2022

M.Sc.

4th Semester Examination

PHYSICS

PAPER—PHS-403

Full Marks : 40

Time : 2 Hours

The figures in the margin indicate full marks.

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

Illustrate the answers wherever necessary.

PHS-403.1 SEMICONDUCTOR DEVICE

[Marks : 20]

1. Answer any *two* questions : 2×2

   (a) Explain how a junction Transistor acts as Phototransistor.

   (b) Find the relation between Hall Mobility and Drift Mobility.

(c) Show the configuration of an SCR and mention one application.

(d) Show the hetero structure laser diode band diagram in equilibrium as well as under bias.

2. Answer any *two* questions : 2×4

(a) Derive the condition to achieve lasing action from a laser diode.

(b) Explain the tunnel diode I-V characteristics using band diagrams.

(c) Find an expression of emitter current due to hole for a p-n-p transistor under common base configuration.

(d) Explain how mobility varies with temperature in a nondegenerate semiconductor.

3. Answer any *one* question : 1×8

(a) Explain with band diagram the principle of Gunn Diode and hence find an expression of electron temperature.

(b) Assuming Boltzman Transport Equation, find the expression of conductivity of a non-degenerate semiconductor in terms of relaxation time.

PHS-403.2 APPLIED OPTICS

[Marks : 20]

4. Answer any *two* questions : 2×2

(a) Why electromagnetic interference (EMI) does in copper cable communication ?

(b) With supporting figure discuss the operation of an all-optical NOT gate.

(c) Write the name of two photosensors.

(d) Why a coherent light is important in holography ?

5. Answer any *two* questions : 2×4

(a) Show that two optical frequencies can be added using a non-linear medium.

(b) Construct an optoelectronic half adder circuit.

(c) Discuss the phase matching condition in optical non-linear medium for 2nd harmonic generation.

(d) With supporting diagram discuss the method of reconstruction of wavefront in a hologram.

6. Answer any *one* question : 1×8

(a) Derive the expressions of TE symmetric and antisymmetric waves in a planar waveguide. What will be the V-parameter of a single mode fiber ?

(b) (i) What are the advantages of parallel processing ?

(ii) Show how can you obtain all-optical NOR, XOR and AND gates in practice.

2+(3×2)

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