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Question Paper Code : 71716

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Sixth/Seventh Semester

Electronics and Communication Engineering

EC 6016 — OPTO ELECTRONIC DEVICES

(Common to Medical Electronics Engineering)

(Regulations 2013)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Identify the following as intrinsic or extrinsic semiconductor.

    (a) p – Si

    (b) Ge

    (c) GaAs

    (d) pn junction.

2. Give the expression for the electrical conductivity of a semiconductor.

3. What is meant by modulation bandwidth of LED?

4. What is Frank – Keldysh effect?

5. Calculate the thermal noise current of a photo receiver circuit with a bandwidth of 1 GHz connected to a load resistance of $1 k\Omega$.

6. Write any two example for magneto optic devices.

7. Define the external quantum efficiency of a photo detector.

8. Calculate V_{π} for a GaAs amplitude modulator operating at $1.1 \mu m$ if the wave guide is 1.5 mm long, 1 pm thick, refractive index of 3.6 and linear electro – optic coefficient of 1.6×10^{-12} m/V.

9. What are the different types of optical interconnects?

10. Define eye closure.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Derive an expression for the product (np) for a degenerate n type semiconductor. (8)

    (ii) Show that the Fermi Dirac distribution function is symmetrical about $E = E_F$ at any temperature. (8)

    Or

    (b) (i) Find the packing fraction of BCC unit cell having spherical atomic shells. (8)

    (ii) Explain the Hall experimental set up to measure the Hall parameters. (8)

12. (a) Derive the expression for the total photon flux emitted by a LED due to forward bias injection. (16)

    Or

    (b) (i) Explain the classes of Lasers with examples. (6)

    (ii) Derive an expression for gain in a semi conducting medium. (10)

13. (a) Discuss the characteristics of p-i-n photodiode with its energy band diagram under biased condition and arrive at the expression for its quantum efficiency. (16)

    Or

    (b) Derive an expression for the gain of a photoconductor with dc excitation at different levels of increasing applied bias if the device has one ohmic contact for electron flow and the other blocking holes. (16)

14. (a) Describe an Electro – optic phase modulator with neat diagram and explain how the phase shift determine the output wave. (16)

    Or

    (b) Write notes on :

    (i) Quantum confined stark effect (QCSE) (8)

    (ii) BRAQWET modulator. (8)

15. (a) Describe about the Mach – Zehnder interferometer with input and output 3dB couplers and arrive at the expression for half wave voltage. (16)

    Or

    (b) Describe the operation of a PIN – HBT front end photo receiver and explain how to evaluate the noise performance of a practical photo receiver circuit. (16)