Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

MAKEUP EXAMINATIONS, DEC 2016 - JAN 2017

SUBJECT: SOLID STATE LIGHTING & CONTROLS [ELE 451]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 06 January 2017** **MAX. MARKS: 50**

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.
- Missing data may be suitable assumed.

1A. For buck boost converter based LED driver topology give the following i) power stage transfer function for current mode control ii) Type II compensator transfer function and circuit schematic iii) procedure for compensator design. ***(08)***

1B. Describe the features of ZigBee for solid state lighting controls. ***(02)***

2A. Explain photons emission in LEDs, Life cycle of photon, Overall, Internal, External & Extraction efficiency of photons in LEDs. Also mention the methods to increase the extraction efficiency. ***(05)***

2B. Explain the significance of Total internal reflection and light escape cone in the construction of LED. ***(05)***

3A. Four LED samples with color chromaticity coordinates and lumen output specifications are given in table 1. Obtain the color chromaticity coordinates and lumen output of light mixing without dimming.

Table 1. LED sample specifications

LED	x	y	Y(ϕ)lm
1	0.4753	0.4263	74
2	0.4194	0.3866	87

(04)

3B. Explain the following i) Flux Binning ii) CIE Chromaticity diagram highlighting its significance on color mixing and white light generation. ***(04)***

3C. Discuss the primary factors affecting the lumen maintenance of LED lamps ***(02)***

4A. Draw the thermal resistance model of LED luminaire and explain the importance of proper thermal management in LED ***(04)***

4B. Mention the advantages and disadvantages of matrix configuration scheme used for connecting multiple LEDs ***(02)***

4C. Discuss the advantages and dis advantages of mixed color white light and phosphor converted white light. ***(04)***

5A. Calculate the number of LEDs required for the design of a luminaire with light output 1000 lm with optical efficiency 92% and thermal efficiency 83%. Use LEDs at 4000K CCT with minimum luminous flux of 100 lm @350mA. ***(03)***

5B. A fixture with 5 LEDs connected in parallel is to be used for designing general lighting luminaire with proper heat management technique. Determine the thermal resistance specification from heat sink to air to ensure maximum ambient and junction temperature of 50˚C and 140˚C. Given LED data Vf = 3.3V, If = 350mA , Rth(Tj-sp) = 5˚C/W and Rth(sp-hs) = 1˚C/W. ***(05)***

5C. Explain the heat sink design considerations for the thermal management of LED luminaires ***(02)***

6A. Derive the inductor and capacitor values for a buck based LED driver circuit. Derive its transfer function for voltage mode operation. ***(04)***

6B. Color mixing is applied to get the chromaticity coordinates x=0.38 and y=0.377. LED chromaticity coordinates are given in Table 2. Determine the % duty cycle for RGB LEDs to obtain the desired white point.

Table 2. chromaticity coordinates

LED	x	y
white	**0.6763**	**0.3237**
Amber	**0.2088**	**0.7408**
Blue	**0.1405**	**0.0391**

(04)

6C. Describe the features of DMX for solid state lighting controls. ***(02)***