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प्रज्ञानं ब्रह्म Manipal INSPIRED BY LIFE

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)



II SEMESTER M.TECH (EMAL / PESC) END SEMESTER EXAMINATIONS, MAY 2016

SUBJECT: SOLID STATE LIGHTING & CONTROLS [ELE 544]

(PROGRAM ELECTIVE - I)

Time: 3 Hours

10 MAY 2016

MAX. MARKS: 50

Instructions to Candidates:

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

1A.	With the help of suitable geometrical model, deduce an expression for the intensity emission pattern in LEDs.				
1B.	Justify the following statement.				
	• The criticality of precisely binned LED's depends upon the lighting application.				
	• The efficiency possible for fluorescent light is intrinsically lower than phosphor based LEDs for white light generation.				
	Remote phosphor technology enhances the efficiency.	(04)			
2A.	Why the color bins are defined as parallalograms in 1931 CIE color space? How useful is the binning information provided in manufacturers data sheet? Substantiate your answer with an example.				
2B.	Why do we need electronics to drive LEDs? Discuss any three method of establishing current equalization in LED strings using simple linear circuit.	(06)			
3.	Design a suitable power supply for a color temperature tunable white light generation implementation scheme for the following specifications.				
	Input Voltage - 90 -110V				
	Ripple current -30%				
	Switching frequency- 30kHz				
	LED Drive current – 350mA				
	Change in LED drive current -5%				
	LED Details:				
	Warm white LED, Vf = 3.2V at 350mA, Number of LEDs = 20				
	Cool white LED, Vf = 3.5V at 350mA, Number of LEDs = 40				

Draw the circuit schematic with all values inserted and appropriate rating.

4A. Fig.1 shows the driver topology used in a LED fixture development for a particular lighting application. Deduce the transfer function using small signal approach to enable the design of controller for color & lumen output consistency from the developed product.



(10)

4B. What are the advantages of PWM dimming technique over analog dimming? For the switched mode LED driver shown in Fig.2, discuss the possible approach for implementing analog & PWM dimming technique.



- 5A. Why do we need temperature control & monitoring for LEDs? Discuss any two method for measuring junction temperature. *(06)*
- 5B. Calculate the required heat sink specification for a LED based lighting fixture to meet the following conditions.

Ambient Tempearture : 45 °C

Junction temperature in operation <90% of Tj max.

Total power to dissipate = 80% of LED power consumption

LED Specifications:

6A.

LED : Chip on Board Module (COB) Forward Current: 360mA Forward Voltage: 40.9VDC Luminous Flux: 1200lm. CCT: 3000K Thermal resistance of the COB module Rj-c 2.6°C/W Maximum Junction Temperature = 150 °C The thermal resistance of filler used to attach COB module on heat sink = 0.4 °C/W Also determine the Case and Board temperature. Discuss the reliability issues in Solid State Lighting Luminaires.

- 6B. Write a technical note on LM-80 & TM-21 SSL standard.
- 6C.Discuss the recent developments in Solid State Lighting technology.(03)

(04)

(03)

(04)