M.TECH ILLUMINATION TECH. AND DESIGN FIRST YEAR FIRST SEMESTER – 2024

FUNDAMENTALS OF ILLUMINATION SCIENCE & TECHNOLOGY

Time 3 hrs   **Full Marks: 100**

Part I (50 marks)
Use Separate Answer scripts for each part
Answer any three questions (Q1 contains 18 marks)

1.
   a) State and explain the laws of illumination. [5]
   b) What is the difference between illuminance & irradiance?. [3]
   c) It is desired to illuminate a drawing hall of 30meter by 20 meter dimension with an average illumination of 200 lux. The lamps having efficiency of 20 lm/Watt fitted from ceiling. Find out the number of lamps & wattage of the lamp, where mounting height 4 meter, COU = 0.75, depreciation factor 0.8. Mention satisfactory spacing arrangement and show space to height ratio. [10]

2.
   a) Derive the expression to find out the relation between luminance and luminous exitance for a perfectly diffusing source. [5]

   b) Discuss the principle of operation of a Luminance meter with necessary diagram [5]

   c) A circular light source has uniform intensity of 2000cd. Find the illuminance on the vertical sign board as shown, also find out illuminance on surface halfway between pole and sign board. [6]
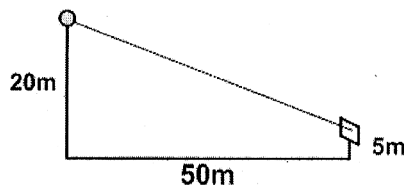
3.
   a) Classify different types of photosensors and briefly explain their operating principles. [7]

   b) A light source emits 60 Watt at 589 nm. If the value of V (λ) at specified wavelength of radiation is of 0.757, calculate how many lumens the light source emits. [3]

   c) How inverse square law can be applicable to find out illuminance from a larger source? [3]

   d) Prove that the summation of reflectance, transmittance and absorbance is unity for any physical surface. [3]

[Turn Over

4. a) Briefly explain the different parts and working principle of a spectro-radiometer. [6]

b) Why V(λ) correction is necessary for phtosensors used for photometric measurement? [3]

c) What do you mean by zonal constant? Find out total luminous flux from a light source whose intensity distribution is given in the table below. [7]

Zone ($^\circ$)	Intensity
0-30	1100
30-60	1150
60-90	1000
90-120	950
120-150	800
150-180	0

5. Write short note on... [4 X 4]

a).Photopic & Scotopic Vision

b) Luminaire

c) Illuminance Meter

d) Integrating Sphere

M.Tech. ILLUMINATION TECH. & DESIGN
FIRST YEAR FIRST SEMESTER EXAMINATION 2024
TIME: 3 HOUR   FULL MARKS: 100

SUBJECT: FUNDAMENTALS OF ILLUMINATION SCIENCE & TECHNOLOGY
PART-II(50 Marks) (Use Separate Answer script from each part)
<u>ANY THREE QUESTIONS [Q.NO.1 carries 18 marks]</u>

Q.1. A) Write down the Wien's radiation law applicable for blackbody radiator and hence explain the life and light trade-off of tungsten filament lamp.
B) Compute the S/P ratio for a gas discharge lamp emits using the following data –

λ (nm)	$L_{e\lambda}$ (mW/sr.cm^2)	V_λ	V'_λ
490	0.17	0.2080	0.9040
550	0.32	0.9950	0.4810
680	0.76	0.0170	0.0001

8+10=18

Q.2. A) What are the external factors of vision?
B) Define visual acuity and contrast sensitivity. Explain their dependency on background luminance with suitable diagrams. Explain the region of seeing and non-seeing with these diagrams.

4+12=16

Q.3. A) Compute the chromaticity of a test lamp, as per 1931 CIE chromaticity system, from the given data [symbols have their usual meaning] -

λ (nm)	$L_{e\lambda}$ (mW/sr.cm^2)	x_λ	y_λ	z_λ
510	0.23	0.0093	0.5030	0.1582
530	0.41	0.1655	0.8620	0.0422
550	0.87	0.4334	0.9950	0.0087
570	1.23	0.7621	0.9520	0.0021

B) Write down the steps of computation of CCT of a test lamp from its chromaticity (x,y) using McCamy model.

8+8=16

Q.4. A) Two coloured fluorescent lamp of following specifications are used to get combined illumination on white diffuse surface. Find out the chromaticity of combined illumination using Grassman's colour mixing law.

Lamp	x	y	Lumen/Watt	Quantity
A (40W)	0.600	0.300	20	4
B (20W)	0.500	0.400	30	3

B) Explain why Object colour theory is known as Subtractive colour theory, whereas Source colour theory is known as Additive colour theory.

10+6=16

Q.5. Write down short notes <u>**on any two**</u> from the followings - 8+8=16
    i) Disability glare and discomfort glare;
    ii) Dominant wavelength and Purity;
    iii) MacAdam step size;
    iv) Specific and general color rendering index.