

B.E.Electrical Engg. Examination 2025
[4th Year; 2nd Semester]
Subject: Advanced Lighting Calculation and Design
Part-I

Time: 3 hours

Use Separate Answer script for each part

Full Marks:100
(50 marks for each Part)**Question number 1 is compulsory and answer any two questions from the rest (20 + 15X2) =50****Answer any 4 from Question number 1****Justify the following with necessary corrections, if any (5X4 =20)**

- 1.a) Both Light Output Ratio (LOR) and the Coefficient of Utilization (COU) are the properties of indoor luminaires only.
- b) The road lighting design is executed based on the **positive contrast** concept.
- c) LPD (watt/m²) is the only standalone criteria for energy evaluation of an indoor lighting design.
- d) Iso-lux diagram is used for road lighting calculation.
- e) V-I characteristics of LED is linear
- f) Illuminance is the best design parameter for road lighting design.
- g) Color correction (v(λ) correction) is very much necessary for a detector for road lighting measurement.
- h) **Nine-Point method** is calculation tool for road lighting.

2.a) Write a note of **Road Lighting Class. 9**

- b) Discuss about the contribution of **CIE-115, 2011** in development of a mathematical model of a road lighting class. **6**

3. a) Discuss about some specific CIE standards published for road lighting. **5**

- b) 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. **7**
- c) Write a note on **Utilization Curve** of luminaires used for Road Lighting. **3**

4. a) What is Bureau of Energy Efficiency? **3**

- b) Write note on **Lighting Power Density (LPD) and Energy Conservation Building Code (ECBC)**. **5**

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 Seminar 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.

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 each tube is 1500 and b) 15 W LED downlighters with COU 0.75. Driver loss 2 W each and lumen output is 1100COU 0.7 , Power

[Turn over

Ref. No. Ex/EE/PE/B/T/421F/2025**B.E. ELECTRICAL ENGINEERING FOURTH YEAR SECOND SEMESTER EXAM 2025****ADVANCED LIGHTING CALCULATION AND DESIGN**

Time: Three Hours

Part-I

Full Marks: 100

Marks: 50

		consumption per luminaire (including Ballast) = 80 W
--	--	---

7

5.a) What is the significance of energy efficiency class for road lighting? Write down the basic algorithm behind development of it for road lighting installations. **10**

c) Write a note on nine points method used earlier for evaluation of a road lighting installation. **5**

B.E.Electrical Engg. Examination 2025
[4th Year; 2nd Semester]
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 Q. No. 1 and any three from the rest]

Q.1.	Explain and justify the following statements with suitable example- A) The technical specification of conventional lighting system is not compatible with daylight integrated artificial lighting system. B) Light-to-solar gain ratio is the most effective glazing parameter to be considered during glazing selection. C) Daylight coefficient (DC) method is more realistic design tool compared to the Daylight Factor (DF) method. D) Diffuse luminous efficacy is higher than global luminous efficacy. E) For any televised sportslighting system, camera vertical illuminance and illuminance gradient are essential design parameters in addition to the vertical illuminance and uniformity of illuminance. F) Average ground reflectance has significant influence on glare rating (GR) value in case of sportslighting.	20 [CO1]
Q.2.	A) Write down the CIE Standard sky luminance distribution model. B) Determine the luminance of the sky element ($\alpha=100^\circ$ from North, $\gamma=55^\circ$) using the following data- i) Sun position ($\alpha_s=200^\circ$ from North, $\gamma_s=45^\circ$); ii) Standard sky type:III.4 (white blue turbid sky with broad solar corona); iii) Standard sky parameters: $a=0.0$, $b=-1.00$, $c=10$, $d=-3.0$, $e=0.45$; iv) Zenith luminance(L_z)= 4.25 kcd/m^2 .	10 [CO2]
Q.3	Derive the mathematical expression of point-specific horizontal illuminance due to an unobstructed sky patch limited by altitude angles $[\gamma_1, \gamma_2]$ and azimuth angles $[\alpha_1, \alpha_2]$. <u>OR</u> Derive the mathematical expression of 'daylight coefficient' for computation of point-specific horizontal illuminance.	10 [CO3]
Q.4.	A) Why energy related parameters of glazing system are to be considered during design of a daylighting scheme? B) Compare between (i) U-value; (ii) Solar heat gain coefficient. C) Define visible light transmittance and write down its computation formula.	10 [CO4]
Q.5.	Describe the experimental procedure to measure (i) Global daylight luminous efficacy and (ii) Diffuse daylight luminous efficacy. <u>OR</u> Compare between top-lighting and side-lighting daylight delivery systems with suitable examples and analyze their relative performance.	10 [CO4]
Q.6.	Analyze the lighting requirements of sportslighting depending on (i) type of sports; (ii) level of sports and (iii) users of sportslighting.	10 [CO5]