# PG CBCS
## M.Sc. Semester-IV Examination, 2019
## PHYSICS
## PAPER: PHS-403

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

---

<u>Use Separate Answer Scripts for each unit</u>

### GROUP-A
### SEMICONDUCTOR DEVICES
**Marks-20**
**Answer 1 and any two from the rest**

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

 a) Explain the negative slope region of current-voltage characteristics of tunnel diode.

 b) What is the origin of thermos emf in a couple consisting of non-degenerate semiconductor.

 c) Prove the condition so that injection efficiency in a transistor would be maximum.

 d) Find the relation between drift mobility and Hall mobility. What is Hall angle                                    (1.5+0.5)

 e) What is SCR?

2. Show the schematic diagram of MOSFET configuration and find an expression of drain current and transconductance.        (1+7=8)

3. Assuming Boltzmann transport equation, find an expression of electrical conductivity of a non-degenerate semiconductor. How mobility vary with temperature for such semiconductor?                    (8)

4. Explain the principle of Gunn effect oscillator? How can you determine the mobility of a carrier experimentally?                (5+3=8)

## GROUP-B
### APPLIED OPTICS
#### Marks-20
#### Answer 1 and any one from the rest

1. **Answer any two questions.** $2 \times 5 = 10$

   a) Write the advantages of an all optical logic gate over electronic and opto-electronic logic gate.

   b) What is holography? Make a comparison between ordinary photography and holography.

   c) What do you mean by multipath broadening in an optical fibre.

   d) Write the example of one Kerr type and one Pockels type of non-linear materials.

   e) Write the advantage of single mode fibre in digital communication over a multi-mode one.

   f) Discuss the truth table of opto-electronic Ex-OP logic gate.

   g) What is Q switching?

   h) Explain the operation of a tunable laser.

2. What do you mean by second harmonic generation of light in a non-linear material? Discuss the method of second harmonic generation. What is phase matching condition in second harmonic generation? Why this condition is essential for second harmonic generation? (2+4+2+2)

3. a) Prove that the 'ray path' in a graded index optical fibre is sinusoidal whose R. I. is given by

   $$n^2(r) = n_1^2 [1 - \left(\frac{r}{a}\right)^2] \text{ for } |r| < r_0$$

   $$= n_1^2 [1 - \left(\frac{r_0}{a}\right)^2] \text{ for } |r| > r_0$$

   b) The R. I. of lore and cladding of a step index fibre is 1.6 and 1.5 respectively. Calculate the acceptance angle of the fibre. Also calculate the minimum and maximum diameter of the fibre so that two symmetrical and two anti-symmetrical modes can be transmitted through the fibre. (4+4+2)

******