Ref. No. **Ex/EE/PE/B/T/421F/2024**

B.E. ELECTRICAL ENGINEERING FOURTH YEAR SECOND SEMESTER

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

Time : ~~Two hours~~/Three hours/~~Four hours~~/~~Six hours~~ **(50 marks for each part)**

Use a separate Answer-Script for each part

No. of questions	Part I	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)	There is a gross fundamental difference found between the Light Output Ratio (LOR) and the Coefficient of Utilization (COU) of an indoor luminaire.	
b)	The calculation of Coefficient of Utilization (COU) of an indoor luminaire is exactly same as road lighting luminaire.	
c)	The basic concepts of road lighting design is based on **negative contrast.**	5 X 4 =20
d)	Lighting Power Density (LPD) is a standalone metric to evaluate a lighting design.	
e)	There is no significance of **three values of service illuminances** as mentioned in IS3646 , Part-I & II , 1992	
f)	If two rooms have the same RCR value , then for the same luminaires will have same COU values.	
g)	Integration of daylight in lighting design 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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PAPER .....

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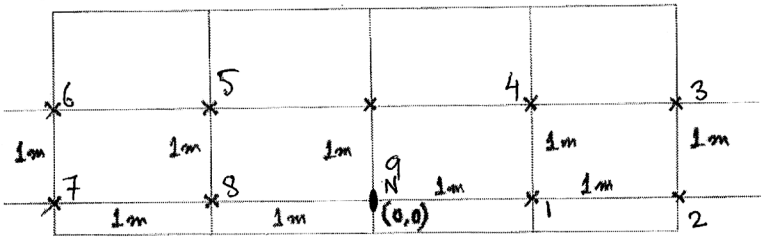
No. of questions		Part I	Marks
2.	a)	Write a note of necessity of a road lighting class as recommended by IS-1944 , 1970	4
	b)	Using the mathematical model as proposed in CIE-115, 2010 discuss the basis of road lighting class. Furthermore, illustrate with a suitable example that how this mathematical model can be used to identify the exact lighting class of a road.	8
	c)	Write a note on the different street lighting arrangements used for the design.	3
3.	a)	There is a 6m wide road as shown in the below figure. A two axis symmetric LED street light luminaire is considered to be placed at Nadir point (0,0). There is a grid with 1m X 1m consists of 9 points (including Nadir point). Calculate the average service illuminance in lux. Consider the Light Loss Factor as 0.6	10



The intensity distribution of the LED luminaire is given below.

γ (°)	$I_{C=25}$(candela)	$I_{C=30}$(candela)	$I_{C=35}$(candela)	$I_{C=40}$(candela)	$I_{C=45}$(candela)
0	1675	1663.6	1651.2	1668.27	1665.57
2.5	1703	1691.6	1679.2	1696.27	1693.57
5	1789	1777.6	1765.2	1782.27	1779.57
7.5	1805	1793.6	1781.2	1798.27	1795.57
10	1888	1876.6	1864.2	1881.27	1878.57
12.5	1943	1931.6	1919.2	1936.27	1933.57
15	1999	1987.6	1975.2	1992.27	1989.57
17.5	2187	2175.6	2163.2	2180.27	2177.57
20	2255	2243.6	2231.2	2248.27	2245.57
22.5	2435	2423.6	2411.2	2428.27	2425.57
25	2602	2590.6	2578.2	2595.27	2592.57
27.5	2799	2787.6	2775.2	2792.27	2789.57
30	2985	2973.6	2961.2	2978.27	2975.57

	b)	Write a note on **Utilization Curve** of road lighting luminaire.	5

Ref. No. **Ex/EE/PE/B/T/421F/2024**

B.E. ELECTRICAL ENGINEERING FOURTH YEAR SECOND SEMESTER

..... 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

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

(50 marks for each part)

Use a separate Answer-Script for each part

No. of questions		Part I	Marks
4.	a)	What is Energy Conservation Building Code published by Bureau of Energy Efficiency ?	5
	b)	Write down the fundamental difference between Building Area method and Space function method of Lighting Power Density analysis as recommended by ECBC 2019	3
	b) c)	Design a general lighting scheme with three different options with different types of lighting system (mentioned below) for the KCR Hall of the Electrical Engineering Dept, Jadavapur University. The tentative dimension of the KCR Hall is 30 m X 20 m X 5 m . The target maintained average illuminance level is 300 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.	7

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

5.	a)	Write down the basic algorithm behind development of energy efficiency class for road lighting installations.	5
	b)	Explain with a suitable example that how illuminance value at a point on the road surface can be calculated for a road lighting installations using isolux diagram.	6
	c)	Explain the difference between point specific illuminance calculation and lumen method based calculations for an indoor lighting applications.	4

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B.E. Electrical Engineering 4th Year; 2nd Semester Examination 2024

Subject: ADVANCED LIGHTING CALCULATION AND DESIGN

Part-II

Time: 3 hours | Use Separate Answer script for each part | Full Marks:100 (50 marks for each Part)

[Answer any three Questions. Q.4 carries 18 marks]

Q.1.	A. Daylight is dynamic in terms of quality and quantity - Explain. B. Sky luminance data is considered as the basic data for daylighting design – Explain. C. Illustrate the procedure of measurement of global daylight efficacy and diffuse daylight efficacy.	4+4+8 =16 [CO1]
Q.2.	A. Describe the CIE Standard sky luminance distribution model. B. Compute the luminance of the sky element ($\alpha=100^0$ from North, $\gamma=30^0$) using the following data. Show each step of computation. i) Sun position ($\alpha_s=140^0$ from North, $\gamma_s=50^0$); ii) Standard sky type:VI.6 (white blue turbid sky with broad solar corona); iii) Standard sky parameters: a=-1.0, b=-0.15, c=24, d=-2.8, e-0.15; iv) Zenith luminance(L_z)=5.5 kcd/m^2.	8+8= 16 [CO2 & CO5]
Q.3	A. Compare between the two daylighting design tools - daylight factor and daylight coefficient. B. Derive the expression of daylight coefficient for computation of point-specific horizontal illuminance.	6+10= 16 [CO2]
Q.4.	A. Write down the design parameters for sports lighting design. B. Explain (i) Average vertical illuminance; (ii) Illuminance gradient and (iii) Camera vertical illuminance with reference to sports lighting design.	6+12 =18 [CO4]
Q.5.	A. How Glare Rating is computed in outdoor lighting? B. Illustrate side-mounted and corner-mounted pole layout for area lighting. C. Differentiate amongst (i) symmetric; (ii) asymmetric and (iii) double asymmetric floodlight luminaire in terms of light distribution.	6+4+6 =16 [CO5]