VI SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING) END SEMESTER EXAMINATIONS, APRIL - MAY 2017

SUBJECT: LIGHTING SCIENCE: DEVICES AND SYSTEMS [ELE4007]
REVISED CREDIT SYSTEM

Time: 3 Hours   **Date: 29 April 2017**   **Max. Marks: 50**

Instructions to Candidates:
- ❖ Answer **ALL** the questions.
- ❖ Missing data may be suitably assumed.

1A. Explain the terms Photopic, Scotopic and Mesopic visions in terms of lighting levels. Draw relevant sketches. **(04)**

1B. In a scheme of street lighting, the lamps with uniform intensity of 1000cd. are mounted at a height of 4m above the center line of the road. The long stretch of road will be assumed to be on a horizontal plane and straight. The width of the road is 12m from kerb to kerb. Determine the maximum and minimum illumination on
  i) the kerbs
  ii) Center line of the road.
Assume 5 lamps with 10m spacing between the lamps. **(06)**

2A. What are thermal radiators? With a neat sketch, explain the spectral energy distribution curve of a blackbody radiator. Derive an expression of Wien's displacement law and explain how it is related to the spectral energy distribution of blackbody radiator. **(06)**

2B. An incandescent lamp emitting luminous intensity of 1000Cd in all directions is placed at the center of a spherical globe of 0.75m radius. The upper hemisphere of a globe is silvered and has 85% reflectance. The lower hemisphere is translucent glass with 70% transmittance. Find the illuminance on the inside of the lower hemisphere and the luminous exitance on the outside of the lower hemisphere. **(04)**

3A. Explain the methods of white light generation using LEDs? And list out the merits and demerits of each. **(04)**

3B. Define and Explain the following terms as applicable to luminaire used for interior lighting applications
  i) Louvres (Non focusing type) with example
  ii) Shielding angle
  iii) Optical gain = 2. **(06)**

4A. List out the factors influencing the principle of gaseous discharge lamps. And explain the importance of ballast in operation of fluorescent lamp. **(04)**

4B. The Table 1 data refers to a High Bay industrial fixture (L=1.22m, W=0.41m) with specular reflector tested at distance of 7m. The fixture was tested with four, T5 54W lamps with rated lumen output of 4,450 lumens. Find the light output ratios and the fixture output if it is fitted with dimensionally similar four, T5 lamps of 28W with rated lumen output of 2,600 lumens. **(06)**

5A. Design an energy efficient lighting system (Layout) for warehouse of dimension 18m x 12m x 6m. Required illuminance level is 200 lm/m². Consider light loss factor to be 0.8, suspension height is 75cm and working plane as 85cm and maintain $S/H_m = 1.2$. Calculate the total energy cost for 1 month (31 days) if lighting system is operated 8hrs/day and cost/unit is 7rs. Available lamp is twin, 56W, and 6250 lumens/lamp. And also calculate initial glare value if the direction view is perpendicular to the shorter wall (Refer Table 2).

Room Index	1	2	3	4
Co-eff. of Utilization	0.43	0.52	0.65	0.72

(07)

5B. Mention any six standard points used to improve the lighting quality in a new interior lighting system as per LEED v4 standards? *(03)*

Table 1

θ (Degrees)		0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
E (Lux)	C_0	135	135	133	130	126	121	115	107	98	88	78	66	55	43	31	20	10	2	0
	C_{90}	135	140	142	134	117	91	74	58	48	38	38	36	35	28	14	9	2	2	0

Table 2

X	Y	GI
2H	4H	14.2
	6H	16.3
4H	4H	17.8
	6H	19.1