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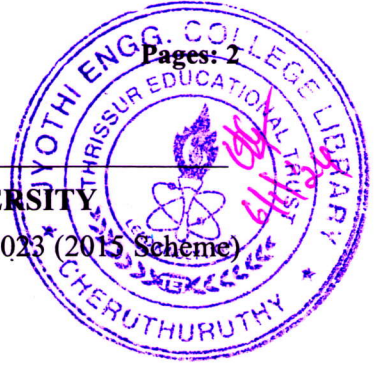
Pages: 2

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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 InGa_N/GaN LEDs, including the role of InGa_N in the emission process. (10)
- b) Differentiate homo-junction and hetero-junction structures of InGa_N/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. (12)
Discuss how quantum well structures enhance the modulation capabilities and efficiency of these devices.
- 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 $1.5 \times 10^{-19} \text{J}$ 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 $2.5 \mu\text{A}$ 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) (10) and Polymer Light-Emitting Diodes (PLEDs) in optoelectronics.
- b) Explain the working principles and applications of Directional Couplers in optical (10) communication systems. Discuss the advantages and limitations of directional couplers.
