Important suggestions 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.**	
Ans:	**Following Advantages of good illumination scheme:** **(Any Four point expected-1 Mark each)** 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. 9. It should have sufficient light. 10. It should not strike the eyes. 11. It should not produce glare. 12. It should be installed at such a place that it gives uniform light. 13. It should be of correct type as needed. 14. It should have suitable sets, reflectors.	

	OR **(Any Four point expected-1 Mark each)** 1. **Comfortable:** The energy illumination scheme should be comfortable to everybody. 2. **Pleasant surrounding**: By the electrical lighting or the electrical illumination scheme the surrounding area of that location should be pleasant. 3. **Long life:** The life of the designed illumination should be large 4. **Economy:** The cost of the designed illumination scheme be low. 5. **Less Maintenance:** For only type of illumination scheme the maintenance and repairing should be less. 6. **Appearance:** The appearance of illumination scheme should be good. 7. **Less glare:** The glare is fatigue to the human eyes. The illumination scheme is designed in such away that there should be less glare to everyone i.e only electrical & mechanical accidents will be less. 8. **Less flicker:** The flicker is change in light intensity. This flicker should be always less for any type of illumination scheme. In the flicker there are changes of stroboscopic effect at the time of workshop lighting it is very imp. 9. **To avoid hard shadows:**The whole illumination scheme is designed for minimum shadows. At the time of flood light the hard shadows are avoided. 10. **Sufficient lux level:** The lux level is decided by the type of applications, type of location & their countries standard 11. **Cleanliness:** The illumination scheme should be free from any type of ash, smoke or any other air pollution it should be clean. 12. **Simple control:** The illumination scheme designed by the electrical lighting is very simple. The control, multicolor light intensity control is also possible in electrical illumination.
b)	**Why LED lamps are becoming more popular, now a days ? Discuss.**
Ans:	**Because of Following Advantages LED lamps are becoming more popular, now a days:** **(4 Marks)** ➢ 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. we can use it. ➢ The LED lamps are manufactured for the wattages 1W 2W 3W, 5W etc. ➢ The LED lamps are available in various colors and diameter. The life of LED lamp is very high minimum 10000 working hours.

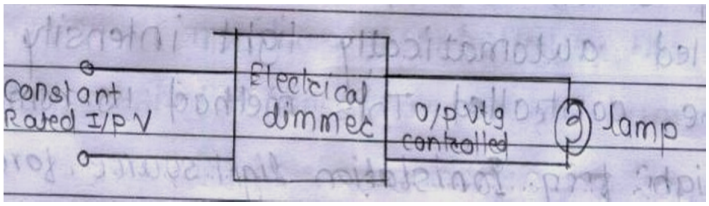
c)	**State the purpose of lighting control.**
Ans:	**Purpose of Lighting Control:** **(Any Four point expected: 1 mark each point)**

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 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 automation there is need of effective lighting control.
12. To provide proper lux level on working plane the lighting control is required.

j15. To control the brightness of T.V monitor there is need of lighting control.

OR

Purpose of of lighting control:- **(4 Mark)**



In the electrical dimmer electrical components for e.g. rheostat, transformer etc arecommonly used. In the electrical dimmer the input voltage is always constant and output voltage across lamp is changed to control the brightness of light intensity. In the electrical dimmer there are four types.

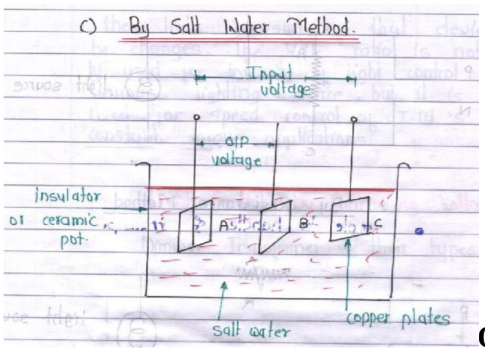
OR

1. To turn ON or OFF the lamps
2. For dimming, the dimming control permits the adjustment of lighting over a range.
3. For changing the lighting levels according to need or desired of the owner.
4. For energy saving.
5. To increase the life of lighting source.

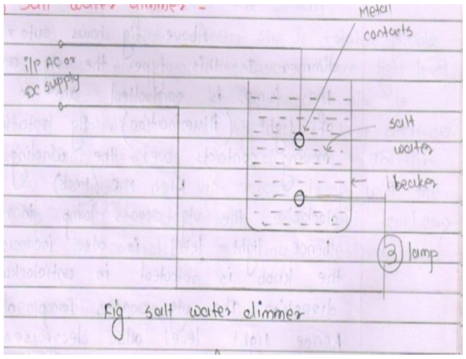
6. To increase the safety of lighting system.
7. In some types of industrial or automation there is need of lighting control.
8. To provide proper lux level on working plane the lighting control is required.
9. To fulfillment light intensity as per Indian or international standard
10. To control the brightness of T.V monitor there is need of lighting control.

d) Explain salt water dimmer.

Ans: **By salt Water method –** **(Figure : 2 Marks & Explanation : 2 Marks)**



OR



orequivalent figure

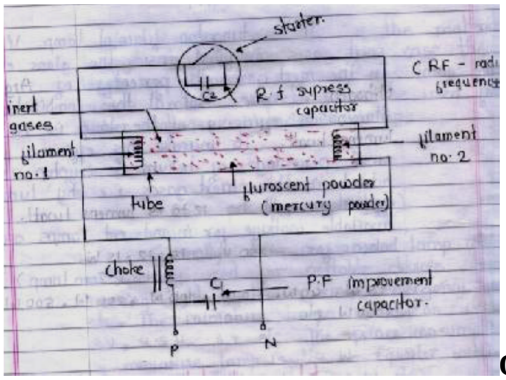
- As position of rod in immersed position changes output voltage across Light sources will be changes .So that light intensity also will be changes.

Q.1B) Attempt any ONE of the following : 06 Marks

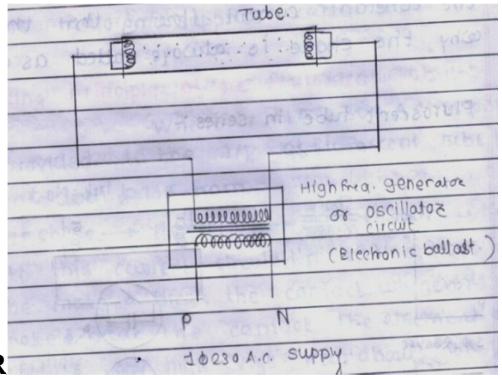
a) Explain construction and working of fluorescent lamp with neat sketch.

Ans: **(Construction-2 Mark, Working- 2 Mark & Figure-2 Mark)**

Figure of fluorescent lamp:-



OR



	Construction:- Fluorescent tube consists of tube, choke, starter & power factor improvementcapacitor. **Operation:-** When switch is ON current flows through the choke-filament no1-starter-filament no. 2-to neutral, At that time choke induces high voltage which isapplied to two filaments and ionized gas, Due to this there will be high voltageionization so that light will be emitted through the tube. Choke is acting asballast 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.
b)	**State the features of good illumination scheme (any six).**
Ans:	**Following features of good illumination scheme:** **(Any Six point expected-1 Mark each)** 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. 9. It should have sufficient light. 10. It should not strike the eyes. 11. It should not produce glare. 12. It should be installed at such a place that it gives uniform light. 13. It should be of correct type as needed. 14. It should have suitable sets, reflectors. **OR** **(Any Six point expected-1 Mark each)** 1. **Comfortable:** The energy illumination scheme should be comfortable to everybody. 2. **Pleasant surrounding**: By the electrical lighting or the electrical illumination scheme

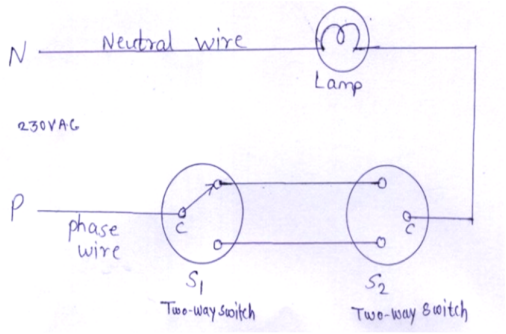
the surrounding area of that location should be pleasant.

3. **Long life:** The life of the designed illumination should be large
4. **Economy:** The cost of the designed illumination scheme be low.
5. **Less Maintenance:** For only type of illumination scheme the maintenance and repairing should be less.
6. **Appearance:** The appearance of illumination scheme should be good.
7. **Less glare:** The glare is fatigue to the human eyes. The illumination scheme is designed in such away that there should be less glare to everyone i.e only electrical & mechanical accidents will be less.
8. **Less flicker:** The flicker is change in light intensity. This flicker should be always less for any type of illumination scheme. In the flicker there are changes of stroboscopic effect at the time of workshop lighting it is very imp.
9. **To avoid hard shadows:**The whole illumination scheme is designed for minimum shadows. At the time of flood light the hard shadows are avoided.
10. **Sufficient lux level:** The lux level is decided by the type of applications, type of location & their countries standard
11. **Cleanliness:** The illumination scheme should be free from any type of ash, smoke or any other air pollution it should be clean.
12. **Simple control:** The illumination scheme designed by the electrical lighting is very simple. The control, multicolor light intensity control is also possible in electrical illumination.

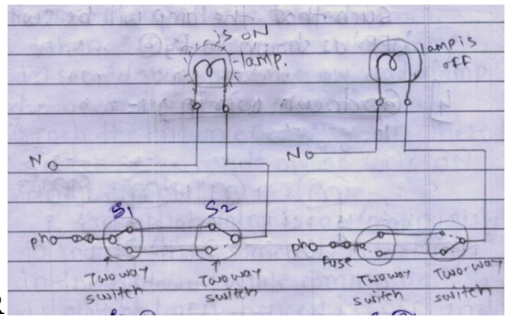
Q.2 Attempt any TWO : 16 Marks

a) Draw and explain how one lamp can be controlled by two switches.

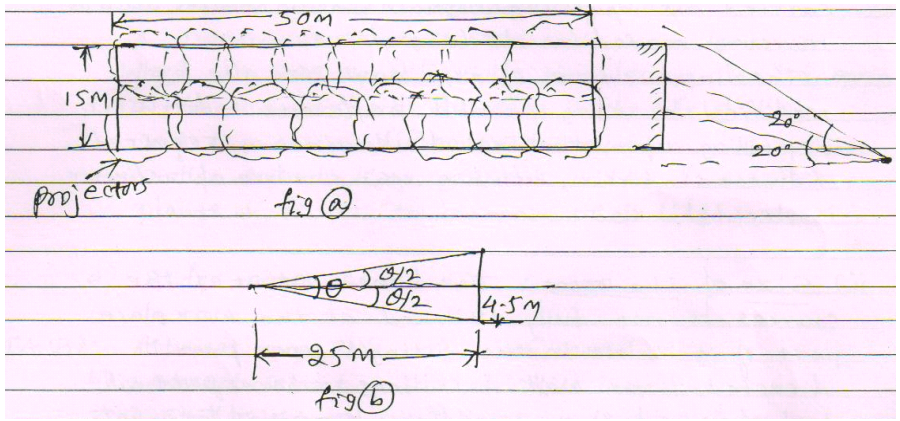
Ans: Single lamp controlled by two point method:- (Figure: 4 Marks Explanation: 4 Marks)



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'.
b)	**A room of 30m x 10 m is illuminated by 20 numbers of 200 W lamps. The MSCP of each lamp is 250. If utilization factor is 0.4 and depreciation factor 1.2 then find average illumination produced on the surface.**
Ans:	i) Area of room=A= 30 × 10m= 300sqmtr. ii) MSCP of each lamp = 250 iii) Depreciation factor=D.F= 1.2 iv) Co-efficient of utilization= U.F=0.4 v) Number of lamps = 20 vi) wattage of each lamp = 200 watts Find: Average illumination=E=? **Solution:** Total lumens given out by all lamps= $(MSCP \times 4\pi) \times 20$ ---------- **(1 Mark)** $= (250 \times 4\pi) \times 20$ = 62831.853 Lumens. ---------- **(1 Mark)** Total lumens received on the floor = Total lumens given out by all lamps x $\frac{U.F}{D.F}$ ------ **(1 Mark)** Total lumens received on the floor = 62831.853 x $\frac{0.4}{1.2}$ = 20943.951 Lumens. ---------- **(2 Mark)** Average illumination on the floor = E_{AV} = $\frac{Total\ lumens\ recieved\ on\ the\ floor}{Area}$ - ------ **(1 Mark)** $= \frac{20943.951}{300}$

	E_{AV}= 69.8131 Lumens per square mtr--- Answer---------- **(2 Mark)** **OR** E_{AV}= 69.8131 Lux--- Answer
c)	**(c) A 50 m X 15 m of a concrete building is to be illuminated by flood lighting projectors 25 m away. If the required illumination is 100 lux, co-efficient of utilization 0.5, depreciation factor 1.5, waste light factor 1.2. Estimate the number and size of the projector assuming 1000 watts lamps having 17 lumens per watt luminous efficiency. Also calculate the angle of spread.**
Ans:	**Given Data:** E = 100 Lux Area of working plane =50 m x 15 m = 750 m^2 U.F = 0.5& D.F = 1.5Waste light factor = 1.5 Wattage of Lamps Assumed= 1000 wattEfficiency = 17 lumens/watt Distance of Projector from building = 25 mtr $Number\ of\ projectors = \frac{illu\min ation\ level \times Area \times waste\ light\ factor \times D.F}{Wattage\ each\ lamp \times\ lamp\ efficiency \times U.F}$ **(1 Marks)** $Number\ of\ projectors = \frac{100 \times 750 \times 1.2 \times 1.5}{1000 \times\ 17 \times 0.5}$ $Number\ of\ projectors = 15.88 \approx 16$ **(3 Marks)** ➢ In order to get uniform illumination. Overlapping of illuminated circles is essential. As such in equal squares we will have 8 illuminated circles length wise, we will therefore need 16 projectors knowing the diameters of thr illuminated circles & distance of the projector from the surface (Fef fig. b) we can findout the angle of spread (Q) as follows **Size of the projector :** **(2 Mark)** 

	➢ **Angle of Projector** : **(2 Mark)** Angle of spread $= \theta = 2\tan^{-1}(\frac{4.5}{25}) = 20^0$ (Re f $Fig.b$) Hence 16 projectors of 1000 watt each with beam angle of 20^0 will be required.
Q.3	**Attempt any FOUR :** **16 Marks**
a)	**What is flood lighting ? State the purpose of flood lighting.**
Ans:	**Meaning of Flood lighting:** **(2 Mark)** Flood lighting means flooding of large surface area with light from powerful sources using projector **Following Purpose of flood lighting:** **(2 Mark)** 1) **Aesthetic flood Lighting** : It is used for buildings at night, ancient building and monuments, churches & gardens etc 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 **OR** 1. It is used for buildings at night, ancient building and monuments, churches & gardens etc 2. It is used for illuminating railway yards, stadiums, car parking area etc. 3. It is used for illuminating advertisements, boarding's etc
b)	**Explain lumen or light flux method design technique of interior illumination.**
Ans:	**Lumens or Light flux methoddesign technique of interior illumination:** **(4 Marks)** This method is applied where an average illumination is required also when inform 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 × wattage of each lamp × efficiency of each lamp× coefficient of utilization) / (depreciation factor)

OR

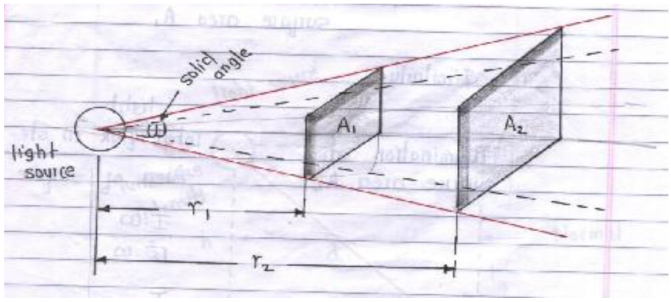
= number of lamps × wattage of each lamp × efficiency of each lamp × utilization factor × maintenance factor

c) State the two laws of illumination.

Ans: 1)Inverse square law:- **(2 Marks)**

This law state that " the illumination of a surface is inverselyproportional to the square of distance between source of light & surface area andit is also directlyproportional to the luminous intensity (I) or candle power ofthe lamp in that direction.

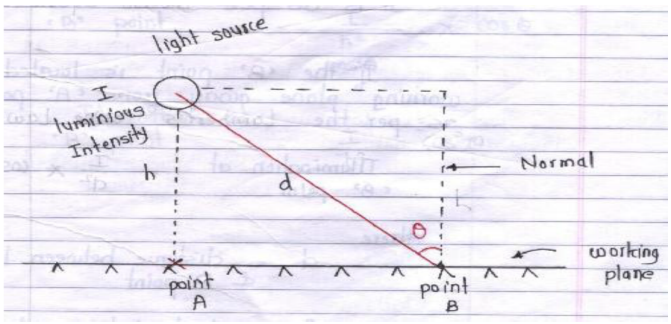
Illumination at A point = I / r^2

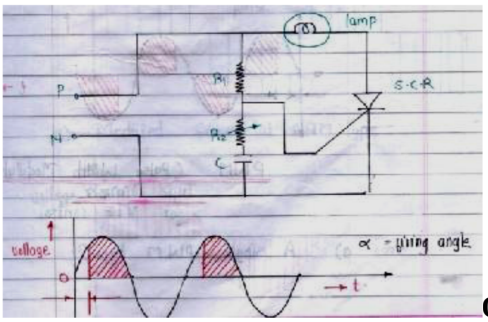
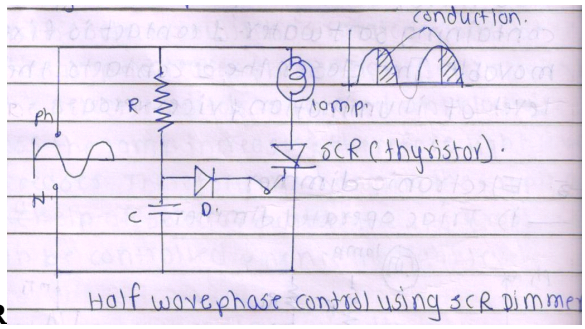


2) Lambert's cosine law:- **(2 Marks)**

This law states that "the illumination E at any point on a surface isdirectly proportional to the cosine of the angle between the normal at that pointand the line of flux.

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



d)	**State any four disadvantages of incandescent lamp and advantages of LED lamps**
Ans:	**The disadvantages in incandescent lamps.** **(Any Two Point expected : 2 Marks)** 1) It gives less lumen output per watts. 2) It is not suitable for street light. 3) Its energy consumptions more. 4) Heat energy is radiated. **Advantages of LED lamp: (Any two advantages are expected) :** **(2 Marks)** ➢ The LED lamps are energy saving lamps, ➢ The power consumption of the single LED is very less. It is in mw. So to increase wattage series & parallel combination of LED can be used. ➢ The LED lamp are manufactured for the wattages 1W, 2W 3W, 5W etc. ➢ The LED lamps is available is various colors and diameter. The life of LED lamp is very high minimum 10000 working hours.
e)	**Explain thyristor operated dimmer.**
Ans:	**Thyristor or SCR operated dimmer:–** **(Figure : 2 Mark & Explanation: 2 Mark)**  **OR**  **orequivalent figure** The SCR is generally used as switching component in electrical system. In theSCR when the anode terminal is +ve cathode is –ve and if the trigger pulse is applied tothe gate of the SCR, then at that moment SCR will start conducting. In the present circuit the capacitor is charged through variable resistance R2 so thatCharging time constant (R2C) will be decided and after that whenever capacitor isfully charged it will discharge through the gate terminal, and SCR will be fired[ON]. The firing

period is decided by the value of R2C i.e. why conduction &firing angle will be changed. This firing angle may be vary 0 to 180º i.e. why the firedoutput voltage can be (variable) available across the lamp. So that light intensity willbe changes, By the SCR only +ve half cycle are controlled.

Q.4 A) Attempt any THREE : 12 Marks

a) State the design considerations for interior location of residential unit (any four).

Ans: **Following design considerations for interior location of residential unit:-**

(Any Four point expected: 1 Mark each)

Procedure for designing illumination scheme for residential unit:

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.

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

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

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

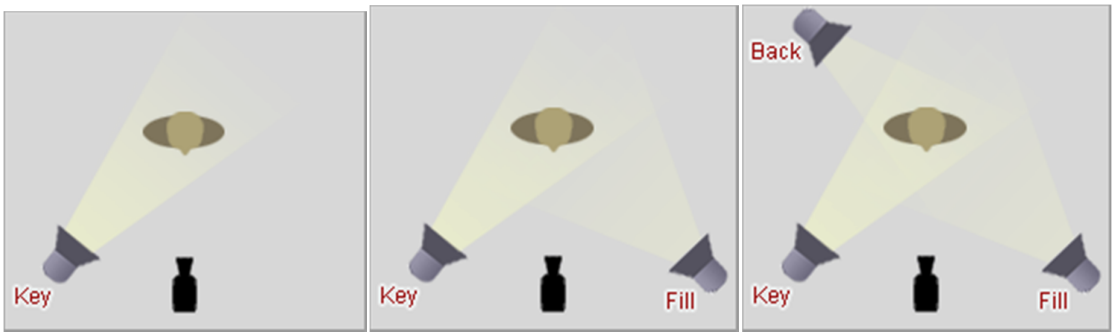
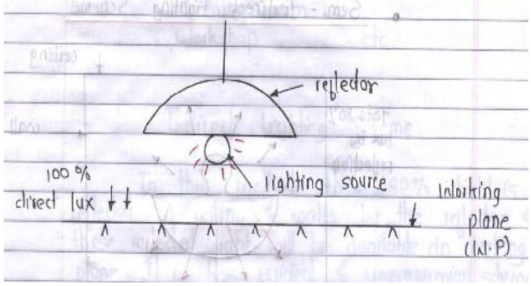
10. Find out total power consumption of all interior applications for calculated lamps and tubes.
11. Find out the rated current for all applications.

If 1Ph, 230V supply is provided, $P = VI\cos\phi$

If 3ph, 400V supply is provided, $P = \sqrt{3}\ VI\cos\phi$

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.
b)	**State the design considerations for interior location of commercial premises (any four).**
Ans:	**Following design considerations for interior location of commercial premises:-** **(Any Four point expected: 1 Mark each)** 1) Find out the type of load and total electrical load for the given commercial premises. 2) Differentiate this total electrical load in lighting load and power load. 3) Make the no. of lighting sub circuit for lighting load. $No.\ of\ \ Lighting\ \ Sub\ circuits = \frac{Total\ \ Electrical\ lighting\ \ load}{800\ W}$ **OR** $No.\ of\ \ Lighting\ \ Sub\ circuits = \frac{Total\ \ No.of\ \ lighting\ \ point}{10}$ 4) Make the no. of power sub circuits for power load. $No.\ of\ \ power\ Sub\ circuits = \frac{Total\ electrical\ \ power\ load}{2000\ W\ or\ 3000\ W}$ **OR** $No.\ of\ \ power\ Sub\ circuits = \frac{Total\ \ No.of\ \ power\ \ points}{2000\ W\ or\ 3000\ W}$ 5) Find out total power consumption of every lighting and power sub circuits. 6) Find out rated Input current for every lighting and power sub circuit. P = V1 cosϕ P = Input power for every sub circuit V = voltage = 230 V I = Input current for every sub circuit 7) Determine the size of wire required for every sub circuit by considering overload starting surge and future expansion. 8) Draw the single line diagram. 9) Mark the batten on plan layout. 10) Find out the total length of battenrequired for every sub circuit and whole commercial premises. 11) Find out the total length and size of wire required for every sub circuit. 12) List out the material required for whole commercial premises. 13) Find out cost of material and labour in estimation chart. 14) Find out the total cost of estimation with profit margin and contingencies charges. 15) Find out per point charges. 16) Draw the circuit diagram.

c)	**Describe 3 point lighting technique used for visual media and still photography.**
Ans:	➢ **Three point lighting techniques –** **(Figure-1 Mark & Explanation-3 Mark)**  It is a standard method which is used in video and still photography. In this three point method Key light,fill light and back light are used. Key light is a principal illuminationsource from front side. Fill light is used from side (left or right). It balances the shades. Back light shines on rim, shoulder, hair etc.
d)	**Explain direct lighting scheme for illumination.**
Ans:	**i) Direct lighting scheme for illumination:** **(Figure: 2 Marks & Explanation 2 Mark)**  **Explanation:** 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. **Drawbacks of direct lighting system: (Any one point expected)** 1. This scheme is more efficient but it suffers from hard shadows and glare. 2. These light creates tunneling effect i.e ceiling remains dark.

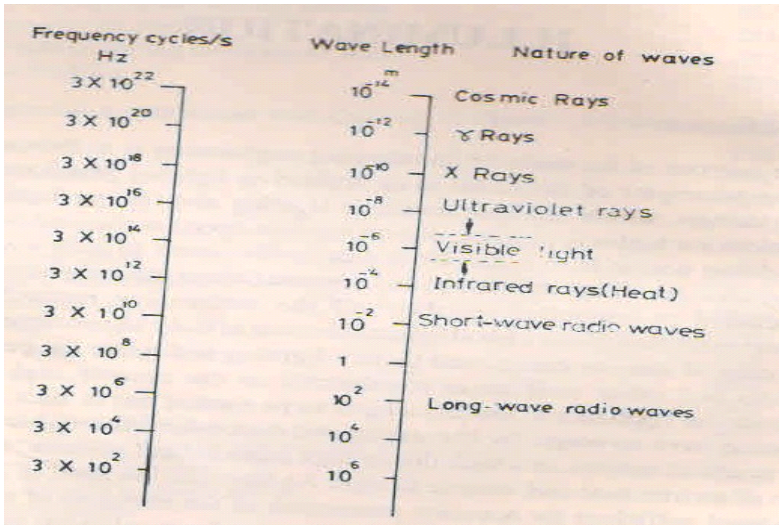
Q. 4B)	**Attempt any ONE :** **06 Marks**
a)	**Compare fluorescent lamp and incandescent lamp (any six point).**

Ans: **(Each Point : 1 Mark)**

S.No.	Points of comparison	Fluorescent Lamp	IncandescentLamp
1	Luminous efficiency	More (40 to 60 lm/w)	Less (12 to 15 lm/w)
2	Colour rendering	Good	Very good
3	Effect of voltage fluctuation	No	Yes
4	Life of lamp	More	less
5	Cost	Capital cost is more and Running cost is less as life is more	Capital cost is less and Running cost is more as life is less
6	Quality of light	Best	Good

b) Explain Visible light, Ultraviolet light and Infrared light.

Ans: **Diagram:**



i) Visible light : **(2 Marks)**

The wavelength of the visible light is always near to 10^{-6} m. The colour of light also depends upon the frequency of the wavelength. In illumination engg. all lamps and lighting accessories are majority designed for this visible light. To get the visible light,

The following types of lamps are widely used

1. Incandescent lamps
2. Fluorescent tubes/lamps
3. Arc lamp
4. Varies types of discharge lamp

Special purpose lamps.

ii) Ultraviolet light : **(2 Marks)**

The wavelength of ultraviolet light is near to 10^{-8} m. In the ultraviolet light the % of visible light is very very less. So it cannot be used for visible applications. The ultraviolet lamps are generally used for bacteria killing purpose in medical applications and water purifier. Besides this there are some commercial applications of ultra-violet lamps. In the ultra-violet light the ultra violet lamps and tubes are availablet.

iii) Infra-red Light : **(2 Marks)**

The wavelength of infrared light is near to 10^{-4} m. The percentage of visible light in the infrared lamp is very less. The infrared lamps for lights is commonly used for heating purpose. drying purpose some times baking purpose also in commercial applications & industrial applications.

Q.5	**Attempt any TWO**	**16 Marks**
a)	**A minimum illumination of 80 lux is required in the room of 50 m x 12 m. Calculate the number, location and wattage of the lamps to be used. Assume that depreciation factor 1.2, utilization factor is 0.4 and efficiency of lamp is 14 lumens/watt.**	

Ans:

NOTE: Marks should 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

Given Data:

E = 80 lumen/sqm — Area of working plane =50 m x 12m = 600 sq m

U.F = 0.4 & D.F = 1.2 — Wattage of Lamps Assumed= 100 watt /200/500 Watt

Efficiency = 14 lumens/watt — assumed: Waste light factor = 1

i) Total Lumens utilized = E x A or ----------**(1/2 Marks)**

= 80 x 600 = 48000 Lumens ----------**(1Marks)**

ii) Total Lumens given out by the lamp = $\frac{Total\ lumens\ utilised \times D.F}{U.F}$ --------- **(1/2 marks)**

$$= \frac{48000 \times 1.2}{0.4}$$

$$= 144000 \ Lumens$$ ----------**(1 Marks)**

iii) Total Wattage $= \dfrac{Total\ lumens\ given\ out\ by\ the\ lamps}{luminous\ efficiency}$ ----------**(1/2 Marks)**

$$= \frac{144000}{14}$$

$$= 10285.714 \quad Watts$$ ----------**(1 Marks)**

The wattage of lamps is assumed – 100 watt:

iv) Number of Lamps $= \dfrac{Total\ Wattage}{Wattage\ of\ each\ lamp}$ ----------**(1/2 Marks)**

$$= \frac{10285.714}{100}$$

$$= 102.85 \cong 103 \quad Nos$$ ---------- **(2 Marks)**

$$\therefore Numbers\ of\ lmaps = 103\ Nos$$

OR Student May Write this way

Total lumens required on working plane = $\dfrac{AIW\ D}{C}$ ----------**(1/2 Mark)**

$$= \frac{600 \times 80 \times 1 \times 1.2}{0.4}$$

$$= 144000 \ Lumens$$ ----------**(1 Marks)**

iii) Total Wattage $= \dfrac{Total\ lumens\ given\ out\ by\ the\ lamps}{luminous\ efficiency}$ ----------**(1/2 Marks)**

$$= \frac{144000}{14}$$

$$= 10285.714 \quad Watts$$ ---------- **(1 Marks)**

iv) Number of Lamps $= \dfrac{Total\ Wattage}{Wattage\ of\ each\ lamp}$ ----------(1/2 Marks)

$$= \frac{10285.714}{100}$$

$$= 102.85 \cong 103\ Nos\ of\ lamp$$ ----------(1 Marks)

$\therefore Numbers\ of\ lamps = 103\ Nos\ of\ 100\ watt$

OR Student Assume Wattage of Lamp = 200 watt

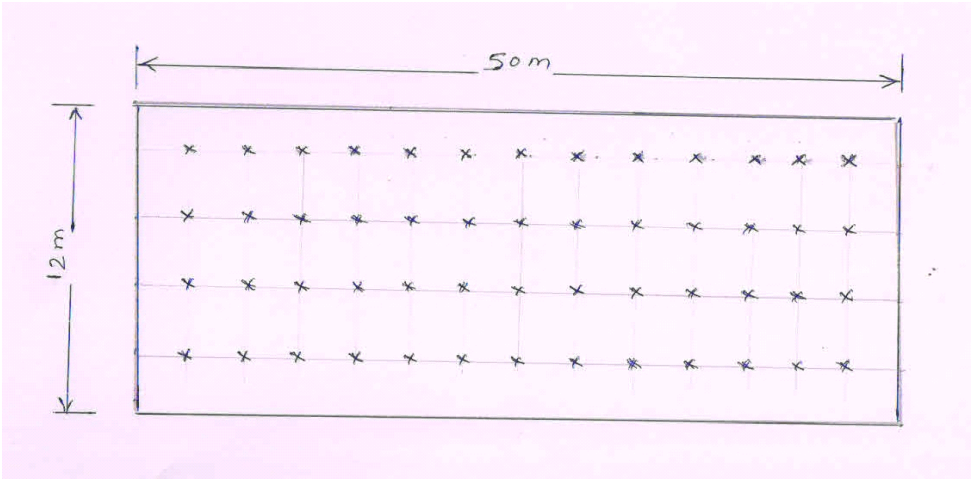
iv) Number of Lamps $= \dfrac{Total\ Wattage}{Wattage\ of\ each\ lamp}$ ----------(1/2 Marks)

$$= \frac{10285.714}{200}$$

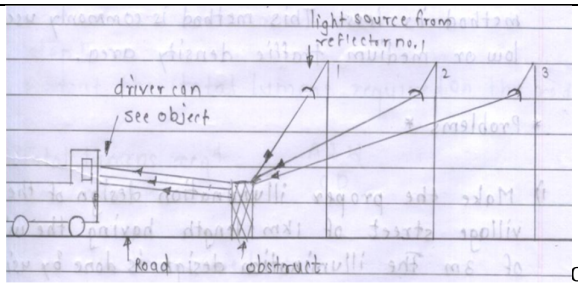
$$= 51.42 \cong 52\ Nos\ of\ lamp$$ ----------(2 Marks)

$$= 52\ Nos\ of\ lamp$$

Location of lamps: **(1 Mark)**



b)	**State main objectives of street lighting. Explain two general principles employed in the design of street lighting.**
Ans:	**Main Objectives of street Lighting:** **(2 Marks)** 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. **OR** **Objectives of street Lighting:** **(Any Two point expected: 2 Marks each)** 1. The street lighting should be such that the object can be seen driver of any vehicle. 2. The street lighting should be attractive. 3. It should increase the community value. 4. As per the Indian standard, the illumination level required for high traffic density should be 20:30 lux for medium traffic density it should be 8-15 lux & for low traffic density it should be minimum 4 lux. 5. It should be such that a river of any vehicle sees the object up to 30 mtr. 6. Percentage of glare should be less so there are less chances of accidents, for that angle of reflector should be well maintain. 7. It should be electrical & mechanical safe. 8. The replacement of lighting accessories should be simple 9. The maintenance & repairing should be simple future expansion should be carries out without any difficulty. 10. It should be economical. 11. For high traffic density, generally metal halide lamp, halogen lamps should be used. For medium traffic density sodium vapourlamp , mercury vapour lamp should be used & for low traffic density CFL, LED and fluorescent tube should be used. **General Principalsemployed in the design of street lighting:** 1. Specular-reflection principle of street lighting 2. Diffusion principle **1) Specular-reflection principle:-** **(3 Marks)**



or equivalent figure

- 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.
- Power consumption required for this method is less.
- This method is commonly used for low or medium traffic density area.

2) Diffusion Principle: **(3 Marks)**

- In this type, the light is directed downwards from the lamps with the intension of producing a uniform illumination on the road surface.
- This is possible by use of suitably design reflectors.
- The filament of the lamp is invisible expect from almost beneath it.
- This illuminates glare, the road surface has a diffusing mature due to which it diffuses some proportion of light towards the observer. This makes the road surface bright for the observer.

c) i) **(i) Which lamps are used for malls and supermarkets and why ?**

Ans: **Lamps used for malls & super market –** **(3 Mark)**

CFL, fluorescent tubes, LED lamps are used in malls & super markets. Fluorescent tubes are available in various sizes, 2 feet & 4 feet, 6 feet. Wattage of the tube ranges from 20w, 36w, 40w, 65w, 80w etc. Above tubes are also available for A.C. & D.C. supply.

The CFL & LED lamps are energy efficient lamps so that power consumption is less so that they are commonly used for malls & super markets. The fluorescent tubes are also having the large lumens output light sources it is pleasant it doesn't give strain to the eyes. So that it is commonly used. Different types of colours can be obtained by this lamp.

	By connecting lamps in series & parallel required lux level can be achieved. **CFL: -** These lamps are also energy saving lamps Available in white, Red, Yellow, Green, Blue, Pink colour etc. They are available in 4w, 7w, 11w, and 15w times more than in incandescent lamp. It can be used in solar operated street light & various emergency lamps. For outdoor **Halogen lamps** – can be operated on A.C. & D.C. supply. Efficiency of halogen lamp is 22 to 33 lumens/watt. These lamps are widely used for focusing purpose on building. Etc **Reason lamps are used for malls and supermarkets** : **(1 Mark)** ➢ Above lamps give a required illuminations and CRI i.e they are used is malls and supermarkets. ➢ Energy saving lamps are highly required ➢ Working hours of the lamps should be high with minimum maintenance.
c) ii)	**(ii) Explain Agriculture lighting.**
Ans:	**Explanation for agriculture Lighting:** **(4 Marks)** 1. 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. 2. 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. 3. 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. 4. 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. 5. 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.6	Attempt any FOUR :16 Marks
a)	**Explain Railway platform lighting.**
Ans:	**Explanation of Railway platform lighting:** **(4 Mark)** Good platform lighting on all stations is essential for the safety and comfort of passengers and railway staff. The recommended value of illumination is 100-150 lux. T-5 fluorescent lamps are used as source of light. The luminaries should be arranged in such a way that the light strikes the platform 'H' straight down and without shadows provided reasonable uniform light across the width of the platform. For non-covered portion of the railway station, street light fitting of T-5 fluorescent lamps with width angle distribution reflectors are suitable modern LED street light fitting of 36/40 w are also used. **OR Student may be write** **(Any Four point expected : 1 Mark each)** 1. The general requirements & objectives for the railway lighting is similar to shipyard lighting or factory lighting. 2. The total area covered by the railway department. 3. Total number of platforms available on the station. 4. The total length of every platform. 5. The total indoor facilities of the railways station for e.g. waiting room, guest room, booking counter & booking office, signal & controlling room, TC chamber, go downs, canteen, book stall. 6. The platform lighting is generally done as outdoor lighting of factory premises or It is similar to street lighting. 7. For indoor lighting the standard lux level available is common but for the platform lighting the 60 to 80 lux should be available on the railway track & platform. 8. The signaling is very important part. At the time of illumination design we have to consider it. **OR Student may be write** **(Any Four point expected : 1 Mark each)** 1. Selection of correct source of light. 2. Adequate level of illumination on the W.P. 3. Correct brightness, relationship eliminating glare and reflection. 4. Appropriate colour of light having regards to: a) requirement of work or process

	b) Psychological effects and combination with natural light. 5. Proper shadow characteristics. 6. Provision of auxiliary and emergency lighting for safety. 7. Provisions for operation i.e. current, switching groups, proper switching control. 8. Maximum overall economy consistent with efficiency. 9. Aesthetic blending of light and décor.
b)	**Define the terms related to flood lighting (i) Beam factor (ii) Waste light factor.**
Ans:	**(i) beam factor related to flood lighting:** **(2 Mark)** It is defined as the ratio of total lumens in the beam of projector to the total lumens given out by the sources (Lamp) **(ii) Waste light factor related to flood lighting:** **(2 Mark)** When a surface is illuminated by the number of lamps, there is certain amount of wastage of light due to overlapping of light ways, so it is called Waste light factor.
c)	**Give the advantages and disadvantages of high pressure mercury vapour lamp over filament lamp.**
Ans:	➢ **Advantages of high pressure mercury vapour lamp over filament lamp:** **(Any Two advantages Expected : 2 Marks)** 1) Good luminous efficiency. 2) Multicolour light can be possible 3) Compact size 4) Long life 5) Suitable for indoor & outdoor applications ➢ **Disadvantages of high pressure mercury vapour lamp over filament lamp.** **(Any Two disadvantages Expected : 2 Marks)** 1) Starting time is more. 2) Initial cost is more 3) Stroboscopic effect is more

OR Student may write this way

Comparison for advantage & disadvantage of high pressure mercury vapour lamp over filament lamp. **(Any Four point expected: 1 Mark each point)**

S.No	High Pressure mercury lamp	Filament Lamp
1	It is works on high frequency & High voltage ionisation	The incandescent lamp works on heating effect. Whenever temperature surrounding the filament increases more than 1800^0C then light will be emitted.
2	The cost of high pressure mercury vapour lamp is high.	It is cost is low
3	The maintenance for this HPMV is more.	The maintenance for this lamp is less.
4	The P.f. of this HPMV is electrical choke is poor	The P.f. of this lamp is unity.
5	After the switch on the light will be emitted after some time delay through the HPMV lamps	After the switch on the light will be emitted immediately through the filament.
6	In the HPMV the choke is acting as ballast so that light intensity will not changes.	Due to supply voltage variation the light intensity may changes it means flicker
7	There is a need of P.F. improvement capacitors.	There is a No need of P.F. improvement capacitors
8	Life of lamp is very high. (minimum 1200-1500 working hrs) (maximum7500 to 10000 hrs)	The Life of this lamp is less. (500 to 700 working hrs)
9	By using the various chemical powders in inert gases the various colours can be achieved in the lamp.	By this lamp we cannot get multicolour light.
10	The stroboscopic effect is more.	The stroboscopic effect is less.

11	There is humming in this tube due to the electrical choke	There is humming is less or no humming in this lamp.
12	The illumination/lumens efficiency is more.(40 to 60 lumen/watt)	The illumination/lumens efficiency is very less. (5 to 18 lumens/watt)

d) State different types of lamps used for decorative purpose.

Ans: **Following are the types of lamps used for decorative purpose:** **(4 Marks)**

1. Flood Fight
2. Neon Lamp
3. Mercury vapour lamp
4. Sodium vapour lamp
5. Multi colour LED Lamp
6. Compact Fluorescent lmap
7. Halogen Lamp
8. Small capacity projector lamp
9. Metal Halide Lamp

e) State the recommended illumination level required for any four areas of Hospital lighting.

Ans: **(i) Recommended illumination level required for any four areas of hospital lighting:**
(Any Four areas required- 1 Mark each)

S.No	Areas	Recommended illumination level
1	Reception & Nursing station	250 to 300 lux
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

----------END----------