ILLUMINATION ENGINEERING
(ELEC 3132)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) The unit of solid angle is
(a) lumen (b) radian (c) steradian (d) candela.

(ii) Which of the following lamps gives nearly monochromatic light?
(a) Sodium vapour lamp (b) GLS lamp
(c) Fluorescent lamp (d) Mercury vapour lamp.

(iii) Candela is the unit of
(a) Luminance (b) Luminous flux
(c) Luminous intensity (d) Wavelength.

(iv) Which gas is sometimes used in filament lamps?
(a) Argon (b) Krypton (c) Sulphur (d) Carbon dioxide.

(v) Melting point of tungsten is
(a) 2000°C (b) 2500°C (c) 2655°C (d) 3400°C.

(vi) When a sodium vapor lamp is switched on, initially the color is
(a) pink (b) yellow (c) green (d) blue.

(vii) The colour temperature of day light is around
(a) 50K (b) 160K (c) 600K (d) 6000K.

(viii) The level of illumination on surface least depends on
(a) candle power of the source (b) type of reflector used
(c) distance of the source (d) ambient temperature.

(ix) Power factor is highest in case of
(a) Mercury vapour lamp (b) Fluorescent lamp
(c) Sodium vapour lamp (d) Incandescent lamp.

(x) Integrating sphere is used to measure
(a) luminance (b) luminous flux
(c) luminous intensity (d) wavelength.

Group - B

2. (a) Briefly discuss the construction and principle of operation of a bench photometer with the help of a neat diagram. Name the different types of photometer head used.

(b) Define existence of a source of light. What is its unit?

(c) Why do we use an auxiliary lamp in integrating sphere?

(3+ 2 + 2) + (1 + 1) + 3 = 12

3. (a) Differentiate between photopic and scotopic vision. What do you mean by mesopic vision?

(b) What are zonal lumens?

(c) What do you mean by cosine error in a luxmeter? How is it eliminated?

(4 + 1) + 4 + 3 = 12

Group - C

4. (a) Briefly discuss the construction and principle of operation of low pressure sodium vapour lamp with the help of a neat diagram.

(b) What do you mean by stroboscopic effect? How is it eliminated?

7 + (1 + 4) = 12

5. (a) Distinguish between thermal and glow starters used in fluorescent lamp.

(b) State Wien's displacement law.

(c) State the functions of choke used in fluorescent lamp.

(d) Briefly explain the principle of operation of Light Emitting Diode.

(3+3) + 1 + 2 + 3 = 12

Group – D

6.(a) An illumination on the working plane of 300 lux is required in a classroom 20 m × 15 m in size. The lamps are required to be hung 3 m above the working plane.

(i) Which type of lamp is used for the design and why?

(ii) What is the efficacy of the lamp?

(iii) Assuming utilisation factor of 0.5, candle power depreciation of 15%, estimate the number and wattage rating of the lamps.

(iv) Draw the disposition of the lamps.

(v) Determine space – height ratio of your design.

(b) Define Maintenance Factor.

(c) Distinguish between disability glare and discomfort glare.

(2+ 1+ 2+ 3+ 1) + 1 + 2 = 12

7. (a) Explain the point to point method of indoor lighting design. What are the disadvantages of this method?

(b) What are the different types of lighting installations used in factory lighting?

(c) The walls of the lobby area in an office building have a reflectance of 50%. The recommended illuminance range is as follows :

Type of Activity	Illuminance Category	Range of Illuminance (lux)
Public spaces with dark surroundings	A	20 – 30 – 50
Simple orientation for short temporary visits	B	50 – 75 – 100
Working spaces where visual tasks are only occasionally performed	C	100 – 150 – 200

(i) Select the illuminance category from the above table, giving proper reason. The lobby area will be visited by occupants of any age.

(ii) Select proper weighting factors from the following table :

Room and Occupant	Weighting Factors		
Characteristics	-1	0	+1
Occupants' age	Under 40	40 – 55	Above 55
Room surface reflectance	Greater than 70%	30 – 70 %	Less than 30%

(iii) Determine the recommended illuminance level for the lobby area. Justify your answer.

(2 + 2) + 3 + (2 + 2 + 1) = 12

Group – E

8. (a) What are the classifications of roads according to BIS1981? Briefly describe each type.

(b) Distinguish between cut-off, semi cut-off and non cut-off luminaires used in road lighting.

(c) What are the different types of arrangement of road lighting luminaires according to the width of the road and mounting height of the luminaires?

(d) Define beam of a luminaire.

4 + 3 + 4 + 1 = 12

9. (a) What do you mean by waste light factor?

(b) Distinguish between transverse, longitudinal and overall uniformity.

(c) The front of a building measuring 60m × 15m is to be floodlighted by means of projectors placed at a distance of 15m from the wall. The average illumination required is 50 lux.

(i) Which lamp is used for the design and why?

(ii) Assuming waste light factor of 1.2, maintenance factor of 0.6 and coefficient of utilisation of 0.5, determine the number of projectors used.

(iii) Determine the beam angle of the projector.

(d) What do you mean by IP code of the luminaires?

2 + 3 + (1 + 2+ 2) + 2 = 12