

Ref. No. Ex/EE/PE/B/T/421F/2024(S)

EXAMINATION, 2024

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

SUBJECT ADVANCED LIGHTING CALCULATION AND DESIGN

(Name in full)

PAPER

Full Marks 100

(50 marks for each part)

Time : Two hours/Three hours/Four hours/Six hours

Use a separate Answer-Script for each part

No. of questions		Part I / Part II	Marks
		Question No 1 (5 X 4) is compulsory & Answer any 2 (2 X 15) from the rest Answer any 5 of Question No 1 Justify or do the necessary corrections, if any for the following statements	
1.	a)	Coefficient of Utilization (COU) is the exclusive property of an indoor luminaire only.	
	b)	The method of calculation of Coefficient of Utilization (COU) for a road lighting luminaire is similar like indoor luminaire.	
	c)	The basic concepts of road lighting design is based on luminance .	5 X 4 =20
	d)	Lighting Power Density (LPD) is a standalone metric to evaluate a lighting design.	
	e)	There is no significance of illuminance values for road lighting design as mentioned in IS1944 , 1970	
	f)	If two rooms have the same RCR value , then for the same luminaires will have same COU values.	
	g)	Introduction of lighting control system for an interior space is always an energy efficient approach.	
	h)	Illuminance is the best design parameter for road lighting design.	

[Turn over

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No. of questions		Part I / Part-II	Marks						
2.	a)	What is existing road lighting class as recommended by IS-1944, 1970	6						
	b)	What is the specialty of the road lighting class as proposed in CIE-115, 2011.	9						
3.	a)	Write down the basic algorithm for calculation of point specific illuminance at a grid point in a road surface using luminous intensity data of a road lighting luminaire as input	10						
	b)	Write a note on Utilization Curve of road lighting luminaire.	5						
4.	a)	What is Energy Conservation Building Code published by Bureau of Energy Efficiency ?	4						
	b)	What is the role of iso-lux diagram for road lighting design ?	4						
	c)	Design a general lighting scheme with three different options with different types of lighting system (mentioned below) for the Seminar Hall of the Electrical Engineering Dept, Jadavapur University. The tentative dimension of the KCR Hall is 20 m X 15 m X 4.5 m. The target maintained average illuminance level is 500 Lux as recommended by IS 3646, Part-I & II, 1992. The overall Light Loss Factor to be considered as 0.8. Calculate LPD for both. Make a comment for the suitable design. <table><tr><th>Option-1</th><th>Option-2</th><th>Option-3</th></tr><tr><td>2 X 20 W LED Tube based luminaire with COU 0.75. Driver loss 4 W for each tube. Lumen o/p of the each tube is 1500</td><td>40 W LED Square fitting with diffuser with COU 0.85. Driver loss 4 W. Lumen o/p of the each luminaire is 3000</td><td>a) 2 X 20 W LED Tube based luminaire with COU 0.75. Driver loss 4 W for each tube. Lumen o/p of the each tube is 1500 and b) 15 W LED downlighters with COU 0.75. Driver loss 2 W each and lumen output is 1100</td></tr></table>	Option-1	Option-2	Option-3	2 X 20 W LED Tube based luminaire with COU 0.75. Driver loss 4 W for each tube. Lumen o/p of the each tube is 1500	40 W LED Square fitting with diffuser with COU 0.85. Driver loss 4 W. Lumen o/p of the each luminaire is 3000	a) 2 X 20 W LED Tube based luminaire with COU 0.75. Driver loss 4 W for each tube. Lumen o/p of the each tube is 1500 and b) 15 W LED downlighters with COU 0.75. Driver loss 2 W each and lumen output is 1100	7
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5.	a)	Write down the basic algorithm behind development of energy efficiency class for road lighting installations.	5						
	b)	What is the significance of energy efficiency class for road lighting?	5						
	c)	Write a note on nine points method used earlier for evaluation of a road lighting installation.	5						

B.E.ELECTRICAL ENGG. Supplementary Examination 2024
[4th Year; 2nd Semester]

Subject: ADVANCED LIGHTING CALCULATION AND DESIGN

Time: 3 hours

Use Separate Answer script for each part

Full Marks: 100
(50 marks for each Part)

Part-II

ANSWER ANY THREE QUESTIONS

(Q.No.1 carries 20 marks)

Q.1.

- A) What are the advantages and challenges of daylight integrated artificial lighting system?
- B) Write down the procedure of measurement of diffuse daylight efficacy and global daylight efficacy.
- C) Write down the mathematical expressions of Daylight Coefficient and state how it differs from the Daylight Factor as daylight prediction tool.
- D) The U-factor, SHGC and VLT are considered as essential selection parameters of a glazing system – explain.

4x5=20

Q.2.

- A) Derive the mathematical expression of point-specific horizontal illuminance due to unobstructed sky from basic law of illuminance.
- B) Describe (i) physical principle, (ii) characteristics and (iii) applications of any one from the following daylighting systems –
(I) Louvers and blind system; (II) Light guiding shades.

8x2=16

Q.3.

- A) Write down the CIE SSLD model and explain its applicability with suitable diagram.
- B) Briefly discuss on the conceptual design metrics of daylighting design.

8x2=16

Q.4.

- A) What are the major objectives of roadlighting design?
- B) Write down the thumb rules of pole layout with suitable diagram.
- C) Briefly discuss the luminance based design parameters of roadlighting design.

8x2=16

Q.5.

- A) What is luminance coefficient? Write down, in step, the computational procedure of average road surface luminance within a span of a road surface for single-sided pole installation.
- B) State the assessment procedure of threshold increment in connection to roadlighting design and explain how the threshold increment is considered as a measure of disability glare.

8x2=16

Q.6.

- A) Explain the pay back method in connection to a lighting installation.
- B) Write down the components of capital cost and running cost of lighting installation

8x2=16

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