1. The choke is used for ballast & power factor improvement capacitor is also used. For the neon tube the continuous high voltage is required, so that following precautions should be taken.
2. The neon tube should be installed by government authorized supervisor.
3. The metal body of the HT transformer must be earthed separately.
4. Caution notice of danger board is required.

ii) Metal Halide lamp:

Constructional it is similar to mercury lamp. Its discharge tube (inner tube) contains a drop of mercury which is named as 'metal' and halides such as thallium, indium or sodium. So the lamp is named as metal halide lamp.

Its operation is some similar to the mercury lamp. An arc is established between one main electrode & auxiliary electrode through argon gas and then regular discharge takes place between two main electrodes through mercury vapour. The light is produced from an excited mercury vapour and the products of dissociation of halide.



or equivalent figure

The halide cycle in metal halide lamp:

- Metal (mercury) atoms move from electric arc towards the tube wall where the halides are present.
- Near the wall, the temperature & vapors pressure allows the metals & halides to form a stable molecule which is known as metal halide molecules.
- When metal halide approaches the arc, molecules break apart.
- The halide move towards the wall and metals are excited and give out energy in the form of light.
- When enough metal atoms or loss during the operation the lamp fails.
- The outer glass may or may not be phosphor coated from inside.



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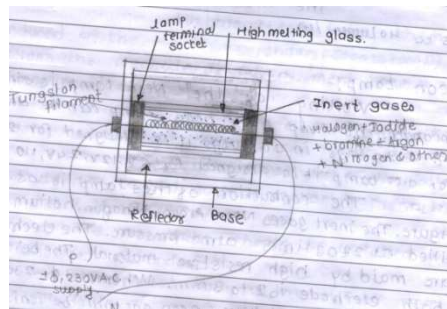
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- Electronic or auto transformer type ballast is used initiate the arc and to control the current,
- The capacitor is used to improve the power factor.
- The power ratings of lamp are from 175 watts to 1000 watts.
- The life is 2000 working hours.
- Some metal halides are used in indoor applications and the compact metal halide lamps are used for display and flood light etc.

iii) Halogen Lamp:-



or equivalent figure

- This is one type of incandescent lamp having number of advantages over the ordinary incandescent lamp.
- The life & efficiency of an incandescent lamp is affected by the gradual & evaporation of tungsten and also its operating temperature but the addition of small amount of halogen vapour to the gas in bulb restores.
- The evaporated tungsten vapour back to the filament by means of chemical reaction and the cycle goes on.
- Halogens are a group consisting of the elements chlorine, fluorine & bromine & iodine. As a result halogen lamps have the following advantages.
- There is no blacking of bulb so there is no depression of light output.
- It has 50 % more efficiency than that of an ordinary incandescent lamp.
- It is smaller in size.
- It gives better coloured radiation.
- Halogen lamps are manufacture upto 5KW and are suitable for outdoor illuminations such as illumination of building, airports, parking.



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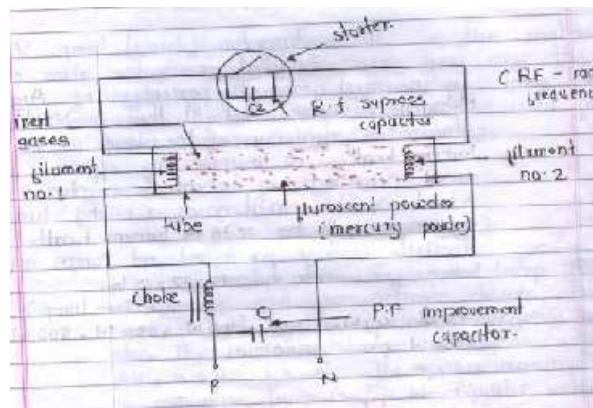
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iv) LED Lamp:-

The working principle of LED is similar to diode (P-N junction) whenever DC current flows through the light emitting diode, if the current path is from anode to cathode there will be voltage drop across the diode. It is 1.5V to 2.1V then light will be emitted through this diode.

- The LED lamps are energy saving lamps,
- The power consumption of the single LED is very less. It is in mw. So by using series & parallel combination of LED.
- The LED lamp is manufactured the available wattage for the LED lamps are 1W, 2W, 3W, 5W etc.
- The LED lamps are available in various colours and diameter. The life of LED lamp is very high minimum 10000 working hours.

v) Construction and operation of FTL



Construction:-

Fluorescent tube consists of tube, choke, starter & power factor improvement capacitor.

Operation:-

When switch is ON current flows through the choke-filament no1- starter-filament no2-to neutral, At that time choke induces high voltage which is applied to two filaments and ionized gas, Due to this there will be high voltage ionization so that light will be emitted through the tube. Choke is acting as ballast starter is used for make and break the circuit. To operate the fluorescent lamp, need a ballast (choke) to limit the current & provide the necessary starting voltage and starter for starting the tube.



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b) Explain various methods used for enhancing lighting control. (6 Marks)

A most common type of lighting control is ON/OFF toggle switch other types of lighting control include occupancy sensors, day light sensors, a variety of manual & automatic dimming devices and centralized controls.

Occupancy sensors including passive infrared, ultrasonic and dual technology sensors served three basic functions.

- i) To turn automatically light ON when a room becomes occupied.
- ii) To keep the light ON without interruption while the controlled space is occupied.
- iii) To turn the lights OFF within a preset time period after the space has been vacated.
- iv) Any method for light intensity control can be used.

Q.2 Attempt any two of the following

16 Marks

a) Given Data:

NOTE: CREDITS may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.

Area = A = 16 m x 10m = 160m²

Illumination = E = 200 lux

Lumens output of lamps = 3000 lumens

U.F. = 0.74, M.F. = 0.8

Determine: 1) Number of lamps if luminous efficiency of 14 lumens/watt

Solution: $Gross\ Lumens = \frac{A \times E}{U.F \times M.F}$ ----- (2 Marks)

$Gross\ Lumens = \frac{160 \times 200}{0.74 \times 0.8}$ ----- (1 Marks)

$Gross\ Lumens = \frac{160 \times 200}{0.74 \times 0.8}$

$Gross\ Lumens = 54054.054$ ----- (1 Marks)



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Lumens output of each lamp = 3000 lumens

$$\text{Number of Lamps required} = \frac{\text{Gross Lumens}}{\text{Lumens output of each lamp}} \text{----- (2 Marks)}$$

$$\text{Number of Lamps required} = \frac{54054.054}{3000} \text{----- (1 Marks)}$$

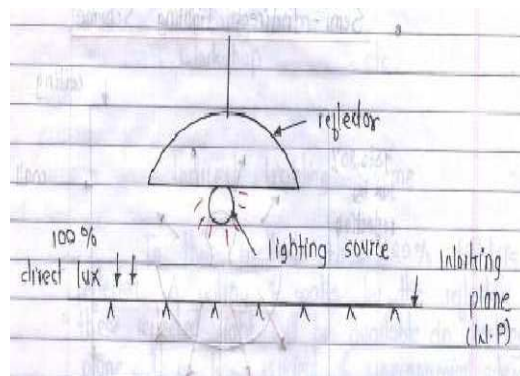
$$\text{Number of Lamps required} = 18.018 \approx 18 \text{ or } 19 \text{ Lamps} \text{----- (1 Marks)}$$

- b) List different types of lightings used for interior illumination and explain any one in detail. (List of type – 3 Marks, Figure-2 Marks & Explanation-3 Marks, Explanation anyone expected following types)

List types of lightings used for interior illumination:-

- i) Direct Lighting Scheme:
- ii) Indirect Lighting Scheme:
- iii) Semi direct Lighting Scheme:
- iv) Semi indirect Lighting Scheme:
- v) General Lighting Scheme:

i) Direct lighting:



or equivalent figure

In this method, the reflector is used on the lighting source. The 100% light is reflected by this reflector on the working plane. So efficiency of direct lighting scheme is very high and it is economical also. But limitation of direct lighting scheme is that glare & shadows are more. The direct lighting scheme is widely used in drawing room, workshop etc.



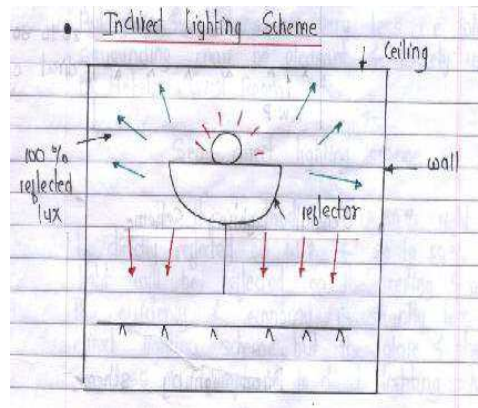
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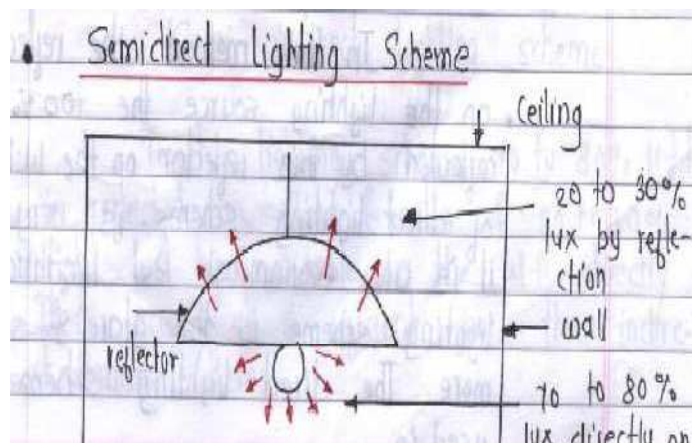
ii) Indirect lighting scheme:-



or equivalent figure

In this method the 100% light is reflected on ceiling and walls by the reflector and this reflected light will be available on working plane. It is less efficient and uneconomical scheme but glare and shadows are very less. i.e. why surrounding may be pleasant and widely used in hotels, guest room etc.

iii) Semi direct lighting scheme:-



or equivalent figure

In this method, the 70 to 80% light will be directly reflected on the working plane and 20 to 30 % light will be reflected on the ceiling and walls. The efficiency and economy is slightly less than direct lighting scheme. But the glare and shadows are less as compare to direct lighting scheme.



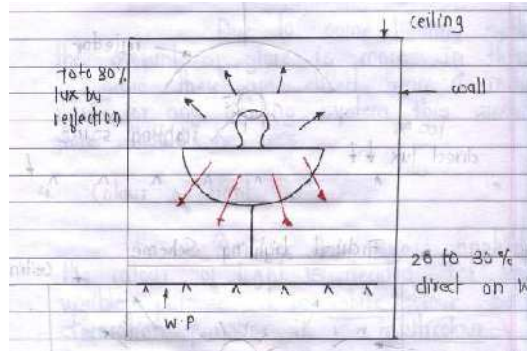
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iv) Semi indirect lighting scheme:-



or equivalent figure

In this lighting scheme, 70 to 80% light is reflected on ceiling & walls and 20 to 30% light will be available on the working plane directly. It is economical and efficiency as compared to indirect lighting scheme.

v) General lighting scheme:-

In this lighting scheme, the reflector is not used on the light source, so the lumens emitted by the light source will be reflected on ceiling wall and can be available directly on working plane also.

This method is commonly used in various residential, commercial and industrial installations.

c) State main objectives of street lighting. Explain two general principles employed in the design of street lighting. (Objective-2 Marks & General principle of design street light-3 mark each)

Main Objectives of street Lighting:

- 1) To make the road clearly visible.
- 2) To promote safety & convenience to the traffic.
- 3) To make the street more attractive.
- 4) To increase the community value of the street.

General principles employed in the design of street lighting.

In street lighting illumination design the two general principles are commonly used,-



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- 1) Diffusion principles
- 2) Specular Reflection principle

1) Diffusion principles -

In this method makes use of light being directed from lamps to provide more or less illumination on the road surface. Specially made reflectors are used to avoid glare.

Illumination level on road is calculated by inverse square law.

2) Specular reflection principle -

In this method obstruction will be clearly visible to the driver by using reflectors with small angle of incidence. In this method reflectors are used in such a way that driver can see any object clearly from more than 40 m distance on road. So that accident will be less.

Q.3 Attempt any Four of the following

16 Marks

a) Define the following terminologies related to illumination. (Each Definition-1 Mark)

i) Luminous intensity:

The Luminous flux emitted by the light source per unit solid angle called as the luminous intensity. **OR** $I = \frac{\phi}{w}$ (Where ϕ = luminous flux, w = Solid Angle)

ii) Candle power:

The candle power is the radiation capacity of the light source in the given direction. The candle power is always given in lumens output per unit solid angle of the given light source. **OR** $C.P = \frac{\text{Lumens}}{w}$, (Where w = Solid Angle)

iii) Reduction Power:

It is ratio of mean spherical candle power to the mean horizontal candle power.

$$\text{Reductio Power (factor)} = \frac{M S C P}{M H C P}$$

iv) Space-Height ratio:

$$\text{Space height ratio} = \frac{\text{Space between lamps}}{\text{Height of lamps above working plane}}$$



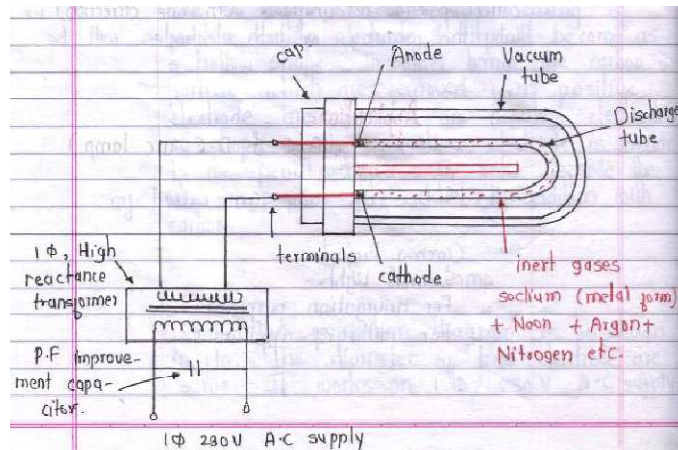
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- b) Explain construction, working principle with the help of neat circuit diagram for sodium vapour lamp.
(Construction-2 Marks, Working-1 Marks & Figure-1 Mark)



or equivalent figure

Construction:-

Above figure shows constructional details of sodium vapour lamp. It consists of 'U' shaped tube and at the ends of the tube two electrodes are sealed. This tube is filled with sodium and small quantity of neon gas. Since there is great effect of the change of surrounding temperature on the light output given by the lamp, hence the inner tube is enclosed in an outer double walled glass tube. Before sealing the lamp vacuum is created between the two glass tube (inner & outer).

Working:-

Before the lamp starts working, the sodium is usually in the solid form deposited on the sides of the inner tube wall. When the voltage is applied to the lamp it warms up and starts vaporizing slowly and radiates out yellow colour light and after about 20 minutes, the lamp starts giving it's full output.

- c) State and explain various design techniques of interior illumination.

(Types of design – 1 Marks & Anyone explanation of following types expected-3 Mark)

Types of lighting used for interior illumination:

- Lumens or Light flux method
- Point to point or Inverse Square law method
- Watts per Square meter method



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i) Lumens or Light flux method:

This method is applied where an average illumination is required also when uniform illumination is required. Total lumens output is calculated from the efficiency of each lamp and the number of lamp is used in the circuit. To calculate lumens received on the working plane, The total lumens already calculated multiplied by the co-efficient of utilization, when the lamps & the surroundings are not perfectly clean then while calculating the lumens received on the working plane, the depreciation factor or maintenance factor is taken into consideration,

Thus lumens received on working plane = (Number of lamps \times wattage of each lamp \times efficiency of each lamp \times coefficient of utilization) / (depreciation factor)

OR

= number of lamps \times wattage of each lamp \times efficiency of each lamp \times utilization factor \times maintenance factor

ii) Point to point or Inverse Square law method:-

This method is applied where the illumination is required at a point due to one or more sources of light. The illumination at any point within the range of lamp can be calculated from the inverse square Law.

If a polar curve of lamp and candle power of lamp reflected by its reflector in different directions is known. If two or more lamps are illuminating the same working plane, illumination due to each can be calculated and added. This method is not commonly used due to more complications involved in its calculations. However, It is used in flood lighting & the yard lighting calculations.

iii) Watts per Square meter method:-

Basically it is a thumb rule method. It is very handy for rough calculation or checking. While applying this method we allow watts/square meter of area to be illuminated is taken accordingly to the illumination desired on an average value considering overall efficiency of the lighting system.



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- d) What are the various factors to be taken into account while designing? 1) Flood lighting
2) Sports Lighting

1) Flood Lighting:

Following factors are to be considered for flood lighting:- (Any four point Expected 2 Marks)

- i) **Comfortable:** - The energy illumination scheme should be comfortable to everybody.
- ii) **Pleasant surrounding:** By the electrical lighting or the electrical illumination scheme the surrounding area of that location should be pleasant.
- iii) **Long Life:** - The life of the designed illumination should be larger.
- iv) **Economy:** - The cost of the designed illumination scheme should be low.
- v) **Less maintenance:** - For any type of illumination scheme the maintenance & repairing should be less.
- vi) **Appearance:** - The appearance of illumination scheme should be good.
- vii) **Fewer glares:** - The glare is fatigue to the human eyes. The illumination scheme is designed in such a way that there should be less glare to everyone i.e. Only electrical & mechanical accidents will be less.
- viii) **Fewer Flickers:** - The flicker is change in light intensity. This flicker should be always less for any type of illumination scheme. In the flicker there are change of stroboscopic effect at the time of workshop lighting in it is very important.
- ix) **To avoid hard Shadows:** - The whole illumination scheme is designing for minimum shadows. At the time of flood light the hard shadows are avoided.
- x) **Sufficient lux Level:** - The lux level is decided by the type of application, type of location.
- xi) **Cleanliness:** - The illumination scheme should be free from any type of ash, smoke or any other air pollution it should be clean.
- xii) **Simple Control:** - The illumination scheme designed by the electrical lighting is very simple. The control, multicolour light intensity control is also possible in electrical illumination.



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2) Sports Lighting:

Sports lighting design can be done by considering following points: (Any four point

Expected 2 Marks)

- 1) Types of sports –indoor or outdoor.
- 2) Illumination level required for that sport.
- 3) Time of sports whether it is day or night.
- 4) Area of illumination which is to be illuminated.
- 5) Surrounding conditions of the ground.
- 6) Height of the tower for the flood light which is installed near to or surrounding the ground.
- 7) At the time of sports light regular designing factor for example, working plane area, utilization factor waste light factor depreciation factor etc. are to be considered.
- 8) Power required and available should be also taken into account.
- 9) Maintenance and repairing cost should be also less.
- 10) Life of the projector & bunched filament lamp should be high.

e) List special purpose lamps used in photography video films.(Any four point expected 1-Mark each)

1. Special purpose low pressure pulsed xenon lamps.
2. Super actinic lamps. (special purpose)
3. Mercury vapour lamp (special purpose)
4. Special purpose compact sources mercury lamps. These are super-high pressure mercury lamps. These have high energy concentration with a small dimension. Hence high brightness is possible.(500-1000W lamps)
5. Special purpose compact source Xenon lamps, chief advantages is that optical adjustment remains constant, when once set and perfect in operation. This is to be used only on D.C supply.
6. Special purpose tungsten filament lamps of 1000W or 500W for photography **OR**

It is a standard method which is used in video and still photography. In this 3 points method Key light, fill light and back light are used. Key light is a principal illumination



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source from front side. Fill light is used from side (left or right). It balances the shades. Back light shines on rim, shoulder, hair etc.

f) Describe the lamps used agriculture and horticulture.

(Agriculture 2 Marks & Horticulture- 2 Marks)

Following Lamps used agriculture and horticulture:-

If any type of agriculture or horticulture premises if the natural sunlight is not available then high pressure sodium lamps and metal halide lamps are to be used.

The requirement of agricultural or horticultural lighting is similar of flood lighting and lighting calculations is also same. Only difference is that basic lux level is decided by the type of applications.

In the greenhouse the fluorescent tubes, the CFL are also used for energy saving purpose. The metal halide lamps which are to be used in the green house having the wattage of 75W, 250W and 400W.

In any types of green house, the all environmental condition which are required for plant growth these all conditions are artificially provided by the lighting scheme. These all Surrounding conditions may be room temp. Humidity, wind pressure, sunlight and percentage of water.

In the green house we can use standard high pressure lamp of 250W, 500W, 1000W etc. In these types of lamps, there may be sodium vapour lamp and mercury vapour lamp.

Q.4 Attempt any three of the following

12 Marks

a) Compare incandescent and energy efficient CFL lamps on the basis of efficiency, lumen output, cost and life span.

(Each Point- 1 Marks)

S.No	Points	CFL	Incandescent Lamp
1	Efficiency	High (40 to 60 lumens per watt)	Low (12 to 15 lumens per watt)
2	Lumen output	High	Low
3	Cost	High	Low
4	Life span	High or (more than 10000 working hrs)	Low or (600 to 800 working hours)



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b) State and explain purpose of lighting control. (Any four point expected 1- Mark each)

Purpose of Lighting Control:

1. Shadows: - Shadows should be minimum.
2. Glare: - Glare should be minimum.
3. Uniformity: - uniform distribution of light throughout the working plane.
4. Colour of light: - Choose fitting which produces colour like a day light e.g. Fluorescent tube
5. To turn ON or OFF the the lamps
6. For dimming, the dimming control permits the adjustment of lighting over a range.
7. For changing the lighting levels according to need or desired of the owner.
8. For energy saving.
9. To increase the life of lighting source.
10. To increase the safety of lighting system.
11. In some types of industrial or automation there is anent of lighting control.
12. To provide proper lux level on working plane the lighting control is required.
13. To provide proper lux level on working plane the lighting control is required.
14. As per Indian or international standard
15. To control the brightness of T.V monitor there is need of lighting control.

c) What are the design considerations to be followed while designing commercial illumination?

(Any four point expected 1- Mark each)

1. Visit to corresponding site and make the proper survey of every room and its interior applications. Measure the dimensions of every room (length, width, height). Make the proper plan layout with proper isometric view.
2. Find out application and working plane of every room.
3. As per the illumination standard decide proper lux level on that particular working plane.
4. As per quality of civil work and surrounding conditions and colour of walls and ceiling decide waste light factor, utilization factor, depreciation factor etc.
5. Find out total lumens required on working plane.



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$$\text{Total lumens required on working plane} = \frac{AIW}{CD}$$

6. Decide the type and wattage of lamp which is to be used for that particular application
7. Assume the proper illumination efficiency of those specific lamps which are to be used on that working plane
8. Find out total no. of lamps and tubes for that particular working plane and after that find out total no. of lamps & tubes or any other lamps for interior application of commercial installation. By assuming proper space to height ratio make the proper illumination scheme. This procedure is repeated for every working plane in every room.
9. Find out total no. of lamps or tubes for that particular working plane

$$\text{Number of Lamps required} = \frac{\text{Total Lumens Required}}{\text{Wattage of each lamp} \% \eta \text{ of each lamp}}$$

10. Find out total power consumption of all interior applications for calculated lamps and tubes.
11. Find out the rated current for all applications.
If 1Ph, 230V supply is provided, $P = VI \cos \phi$
If 3ph, 400V supply is provided, $P = \sqrt{3} VI \cos \phi$
12. Determine size of wire or cable required for whole residential or commercial installation. The size of wire is decided by the starting current, which is 1.5 times rated current, for momentary overload S.C. future expansion and starting surge.

d) What is flood lighting? State the various purpose of flood lighting.

Flood Lighting: - Flood lighting means flooding of large surface area with light from powerful sources using projector (1 Marks)

Various purpose of flood lighting: (3 Marks)

- 1) **Aesthetic flood Lighting** : It is used for buildings at night, ancient building and monuments, churches & gardens etc



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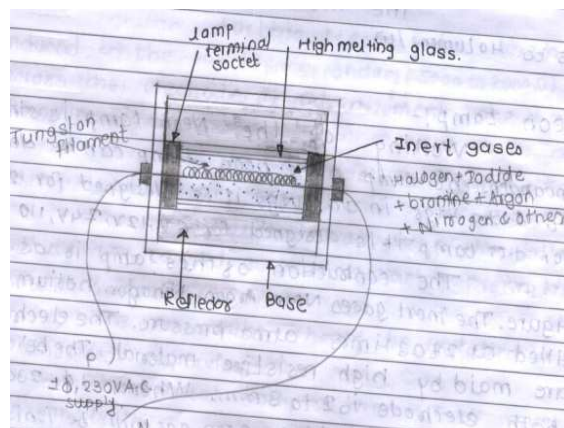
- 2) **Industrial & Commercial Flood lighting:** It is used for illuminating railway yards, stadiums, car parking area etc.
- 3) **Advertising flood lighting:** It is used for illuminating advertisements, boarding's etc.

Q.4 B) Attempt any one of the following

6 Marks

- a) Explain with the help of neat sketch, construction, working principle and applications of halogen lamp. (Figure-2 Marks, Construction-2 Marks, working-1 Mark & Application-1 Marks)

Halogen Lamp:-



1. This is one type of incandescent lamp having number of advantages over the ordinary incandescent lamp.
2. The life & efficiency of an incandescent lamp is affected by the gradual & evaporation of tungsten and also its operating temperature but the addition of small amount of halogen vapour to the gas in bulb restores.
3. The evaporated tungsten vapour back to the filament by means of chemical reaction and the cycle goes on.
4. Halogens are a group consisting of the elements chlorine, fluorine & bromine & iodine. As a result halogen lamps have the following advantages.
5. There is no blacking of bulb so there is no depression of light output.
6. It has 50 % more efficiency than that of an ordinary incandescent lamp.



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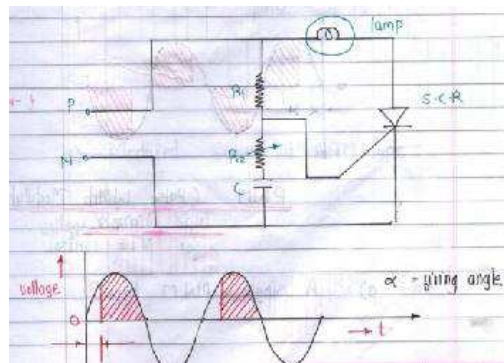
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7. It is smaller in size.
8. It gives better coloured radiation.
9. Halogen lamps are manufacture upto 5KW and are suitable for outdoor illuminations such as illumination of building, airports, parking.

b) Explain with the help neat sketch the working of electronic dimmer used in illumination control. (Any one type of electronic dimmer explanation expected, Figure-2 Marks, Working- 4 Marks)

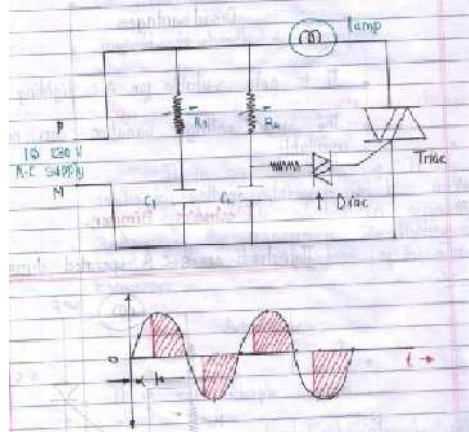
Thyristor or SCR operated dimmer:–



The SCR is generally used as switching component in electrical system. In the SCR when the anode terminal is +ve cathode is –ve and if the trigger pulse is applied to the gate of the SCR, then at that moment SCR will start conducting.

In the present circuit the capacitor is charged through variable resistance R_2 so that Charging time constant (R_2C) will be decided and after that whenever capacitor is fully charged it will discharge through the gate terminal, and SCR will be fired [ON]. The firing period is decided by the value of R_2C i.e. why conduction & firing angle will be changed. This firing angle may be vary 0 to 180° i.e. why the fired output voltage can be (variable) available across the lamp. So that light intensity will be changes, By the SCR only +ve half cycle are controlled.

Triac operated Dimmer:–



In this method, the limitation of thyristor operated dimmer is overcome. The triac is nothing but two SCR connected back to back and gate terminal is common. It will conduct +ve or -ve half cycles.

Whenever capacitor C1 & C2 are charged through the resistance R1 & R2 for +ve half cycle, capacitor C2 will be discharged through the gate terminal i.e. why the firing angle or conduction angle is decided by this R_2C_2 values.

But for the -ve half cycles the capacitor C1 is charged & discharged through the R1 & firing angle is decided by this R1C1 values.

In this way both half cycles are controlled by using triac type dimmer. To get the unidirectional pulse diac is used in series with the gate.

This method is commonly used for light intensity control and other application also e.g. fan regulator.

Q.5 Attempt any four of the following

16 Marks

a) State and explain laws of illuminations.

(Each Law- 2 Marks)

Mainly there are two laws of illumination,-

1. Inverse square law
2. Lambert's cosine law



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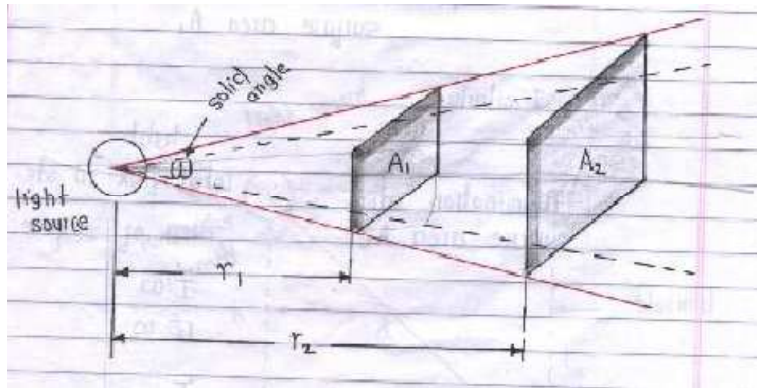
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1) **Inverse square law:-**

This law states that “the illumination of a surface is inversely proportional to the square of distance between source of light & surface area and it is also directly proportional to the luminous intensity (I) or candle power of the lamp in that direction.

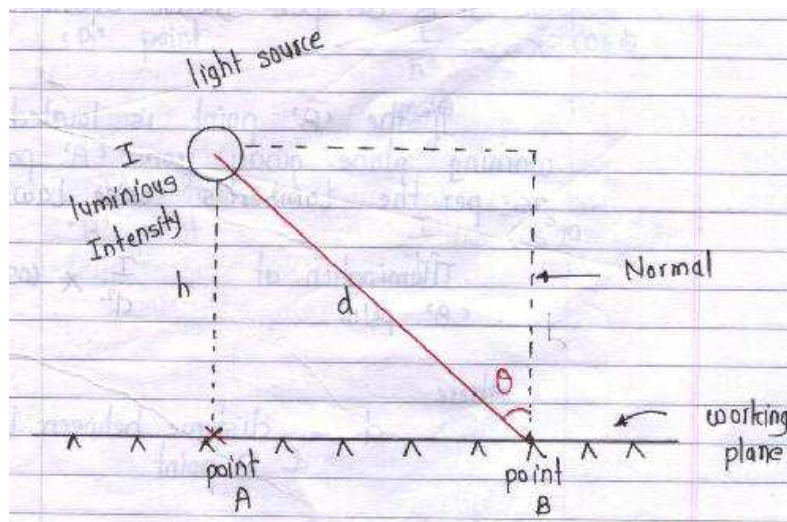
$$\text{Illumination at A point} = I / r^2$$



2) **Lambert's cosine law:-**

This law states that “the illumination E at any point on a surface is directly proportional to the cosine of the angle between the normal at that point and the line of flux.

$$\text{Illumination at B point} = I/d^2 \times \cos \theta$$





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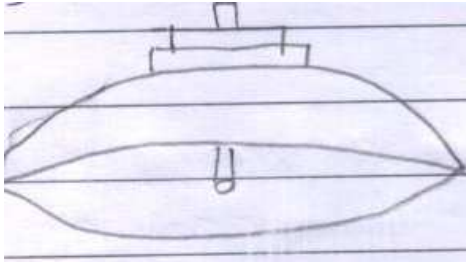
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b) Explain how different types of reflectors are used for enhancing interior illumination.

i) Diffusing Fitting:-

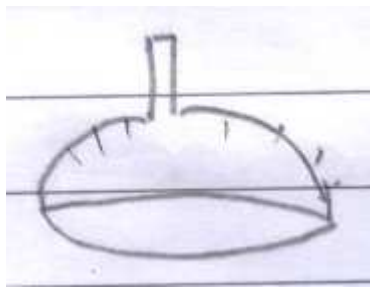
(Each Type of Reflectors -1 Mark each)



or equivalent figure

These give high quality of light minimizes glare and gives less shadows. A diffusing glass screen may be fixed across the standard reflector in order to get more diffused light.

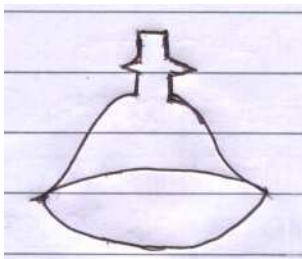
ii) Concentrating Fitting:-



or equivalent figure

These have a shape of deep parabola. Space to height ratio required is to get uniform distribution of light waste light factor is more in such cases. It is suitable for high mounting height as required in workshop and industries, having electric overhead cranes.

iii) Dispersive Reflector:-



or equivalent figure

This is most commonly used in industries. The space to height ratio is 1.5, which gives uniform from illumination. These are preferred for moderate ceiling height.

The lamps rated for 40-1500 watt are fixed inside for reflector.



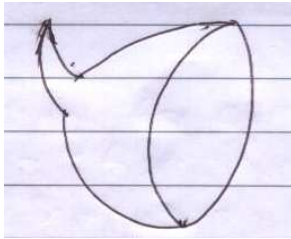
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iv) Angle Reflectors:-



or equivalent figure

The vertical surface cannot be illuminated by normal overhead lamps, in such cases angle reflectors are used. These are available in various shapes like parabolic, elliptical etc. The choice depends on the requirement illumination.

c) Which lamps are used for industrial premises and why?

i) In industrial premises for indoor lighting:

(2 Marks)

Incandescent lamp, Fluorescent tubes, CFL, LED lamps (for the showroom) are commonly used because to get better illumination, low power consumption, less maintenance and better economy

ii) For Outdoor applications:

(2 Marks)

We can use Halogen lamps, mercury vapour lamp, sodium vapour lamp, metal halide lamp etc to get better illumination during night period

d) State different types of lighting used for advertisement and hording.

Following are the different types of lighting used for advertisement and hording:

(4 Marks)

- i) Neon Sign Tube Lighting System
- ii) Metal Halide lamp lighting system
- iii) Flood Light Lighting System
- iv) Halogen Lamp lighting System
- v) LED Lighting System and similarly types of lamps



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e) State the requirement of illumination scheme for aquariums and shipyards.

The requirement of scheme for Aquariums:- (Any Four points Expected 1/2 Marks Each)

- i) The aquarium lighting depends on the size of the aquarium tank (Length, width and depth).
- ii) The aquarium lighting depends upon the all surrounding condition e.g. colour and size of the given hall in which the aquarium is placed.
- iii) The aquarium lighting depends on the maintenance schedule of the tank water and other aquarium accessories.
- iv) The aquarium lighting depends on the surrounding temperature and required temperature of water in the tank.
- v) In sum type of aquarium the ultraviolet lamp are provided for the bacteria killing purpose.
- vi) The aquarium lighting also depends on the various aquarium lighting also depends on the various aquarium accessories used in the tank.
- vii) The aquarium lighting should be electricity and mechanically safe to the all type rises and operator also.
- viii) The aquarium lighting should be economical.
- ix) The life of the aquarium lighting should be long.

The requirement of scheme for shipyards:- (Any Four points Expected 1/2 Marks Each)

- i) The shipyard lighting always depends.
- ii) The shipyard lighting always depends upon the all surrounding conditions for e.g. wind pressure, rain fall, location of shipyard from the sea-shore etc.
- iii) The shipyard lighting always depends upon the type & capacity of alternator which is held in ship for interior applications and the capacity of alternator which is installed in the ship-yard and any other non-conventional sources installed in that particular area for all outdoor application.
- iv) In the every shipyard there may be limitation conventional sources to over-come these limitations sometimes non-conventional sources for e.g. solar, tidal, wave-let, etc non-conventional energy sources are to be used. At the time of illumination design we have to consider this factor.
- v) In the ship-yard after scotching various shipyard is necessary for this case control room, emergency –control, emergency medical centre. Loading and loading areas etc. are



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- required, at the time of illumination design we have to consider all these applications for its standard lux level.
- vi) In the every ship-yard the electrical & mechanical safety is the prime-moto. At the time of illumination design the all safety precautions are to be taken.
 - vii) The life of the shipyard lighting should be always more.
 - viii) The cost of the ship-yard lighting should be always economical.
 - ix) The every ship-yard station should be free from any type of pollution for e.g. water pollution, sound pollution or noise pollution to the commercial communication signals.
 - x) At the time of ship-yard lighting for the outdoor applications we have consider total area of water, which is covered by the illumination.
 - xi) The ship-yard lighting is always at the remote place slightly away from the sea-share, so at the time of ship-yard lighting the every wiring & can be replace easily.
 - xii) The maintenance and the repairing of the shipyard lighting system should be simple & less, at the time of ship-yard lighting the navigation signals and lights are very important to control the various ships at the time of ship-yard lighting we have to consider this factor also.
 - xiii) In the ship-yard lighting the various lamp are used to get the proper lux level and for energy saving purpose also, the some of the lamps are as below-forged, Bollards, foot lamps, solar grass lamps, LED-Solar energy lawn lamps, various focus lamps, metal halide lamps etc.

Q.6 Attempt any four of the following

16 Marks

- a) Distinguish between LED lamps and Neon sign tubes (Any four point expected- 1 Mark each)**

S.No.	LED Lamps	Neon sign Tube
1	To glow the LED high voltage is not required	To glow neon tube high voltage is required.
2	Colour of lights is not depends on gas filled in the lamp	Colour of lights depends on gas filled in the lamp
3	Power consumption is less	Power consumption is more



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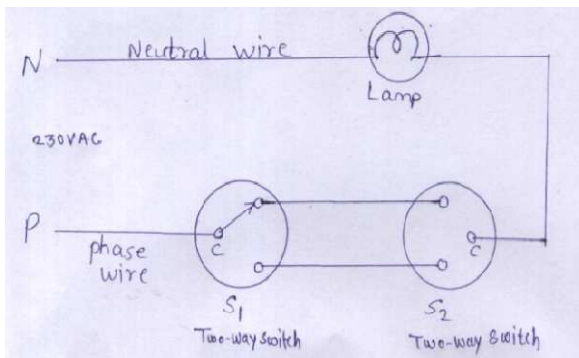
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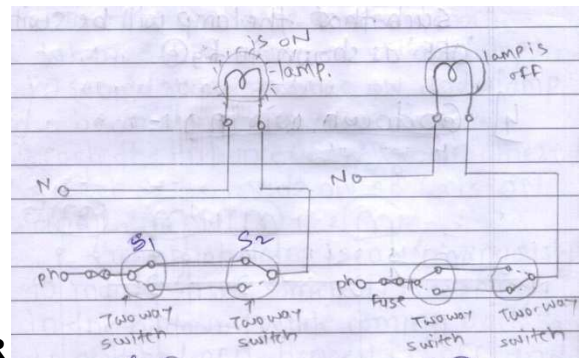
4	It can be used for general propose lighting as well as advertizing propose	It is only used for advertizing propose and not for general illumination.
5	Long Life	Moderate life
6	No Maintenance	Maintenance of auxiliary are required
7	Cost per watt is high	Cost per watt is comparatively less

b) With the help of neat circuit diagram explain the control of one lamp from two switches.

(Figure-2 Marks & Explanation-2 Marks)



OR



or equivalent figure

This system is commonly used for stair case wiring. It consists of two way switches (the switch operates always in one of the two possible positions) the circuit diagram is as shown in figure above.

Assume that the lamp is in between ground floor and first floor with switch S_1 is on ground floor and S_2 is on first floor. When the position of the switches S_1 & S_2 is as shown in figure then the lamps is 'ON'. When a person reaches on first floor the lamp is required to be switched 'OFF' so the person will change the position of switch S_2 such that the lamp will be switched 'OFF'.

c) What are the design requirements for indoor factory lighting?

The following design requirement for indoor factory lighting:- (Any four point expected- 1 Marks each)

- 1) The type of industry or factory.
- 2) The total premises area of the whole factory in m^2 .



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- 3) The location of the factory.
- 4) The surrounding conditions. e.g. wind pressure, natural sun light, rainfall, etc.
- 5) The type of product which are manufactured in the factory.
- 6) The total indoor & outdoor area of the given factory.
- 7) The necessary lux level for the outdoor locations to increase the beauty of the factory at night, and pleasant working conditions.
- 8) The working plane required for the indoor application whether it is a ground surface or above ground surface.
- 9) The application of every room in the given factory. e.g. office, workshop, Research & development centre, testing centre, maintenance & repairing department, quality control department, sales department, commissioning department, showroom, guest room etc.
- 10) The required lux level for indoor premises in the given factory is decided as per application of department. e.g. In Workshop - 200 lux, e.g. In Showroom - 350 lux
Above lux level is assumed.
- 11) As per civil construction work, the colour of ceiling walls & machines. The waste Light factor, utilization factor & depreciation factor is decided.
- 12) To minimize the stroboscopic effect & to minimize the glare the combination of various types of lighting source are selected.
- 13) The location & mounting of light source are selected in such a way that electrical & mechanical accident will be less.
- 14) The maintenance and repairing work for the whole illumination scheme should be less.
- 15) The overall cost of the illumination scheme should be less.
- 16) The lighting sources are selected in such a way that the overall power consumption will be less.
- 17) The lighting sources are selected and the illumination scheme is designed in such a way that the replacement of lighting accessories will be simple.
- 18) If expansion is required then it should be possible in present illumination scheme.



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- d) What is meant by “Dark Sky” used for stadium lighting and what will happen if very few stadium lights are installed?

(Note: In this question credit may be given by judgment on part of examiner of relevant answer based on candidate understands.)

Dark sky lighting:

1. waste energy
2. waste money
3. draws attention to air pollution
4. robs residents of night sky
5. creates safety hazards
6. interferes with animal habitats

What will happen if very few stadium lights are installed:

(2 Marks)

- i) Lux level will be insufficient.
- ii) So there will be no proper illumination level in the stadium.
- iii) Sports activities will be affected.
- iv) Chances of accidents during sports.

- e) State different types of lamps used for Decorating purposes and stage lightings and state the reason why these lamps are used.

(4 Marks)

Generally Stage is required to perform various social & cultural activities. For e.g. Dance, Drama, gathering etc. The stage lighting is commonly used for to fulfill all these activities and is very important part of this program

Lamps used for Decorating and stage lighting:

For the stage lighting multicolours LED lamps, Compact fluorescent lamp (CFL), small capacity projector lamps, metal halide lamp, Neon Lamp & other types of advanced lighting system can be provided.

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