

B.E. ELECTRICAL ENGINEERING FOURTH YEAR FIRST SEMESTER EXAM 2025**SUBJECT: - SOLID STATE LIGHTING SYSTEM (HONS.)**

Time: Three hours

Full Marks 100
(50 marks for each part)**Use a separate Answer-Script for each part**

Question No.	PART I (50 Marks) ANSWER ANY THREE QUESTIONS QUESTION NO. 1 CARRIES 18 MARKS	Marks
Q. 1. (A) (B) (C)	Explain Incandescence, Electro-luminescence and Photo-luminescence processes of light generation in electric lamps with suitable examples. Draw and compare spectral power distribution plots of a warm white W-LED and a cool-white pc-WLED. Plot a typical V-I characteristics curve of a LED chip and explain why constant current source is required to drive these light sources.	(6+6+6=18)
Q.2. (A) (B)	Explain the following electron and photon interaction processes in connection with light generation – (i) absorption, (ii) spontaneous emission and (iii) stimulated emission with energy diagram. Discuss direct band gap semiconductor materials used to generate red, green and blue light in terms of band gap energy and spectral power distribution.	(10+6=16)
Q.3. (A) (B)	Explain injection luminescence in connection with light generation from LED. Write down the expression of radiant efficiency & explain each component The peak radiation intensity and chromaticity significantly depends on junction temperature for a LED chip - explain with suitable diagram for GaAs semiconductor.	(8+8=16)
Q.4. (A) (B) (C)	Explain 'escape cone' in connection with light extraction process from LED chip. Why the critical angle (θ_c) is small in case of LED chip? Show that the solid angle subtended by an escape cone at a source point i.e. point of emission given by $\Omega = 2\pi (1 - \cos \theta_c)$.	(6+4+6=16)
Q.5. (A) (B) (C)	Discuss characteristic features of the CIE 1931 x-y chromaticity diagram. Explain the application of this chromaticity diagram to obtain any intermediate color of mixed radiation from a LED floodlight containing red, green and blue LED light source. Explain standard deviation of colour matching (SDCM) with the help of appropriate diagram. Why the SDCM compliance is necessary in case of LED Module?	(6+6+4=16)

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B.E. ELECTRICAL ENGINEERING FOURTH YEAR FIRST SEMESTER

EXAMINATION, 2025

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(1st/2nd-Semester/Repeat/Supplementary/Spl. Supplementary/Old/Annual/Bi-Annual)

SUBJECT SOLID STATE LIGHTING SYSTEMS(HONS.)

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(Name in full)

Use a separate Answer-Script for each part

No. of questions	Part-I / Part II	Marks
	<u>Answer any 3 (3X 16=48) , 2 marks for organized answer</u>	50
1. a)	Why driver is required for LED? What is the fundamental light generation principle of LED? How the color of LED is decided by the type of doping materials?	3
b)	Discuss the difference between LED Package , LED arrays , LED module and LED luminaire as mentioned in NIST , Technical report , Optical division.	13
2. a)	Develop the equivalent circuit of a LED. What do you mean by ESR (equivalent series resistance) of LED?	6
b)	What do you mean by active and passive current control of LED?	10
3. a)	Explain the V-I characteristics of LED .	4
b)	What are the different parameters to be included in any LED test report according to the IES-LM-79-08 standard?	12
4. a)	Discuss the different design parameters used as Key Factors of Thermal Management of high Wattage LED luminaires.	12
b)	Why Thermal Interface Material (TIM) is used between the heat sink and the MCPCB?	4
5.. a)	Explain the active and passive current control methods of LED.	10
b)	Write a note on applications of LED in Human Centric Lighting.	6