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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B.Tech Degree (S, FE) Examination December 2023 (2015 Scheme)

Course Code: EC469

Course Name: OPTO ELECTRONIC DEVICES

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Define the Franz-Keldysh effect in semiconductors. Explain how electric fields influence the absorption spectrum. (10)

b) Discuss applications of the Franz-Keldysh effect in optoelectronic devices and communication systems. (5)

2 a) Explain the threshold condition for lasing in a laser system. Discuss the factors that influence this threshold and their impact on the overall performance of the laser. (10)

b) Explain the line broadening mechanisms in lasers. Discuss the significance of linewidth in laser applications. (5)

3 a) Comment on the absorption of light in semiconductors. Discuss the role of bandgap energy in determining the absorption characteristics. (9)

b) Describe the differences between direct and indirect bandgap semiconductors and their implications for absorption. (6)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Describe the structure and working of InGaN/GaN LEDs, including the role of InGaN in the emission process. (10)

b) Differentiate homo-junction and hetero-junction structures of InGaN/GaN LEDs. (5)

5 a) Explain the principles behind generating white light with dichromatic and trichromatic sources, emphasizing the advantages and limitations of each. (8)

b) Discuss the temperature dependence of trichromatic sources and its implications for colour stability in lighting applications. (7)

6 a) Explain the working principles of quantum well electro absorption modulators. Discuss how quantum well structures enhance the modulation capabilities and efficiency of these devices. (12)

b) Discuss the principles and applications of optical switching devices (3)

PART C

Answer any two full questions, each carries 20 marks.

7 a) A photo diode QE of 65 % when photon energy of $1.5*10^{-19}$J are incident upon it (10)
(i) At what wave length is the photo diode operating?
(ii) Calculate incident optical power required to obtain a photo current of 2.5μA when the photo diode is operating as described above.

b) Describe the working principles of PIN photodiodes and Avalanche photodiodes (10)

8 a) Explain different types of add and drop multiplexer. (10)

b) Describe the structure of thin film transistor display. (10)

9 a) Explain the working principles and applications of Liquid Crystal Displays (LCDs) and Polymer Light-Emitting Diodes (PLEDs) in optoelectronics. (10)

b) Explain the working principles and applications of Directional Couplers in optical communication systems. Discuss the advantages and limitations of directional couplers. (10)

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