

Reg.No.:



VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN

[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]

Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 8010

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – MAY / JUNE 2024

Sixth Semester

Electronics and Communication Engineering

U19EEOE6 – ENERGY EFFICIENT LIGHTING SYSTEM

(Regulation 2019)

Time: Three Hours

Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	List the qualities of a good lighting system.	2	K1	CO1
2.	Distinguish between shadow, glare and reflection.	2	K2	CO1
3.	Define one candela.	2	K1	CO2
4.	Define Luminous Flux and Luminous Intensity. Give the relation between these two quantities and their units.	2	K1	CO2
5.	Assume that you are asked to design the indoor lighting systems for a new library building. Discuss the various steps and options for designing an energy efficient lighting system.	2	K4	CO3
6.	Explain the difference between depreciation factor and wastage factor.	2	K2	CO3
7.	Assume that you are asked to design the outdoor lighting systems for a new library building. Discuss the various steps and options for designing an energy efficient lighting system.	2	K4	CO4
8.	List the various types of street lighting.	2	K1	CO4
9.	Explain the principle of operation of an induction generator.	2	K2	CO5
10.	Explain the process of battery charging and its control.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)
Marks KL CO

- | Q.No. | Questions | Marks | KL | CO | | | | | | | | |
|-----------------------|---|------------|-------|-------|-------|-----------------------|----|----|----|--|--|--|
| 11. | a) Explain in detail the various methods of artificial lighting
(OR) | 13 | K1 | CO1 | | | | | | | | |
| | b) Explain in detail the various lighting schemes. | 13 | K1 | CO1 | | | | | | | | |
| 12. | a) i. In a photometric measurement with a photometer screen, the standard lamp of 50 CP is kept at 20 cm from the screen. If the test lamp having intensity uniformly in all directions is adjusted to 5 cm from the screen, find the luminous flux emitted by the test lamp.
ii. If the standard lamp has a wattage of 50 W, find its MSCP.
(OR) | 7

6 | K4 | CO2 | | | | | | | | |
| | b) State and explain the laws of illumination with suitable equations and illustrations. | 13 | K2 | CO2 | | | | | | | | |
| 13. | a) A hall of 40m x 25m x 6m requires an average illumination of 90 lux on the working plane. The utilization factor is 0.5, depreciation factor is 1.2 and the preferred space-height ratio is 1.2. You have the option to choose any one of the following lamp types for the design- | 13 | K3 | CO3 | | | | | | | | |
| | <table border="1" style="margin: auto; border-collapse: collapse; width: 60%;"> <thead> <tr> <th style="padding: 5px;">Lamp type</th> <th style="padding: 5px;">200 W</th> <th style="padding: 5px;">300 W</th> <th style="padding: 5px;">500 W</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">Efficiency (lumens/W)</td> <td style="text-align: center; padding: 5px;">16</td> <td style="text-align: center; padding: 5px;">18</td> <td style="text-align: center; padding: 5px;">20</td> </tr> </tbody> </table> | Lamp type | 200 W | 300 W | 500 W | Efficiency (lumens/W) | 16 | 18 | 20 | | | |
| Lamp type | 200 W | 300 W | 500 W | | | | | | | | | |
| Efficiency (lumens/W) | 16 | 18 | 20 | | | | | | | | | |
| | Determine the lamp type to be chosen and sketch the lamp layout with spacing.
(OR) | | | | | | | | | | | |
| | b) i. A filament lamp 'A' has a filament radius of 0.0012 cm and length 60 cm. Design a new filament lamp which gives double the candle power at one-fourth the supply voltage when compared to lamp A.
ii. Predict the efficiency of the designed lamp, if the lamp A has an efficiency of 15 lumens/W. | 7

6 | K4 | CO3 | | | | | | | | |
| 14. | a) Explain in detail the steps involved in the design and selection of lighting scheme in flood lighting applications.
(OR) | 13 | K3 | CO4 | | | | | | | | |
| | b) A building front of dimensions of 50 m x 21m has to be illuminated with an average illumination of 100 lux using a certain arrangement of identical projectors kept 25 m away. If the beam spread is 20 degrees, (i) choose a suitable lamp type and wattage of each projector, (ii) Sketch the layout of the projected light. Assume a wastage factor of 1.2, utilisation factor of 0.5, maintenance factor of 0.9. | 7+6=13 | K4 | CO4 | | | | | | | | |

15. a) It is desired to supply DC power to an incandescent lamp of 100W using a AC mains supply. Brightness control is also desired in the application. With suitable block diagrams and circuit diagrams, describe the supply system to the lamp. 13 K3 CO5

(OR)

- b) It is desired to provide artificial lighting to a 20m x 20m classroom from the solar panels installed. Making suitable assumptions, design the luminaries as well as the solar inverter system required. 13 K3 CO5

PART – C

(1 x 15 = 15 Marks)

- | Q.No. | Questions | Marks | KL | CO |
|--------|--|--------|----|-----|
| 16. a) | Three lamps A, B, C are placed horizontally along a straight line and are 5 m vertically above a working plane. The lamp wattages are 20 W, 100 W and 30 W respectively. The lamp B is placed between lamps A and C. Lamp C is 5 m from lamp A and 2 m from lamp B. Each lamp consumes 1.1 W per candle power. | 8+7=15 | K4 | CO2 |
| | i. Find the illumination at a point on the working plane which at the mid-point of the horizontal distance between lamp A and C.
ii. If a 40% higher illumination is required at the same point on the working plane considered in (i), what should be the new wattage of lamp A? | | | |

(OR)

- b) In the figure below, point P is placed on a plane perpendicular the light source plane as shown. The source has a peculiar shape. Clearly discuss the steps involved (no need to derive equations) with suitable notations/illustrations to find the illumination at point P due to the area A3 of the source. The brightness is constant throughout the entire source. 15 K4 CO3

