বিদ্যাসাগর বিশ্ববিদ্যালয়

VIDYASAGAR UNIVERSITY

M.Sc. Examinations 2020
Semester IV
Subject: PHYSICS
Paper: PHS 403
(Theory)

Full Marks: 40 **Time: 2 hrs.**

Candidates are required to give their answers in their own words as far as practicable.

UNIT – PHS403.1 (Semiconductor Devices)

Answer any one of the following:

1. Explain the operation of Gunn Diode?
2. Find an expression of Electron Temperature for Gunn Diode?
3. Find total emitter current assuming a pnp transistor under common base configuration?
4. Find recombination current, Transport coefficient and injection ratio for a pnp transistor under common base configuration?
5. Explain I-V characteristics of Tunnel Diode?
6. Find the expression of channel conductance of a FET assuming applied voltage is small.
7. Explain forward blocking state and reverse blocking state of SCR.
8. Explain how conducting channel appears in MOSFET.
9. Find the relation between Hall Mobility and Drift Mobility. Explain the principle of Drift Mobility measurement experiment.
10. Explain variation of mobility with temperature for a nondegenerate semiconductor.
11. Explain the volume component and contact component of Thermoemf of junction consisting

of semiconductors.

12. Explain Quantum Hall Effect.

PHS – 403.2 (Applied Optics)

Answer any One of the following questions

1. What do you mean by non-linear medium? Discuss the method of second harmonic generation using a non-linear material. Explain 'index ellipsoid' in connection to the second harmonic generation using a non-linear material.
2. Show that the refractive index of a non-linear material depends on the intensity of light falls on it. Give four applications of nonlinear optical materials.
3. What is self-focusing? Derive the expression for the self-focusing length of an optical fibre.
4. Construct optoelectronic X-OR gate and AND gate and verify truth tables.
5. Construct an optoelectronic full adder circuit and verify the truth table.
6. Show how can you obtain all-optical NOR, XOR, AND, NAND, and OR gates in practice.
7. What is the advantage of the tri-state logic system over the binary system? How the tri-state logic system is achieved in practice?
8. Obtain the expression for a multipath broadening of a laser pulse in an optical fibre.
9. Describe the working principle of an optical fibre and explain the necessity of cladding in it. Give the expression for the numerical aperture (NA) of an optical fibre and show that it is related to the frictional index change Δ, by the equation

$$NA = n_1 (2\Delta)^{1/2}$$

10. Show that the ray path in a graded-index optical fibre is sinusoidal.
11. Derive the expression of V-parameter of an optical fibre and show how the number of modes allowed in a fibre is calculated by using V-parameter.
12. What is the difference between holography and normal photography? What is the basic holographic equation? How the image of an object can be reconstructed from a hologram?

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