

**M.Sc. 4th Semester Examination, 2013**

**PHYSICS**

**PAPER – PHS-403(A + B)**

*Full Marks : 40*

*Time : 2 hours*

*The figures in the right-hand margin indicate marks*

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

*Illustrate the answers wherever necessary*

**Use separate scripts for Gr. – A & B**

**GROUP – A**

**[ Marks : 20 ]**

**Answer Q. Nos. 1 & 2 and one from the rest**

1. Answer any *two* bits : 2 × 2
- (a) Prove that Einstein Relation is valid for electrons in a *p-n* junction under equilibrium condition.

( Turn Over )

(b) What is meant by open circuit voltage and find its expression in a solar cell.

(c) What is meant by diffusion length ?

2. Answer any *two* bits : 3 × 2

(a) Why degenerate semiconductors are essential for the fabrication of semiconductor laser.

(b) Prove that Fermi level remains invariant in a *p-n* junction under equilibrium condition.

(c) Explain schottky barrier assuming width of the M/S junction in large compared to mean free path.

3. Explain the origin of negative differential mobility in a Gunn diode and hence find a relation between electron temperature and lattice temperature. What are the essential conditions a material to show Gunn effect oscillation. 4 + 4 + 2

4. (a) Assuming a transistor connected in common base configuration. Find an expression for total emitter current. 5

- (b) Find an expression of efficiency of a solar cell deriving maximum power output. 5

GROUP – B

[ Marks : 20 ]

Answer Q. No. 1 and any one from the rest

1. Attempt any five : 2 × 5

- (a) What is the difference between an electron source and a neutron source ?
- (b) What is the basic principle of Sol-Gel synthesis ?
- (c) What do you mean by electrochemical synthesis route ?
- (d) Compare probe microscopy with electron microscopy.
- (e) What is the basic concept of 'Raman' spectroscopy ?

- (f) Optical absorption occurs due to electronic transition. True or false ? Justify.
- (g) What is optical lithography ?
2. (a) Describe one thin film deposition technique. State the advantage and disadvantage of the synthesis route.
- (b) What do you mean by polymer material and nano material ?
- (c) State briefly the principle of 'Melt-Quench' method to prepare a glass. 4 + 3 + 3
3. (a) Why the operating voltage of TEM is greater than that of SEM ?
- (b) Give the working principle of photoluminescence.
- (c) What are the main features of atomic force microscope.
- (d) Write a short note on D.T.A. or N.M.R. 2 + 2 + 3 + 3