| Reg. No. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|

# MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
*(A constituent unit of MAHE, Manipal)*

## VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)
## END SEMESTER EXAMINATIONS, NOVEMBER 2019

### SOLID STATE LIGHTING & CONTROL [ELE 4027]

REVISED CREDIT SYSTEM

**Time: 3 Hours** **Date: 26 November 2019** **Max. Marks: 50**

**Instructions to Candidates:**

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- Draw figures where ever necessary

**1A.** What is the significance of light escape cone in LED fabrication? Show that the extraction efficiency in LED is a function of refractive index of semiconductor material used. ***(05)***

**1B.** Explain the internal and external efficiency of LEDs with expressions. ***(05)***

**2A.** Explain the types of LED based on semiconductor material. ***(03)***

**2B.** Explain the difference between color temperature and correlated color temperature of a light source. ***(03)***

**2C.** For the design of an RGB LED luminaire, producing a CCT of 5000K and lumen output of 400 lumens, determine the mixing proportions using an appropriate algorithm.

| Type | x coordinate | y coordinate | Luminous flux |
|---|---|---|---|
| Red | 0.7006 | 0.2993 | 38 |
| Green | 0.1763 | 0.7228 | 65 |
| Blue | 0.1512 | 0.0336 | 17 |
| 5000K | 0.3451 | 0.3516 | - |

***(04)***

**3A.** The color of a blue cloth appears to be black under the light source L1. When the same blue cloth is placed under light source L2 it appears blue. Discuss the optical property of the source that is responsible for this. ***(03)***

**3B.** A blue LED with peak wavelength 450nm is turned on at -20°C, +20°C and +50°C. Discuss the effect of change in temperature on the spectrum. ***(03)***

**3C.** Write down the advantages and disadvantages of OLEDs and AC LEDs. ***(04)***

**4A.** Explain with neat diagrams the following methods of current regulation.
a) Resistor (b) LM317 ***(03)***

**4B.** Design a suitable driver circuit for the luminaire specifications given below

Input voltage – 25V

LED string voltage – 75V

LED drive current – 350mA

Ripple current - 5%

Voltage ripple – 15%

LED string resistance – 10 ohms

Switching frequency – 50kHz

Draw the desired circuit diagram and label the values. ***(04)***

**4C.** With respect to LED model and its characteristics explain why LED is current driven device and a constant voltage load. ***(03)***

**5A.** With neat block diagrams explain the feedback schemes used to control CCT and flux variations in the luminaire. ***(05)***

**5B.** Explain the parameters on which the junction temperature depend on and one junction temperature measurement technique. ***(05)***