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**Question Paper Code : 31344**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Eighth Semester

Electronics and Communication Engineering

EC 2047/EC 803/EC 1011/10144 ECE 38 – OPTOELECTRONIC DEVICES

(Regulation 2008 / 2010)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What do you understand by wave - particle duality of Light?
2. Estimate the energy required to excite electrons from the donor levels to the conduction band in silicon, given that  $m_c = 0.26m$  and the relative permittivity of 11.8.
3. What is meant by stokes shift?
4. A typical He-Ne laser operates with a current of 10 mA at a dc voltage of 2500V and gives an output of 5mW. Determine the overall power efficiency.
5. Calculate the maximum frequency of operation of a thermal detector with thermal time constant of 1 mS.
6. What are the limitations of Germanium based photo diodes?
7. Determine the change in refractive index due to Pockel's effect in a 10mm wide KD\*P crystal, for an applied voltage of 4kV. The electro optic coefficient and refractive index of the material are  $26.4 \times 10^{-12}$  m/V and 1.51 respectively.
8. What is Quantum confined Stark effect?
9. What are the disadvantages of Hybrid Opto electronic Integration?
10. List the factors that dictate the half wave voltage in an active wave guide device.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain the principle of superposition and hence derive an expression for maximum irradiance resulting from four coherent sources. (10)
- (ii) With a neat diagram explain the interference effects in a thin film of refractive index "n". (6)

Or

- (b) (i) Explain in detail about the excess carriers in semiconductors and hence derive the expression for the variation of excess carriers concentration with distance and time. (12)
- (ii) Discuss about Drift and diffusion of carriers with relevant mathematical expressions. (4)
12. (a) Explain the principle, construction and working of an Electro luminescence device with necessary diagrams. (16)

Or

- (b) (i) Discuss the theory of mode locking in laser, with neat diagrams and hence derive an expression for irradiance in a mode locked laser. (12)
- (ii) Explain active and passive mode locking. (4)
13. (a) (i) Explain the principle, construction and working of a Pyro electric detector. (10)
- (ii) Brief about photo emissive devices. (6)

Or

- (b) (i) Explain the principle and operation of Photo transistors. (8)
- (ii) Discuss the construction and working of a vidicon type imaging tube. (8)
14. (a) (i) Explain the concept of external modulation and compare with direct modulation. (6)
- (ii) Explain with a neat diagram, the construction of electro optic effect based external modulator. Also deduce the expression of modulated light. (10)

Or

- (b) (i) Discuss in detail the principle and operation of a photonic switch based on Self electro optic Device (SEED). (10)
- (ii) Explain the concept of Bipolar Controller Modulator (6)

15. (a) (i) Explain the importance of Opto electronic integration. (4)  
(ii) Brief about the principal forms of opto electronic integration with their relative merits and demerits. (12)

Or

- (b) Explain the principle and operation of  
(i) Waveguide coupler (4)  
(ii) Waveguide interferometer (6)  
(iii) Active directional coupler switch. (6)
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