Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

I SEMESTER M.TECH (ENERGY SYSTEMS AND MANAGEMENT)

END SEMESTER EXAMINATIONS, NOVEMBER 2019

INTEGRATED LIGHTING DESIGN [ELE 5154]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date:19 November 2019** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- Use of Design data book is allowed.

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

1B. What are Blackbody radiators? With neat diagram, explain the relation between Wien's displacement law and spectral energy distribution of a blackbody radiator. ***(04)***

1C. Describe how the transmittance of a light varies depends on thickness of material. ***(02)***

2A. 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 from outside the lower hemisphere. ***(04)***

2B. Design suitable flood lighting scheme required to illuminate the upper 50m of a perfectly diffusing surface building of 30m width and 70m height from the ground. An illuminance level of 100 lux is desired. The projectors are to be mounted on towers, at an appropriate distance away from the base of the building. The building surface has major setback features and architectural projections. Direct lighting fixtures are used, but are poorly maintained. Available lamp is 1000W - Metal Halide - Ellipsoidal. If the projectors are designed to produce a wide beam spread of 45 degrees, suggest appropriate location (distance) for mounting them. Show disposition of circular light patches on the building. Also calculate the total energy cost for 1 month (31 days) if lighting system is operated 12hrs/day and cost/unit is ₹7. Assume: CU=0.4, WLF=1.5 and DF=1/1.5 ***(06)***

3. A room of dimensions 15X6X2.9m is to be lit with illuminance of 200lux on a work plane height of 90cm. Given: CU=0.52, LLF=0.77.

a) Comment on the BZ classification of the luminaire for uniform illumination: Available lamp is 42W, Compact Fluorescent Lamp.

b) Repeat the calculation with energy efficient fluorescent lamp and Comment on energy effectiveness for 8 months (March to October) if lamp is operated 7hrs/day and acceptability of the two schemes. Also calculate the total amount of savings if cost per unit is ₹7. ***(10)***

4. Design an energy efficient lighting system using HPSV lamps for a tunnel of length 1km. The road is one way which has a traffic density of 90000 to 150000 AADT. Tunnel has a face dimension of 15m x 8m. Maximum speed limit is 80kmph. Given CU = 0.6, LLF = 0.8, surface reflectance = 0.25 and SSSD = 140m. The luminance level of threshold zone is 260Cd/m^2. Flickering frequency range is 2.5Hz to 15Hz. Consider the following design conditions:

- Luminance level in the first transition zone: 50% of the luminance in threshold zone.
- Luminance level in the second transition zone: 50% of the luminance in first transition zone.
- In the interior zone, maintain a luminance level of 50% of luminance in the second transition zone.

Ensure spacing between the poles should not exceed 9m. ***(10)***

5. Design lighting system for a given roadway specifications:

- Required illuminance = 15lux
- Use HPSV 250W (LLF = 0.693)
- Road width = 12m
- MH = 10m
- Poles arrangement is staggered with overhang of 0.85m (Positive)

Also comment on the quality of lighting system and give suggestions if any. ***(10)***