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PG CBCS

M.Sc. Semester-IV Examination, 2022

PHYSICS

PAPER: PHS 403

(SEMICONDUCTOR DEVICES & APPLIED OPTICS)

Full Marks: 40 **Time: 2 Hours**

Write the answer for each unit in separate sheet

The figures in the right-hand margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

PHS 403.1 Semiconductor Devices

Marks: 20

GROUP-A

1. Answer any two question: **2×2=4**

a) What is the advantage of semiconductor controlled rectifier (SCR) over a p-n-p-n diode?
b) What are the basic assumptions of quantum Hall effect?
c) How mobility varies with temperature in a non-degenerate semiconductor?
d) Why a SCR is also known as a thyristor?

GROUP-B

2. Answer any two questions: **2×4=8**

a) Derive the relation between ID and VD in a JFET.
b) Discuss with diagram the upper valley and lower valley in a Gunn diode.
c) Discuss the triggering mechanism of a semiconductor controlled rectifier (SCR).
d) "p-n-p-n diode can be considered as equivalent to two coupled transistors', explain.

GROUP-C

3. Answer any one questions: **1×8=8**

a) Discuss different region of a tunnel diode with a neat figure. (8)
b) What is Gunn effect? Derive the expression of the drift velocity of Gunn Diode. (2+6)

PHS 403.2 Applied Optics

Marks: 20

GROUP-A

1. Answer any two question: **2×2=4**

a) State the conditions for multi photon absorption process to generate higher energetic photons than absorbed photons.
b) What are the applications of Pokel's cell? Give the names of two organic materials could be used as Pokel's cell.
c) What are the allowed crystal structures of a Biaxial crystals?

(Turn Over)

GROUP-B

2. Answer any <u>two</u> questions: **2×4=8**

a) Compute the intermodal dispersion per kilometer of length of the fiber and the total dispersion in a 15 in length of the step-index fiber with a core of refractive index 1.55 and cladding of refractive index 1.51.

b) Explain reconstruction of images from holographic plate with proper diagram.

c) Deduce the expression for total time delay due to modal dispersion in Step-Index fiber.

GROUP-C

3. Answer any <u>one</u> questions: **1×8=8**

a) Drive the V-number (normalized frequency) of an optical fiber with inner diameter d, for λ wavelength of light, where n_1 & n_2 is refractive index for inner and outer core respectively. What is graded index fiber? Discuss its advantages over a step-index fiber. (4+2+2)

b) What is optical confinement factor? Deduce the condition for achieving laser oscillations in a quantum well laser. What do you mean by zero dispersion fibers? What are dispersion compensating fibers? (1+3+2+2)

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