

B.E. ELECTRICAL ENGINEERING FOURTH YEAR FIRST SEMESTER EXAMINATION, 2025

.....
 (1st/2nd Semester/Repeat/Supplementary/Spl. Supplementary/Old/Annual/Bi-Annual)

SUBJECT ILLUMINATION SCIENCE AND LIGHTING DESIGN

.....
 (Name in full)

Use a separate Answer-Script for each part

No. of questions	Part I / Part II	Marks 50
	<u>Question No 1 (5 X 4) is compulsory & Answer any 2 (2 X 15) from the rest</u>	
	<u>Answer any 5 of Question No 1</u>	
1. a)	"Spectral power distribution is the most fundamental parameter of a light source."- Justify or do the necessary corrections, if any	5 X 4 =20
b)	"There is no role of $v(\lambda)$ filter for any photometric measurements."- Justify or do the necessary corrections, if any	
c)	Write a note on generic and specific coordinate systems used for photometry and its applications.	
d)	Explain the V-I characteristics of LED. How it is different from V-I characteristics of Zener Diode.	
e)	What is the basic difference between COU and LOR of an indoor luminaire?	
f)	Point source realization an extended source is mandatory for photometry (far-field).	
g)	Explain the significance of 1v as minimum voltage for 1/10 v analogue lighting control system.	
h)	What is a role of driver in operating a LED source?	
i)	Write a note on IoT based lighting .	
2. a)	Discuss the classification of different LED light sources and SSL products as mentioned in ANSI/IESNA RP-16-05	13
b)	What is the fundamental difference between IESNA LM-79 and IESNA LM-80 standards used for measurement of SSL product?	2
3. a)	What are the feature of IESNA LM79 : Approved method for Electrical and Photometric Measurements of Solid-State Lighting product?	8
b)	Explain the fundamental difference between 2 Π and 4 Π geometry used for lumen measurement of SSL product.	3

Form A: Paper-setting Blank

Ref. No. Ex/EE/PE/B/T/413F/2025

EX/EE/PE/B/T/414F(O)/2025

EXAMINATION, 2025

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|-------|--|---|
| c) | What is the fundamental difference between operating principles of type-B and type-C goniophotometers ? | 4 |
| 4. a) | Why lighting control is required ? | 7 |
| b) | Explain the fundamental difference of network , physical layer , program and communication protocol as mentioned IES TM-23-11 | 8 |
| 5. a) | Explain with a suitable example that, how a point specific illuminance calculated from a luminous intensity database represented in C-V coordinate system. | 6 |
| b) | Explain the chronological developments of lighting control protocols from classical analogue to modern lighting control | 6 |
| c) | Explain the operation of a fluorescent lamp using electromagnetic ballast. | 3 |

B.E. ELECTRICAL ENGINEERING 4TH YEAR 1ST SEMESTER EXAM 2025**SUBJECT: ILLUMINATION SCIENCE AND LIGHTING DESIGN**

Time: 3 hours

Use Separate Answer script for each part

Full Marks:100

Part-II (50 Marks)**ANSWER ANY THREE QUESTIONS****Q. NO. (1) carries 18 marks**

Q.1. (A) Define Threshold size and Minimum perceptible contrast in the context of external factors of vision. Illustrate, with suitable diagrams, what do you identify the 'region of seeing' and 'region of non-seeing' in connection to the above two parameters. (CO 1)

(B) Discuss the salient features of the CIE 1931 XYZ chromaticity system by a suitable diagram. (CO 2)

(C) Develop a computational procedure to obtain chromaticity of a test light source using spectral power distribution data of the source. Hence compute the tristimulus values and chromaticity coordinates of a line spectrum source using the following data - (CO 2 & CO 4)

λ (nm)	M_λ (W/cm ² .nm)	Tristimulus distribution values		
		x_λ	y_λ	z_λ
490	1.83	0.0320	0.2080	0.4652
550	3.34	0.4334	0.9950	0.0087
680	8.10	0.0468	0.0170	0.0000

6+4+8=18

Q.2. (A) Discuss the colour vision model with appropriate diagram. (CO 2)

(B) Establish that for a flat perfect diffuse source 'Luminance' is independent of the angle of view. (CO 4)

(C) Show that for a flat diffuse reflecting surface the luminance contrast can be expressed in terms reflectance of target object and reflectance of its background. (CO 4)

8+4+4=16

Q.3. (A) What are the applications of CIE Standard illuminant? Compare between specific colour rendering index and general colour rendering index of a test lamp. How they are related?

(CO 1 & CO 4)

(B) Discuss the procedure to determine the dominant wavelength and purity of a test green LED source by suitable diagram (CO 2)

(C) Explain the attributes of the Munsell colour model and hence its notation for specifications for colour sample and achromatic sample. (CO 3 & CO 5)

6+6+4=16

Q.4. (A) Compare between mean cylindrical illuminance (E_{cy}) and mean spherical illuminance (E_{sc}). Mention their importance for an indoor lighting system. (CO 5)

(B) Derive the expression of E_{cy} and E_{sc} for a point source. (CO 4)

6+10=16

Q.5. (A) Discuss CIELAB. (CO 3)

(B) Derive the mathematical expression of the Grassman's colour mixing law to compute the chromaticity of the resultant radiation using luminaire technical data sheet data. (CO 4)

8+8=16