Reg. No.



(A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING) GRADE IMPROVEMENT EXAMINATIONS, JAN 2021

LIGHTING SCIENCE: DEVICES & SYSTEMS [ELE 4007]

REVISED CREDIT SYSTEM

Time:	: 3 H	lours	Date: 08 January 2021	Max. Marks: 50	
Instru	ctio	ns to Candidates:			
	**	Answer ALL the questions.	v assumed		
	•	Missing data may be suitably	assumeu.		
1A.	Dra	aw neat sketch of Spectral Ey	e Sensitivity curve, explain different types of vi	sion. (04)	
1B.	Using Wien's law plot the spectral radiant exitance curve for wavelength from 280nm to 720nm in steps of 40nm for a black body radiator at temperatures of 5000K and 6500K. Hence prove the validity of Wien's displacement law.				
1C.	A lamp having uniform candle power of 250Cd in all direction is provided with a reflector that directs 65% of total light uniformly into a circular area of 9m in diameter. The lamp is hung 8m vertically above the area. Calculate the illumination at the edge of the circular area with and without reflector. Determine the average illuminance over the area without reflector.				
2A.	Two identical lamps distributing light uniformly in all directions are mounted at a height of 5m above the ground. What must be the spacing between lamp so that illumination midway between lamp is atleast 60% illumination directly under the lamp.				
2B.	Why Tungsten Halogen Lamp does not have Infinite Life span in spite of Haloger Regenerative Cycle ?			Halogen (02)	
2C.	With a neat sketch explain the working of Fluorescent Tube light mentioning the role of starter and ballast. Also explain about Triphosphor Phosphate coating used in the inner wall of the tube.			he role of the inner (04)	
3A.	List and i. ii.	the comparison between H High Pressure Sodium Vap Luminous Efficacy Colour Rendering Index	igh Pressure Mercury Vapor (HPMV), Metal Ha or (HPSV) Lamp on following factors	lide (MH)	

- iii. CCT
- iv. Start Up Time
- v. Restrike Time
- vi. Application

(03)

- **3B.** Sketch the thermal resistance model of an LED including heat sink and mention the different thermal resistances in the model. Also define Junction Temperature.
- 3C. With relevant sketches explain the photometric characteristics of following reflectors
 - i. Integral reflector
 - ii. Circular reflector with source at centre of curvature
- **4A.** A Type C photometric test was conducted in MIT Lighting Measurement laboratory for a Philips Metal Halide lamp with luminous efficacy of 85 lm/W housed in a circular reflector with rotational symmetric distribution. The luminaire intensity distribution is given by the relation $I_{\Theta} = 600(0.35 + \cos\Theta)$. The angle Θ being measured from downward vertical and it emits no light above 110°. If the LOR of the luminaire is 55%, considering zone angles of 10° calculate the LDL and wattage of the lamp.
- **4B.** Create an IES file for the photometric details of the luminaire given in the Question 4A. The luminaire has circular luminous face with radius 18cm and thickness 3cm. Assume the ballast power consumption is 10% of the lamp wattage. If any other data is required/missing can be assumed suitably.
- **4C.** A Paint shop of size 15m x 12m x 6m in a Garage is illuminated by 16 numbers of LED lamp luminaires. Luminaires are disposed with 4x4 arrangement to get uniform light distribution maintaining an illuminance level of 500lux at floor. Determine the Rating of the LED lamp used if its luminous efficacy is 125 lm/W. The table given below can be used to determine the value of Co-efficient of Utilization. Light Loss Factor of 0.7947 can be assumed.

Room Index (RI)	0.8	1.0	1.2	1.4
Co-efficient of Utilization (CU)	0.60	0.70	0.80	0.90

UGR

Also estimate the Glare Index for the Paint shop in the direction of view along the shorter wall of the room. UGR values are given in the table below.

Х	Y	
2H	2H	17.2
3H	2H	17.4
2H	4H	17.6
3H	4H	17.8

Room Dimensions

(04)

- **5A.** Explain Control Zones and ASHREA standards for control zones.
- **5B.** Explain Day Light Harvesting. With schematic diagram explain how control zones are created to maintain uniform light distribution in a classroom with day light integration. **(03)**
- 5C. Explain the key problems and issues in Office Lighting and suggest suitable sensor technology for it. Also explain the design settings and recommendations to be considered in office lighting(04)

(03)

(03)

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(03)

(04)