

V SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING) END SEMESTER ON-LINE PROCTORED EXAMINATIONS

## **JANUARY 2022**

## **INTRODUCTION TO LIGHTING DESIGN (OE) [ELE 4302]**

REVISED CREDIT SYSTEM

Time: 75 Minutes + 10 Minutes	Date: 01 January 2022	Max. Marks: 20

## Instructions to Candidates:

- ✤ Answer ALL the questions.
- Missing data may be suitably assumed.
- Time: 75 minutes for writing + 10 minutes for uploading.
- **1A.** Determine the photon energy in eV (electron-volt) for the following conditions:
  - A. A photon is emitted in Ultra-violet region of electromagnetic spectrum with a wavelength of 110 nanometres (nm). What is its energy in eV?
  - B. Estimate the photon energies in eV for visible light colours, red (800nm) and violet (400nm).

## Assume:

Planck's constant =  $h = 6.626 \times 10^{-34} Js$ ,

Speed of light =  $c = 3 \times 10^8 \text{ m/s}$ ,

 $1 \text{ eV} = 1.6 \text{ x} 10^{-19} \text{J}$ 

- **1B.** "A red rose in daylight makes the red petals appear brighter and the green leaves duller. In twilight, the red petals appear duller, and the green leaves appear brighter." Explain why?
- **1C.** The illuminance measurements of a LED downlight using goniometer are shown in table below. The measurements were done at distance of 4m from the optical center of the source.

Calculate the total luminous flux emitted by the LED downlight using Zonal flux method considering 10-degree zones.

Theta	0	10	20	30	40	50	60	70	80	90
Illuminance	75	72	70	63	52	37	21	7	1	0.00

(04)

(03)

(03)

(03)

- 2A. Justify, why Light-emitting diode (LED) is a current controlled device? (03)
- **2B.** Why is it important to assess the performance of a lighting system? Explain.

**2C.** A room measuring 18m x 9m is to be lit to a lighting level of 250lux. The luminaires are ceiling mounted at a height of 4m.

Assuming a maintenance factor of 0.83 and coefficient of utilization of 0.56, design a suitable lighting scheme using 36W fluorescent lamps having a luminous efficacy of 150lm/W. The Space-to-Height ratio (SHR) limit specified by the manufacturer is 1.5.

- a. Estimate the number of lamps required.
- b. Design a suitable lighting scheme (Draw the lamp disposition).
- c. Calculate the final illuminance level.
- d. What is the final SHR for the design?

(04)