# M.Sc. 4th Semester Examination, 2012

## 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*

PAPER – PHS - 403(A)

[*Marks* : 20 ]

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

**1.** Answer any *two* bits : 2 × 2

(*a*) Find an expression for barrier potential of a $p$ - $n$ junction in term of acceptor, donor and intrinsic carrier concentration at room temperature.

(*b*) Explain the principle of Varicaps.

(*c*) What is meant by Ohmic contact ?

2. Answer any *two* bits : 3 × 2

(*a*) Assume a $p^+n$ junction with a graded $n$ region where the doping is described by $N_d(x) = Gx^m$. The depletion layer width extends from the junction at $x = 0$ to the $n$ region. Find the expression for the maximum electric field.

(*b*) Clearly explain the quantum will fabrication using multilayer structure of GaAs and AlGaAs.

(*c*) Explain the generation of photocurrent in a solar cell and hence find an expression of open circuit voltage.

3. (*a*) Derive Einstein's relation assuming a $p$ - $n$ junction under equilibrium condition.

(*b*) Derive diode equation for a $p$ - $n$ junction. 5 + 5

4. (*a*) Explain what is meant by equilibrium and non-equilibrium carriers.

(*b*) Derive an expression of growth of carriers when light falls on a semiconductor. What is quadratic recombination ? 2 + 7 + 1

PAPER – PHS - 403(B)

[*Marks* : 20 ]

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

**1.** Attempt any *five* from the following : 2 × 5

(*a*) Why quantum effect is shown in nano materials ?

(*b*) What do you mean by adsorption and desorption ?

(*c*) Why electron microscopy is better than optical microscopy ?

(*d*) What do you mean by lithography ?

(*e*) How X-ray can be generated for the study of X-ray diffraction pattern ?

(*f*) What is the basic principle of CVD technique of material synthesis ?

(*g*) Give the schematic presentation of electron beam interacting with matter.

2. (*a*) Name any two wet chemical route or solution phase route of material synthesis. State briefly the idea of any one route among them.

(*b*) What do you mean by MOCVD ?

(*c*) What is meant by two-dimentional nano structure ? Give example.

(*d*) Give the principle of Optical Absorption measurement. Explain with block diagram.

3 + 2 + 2 + 3

3. (*a*) Give the schematic diagram of SEM instrument.

(*b*) What is the basic principle of probe microscopy ?

(*c*) What do you mean by photoluminescent material ?

(*d*) How the 'Auger' electron is generated ?

(*e*) Give the schematic arrangement of UHV chamber with different pump system. State three uses of UHV system. 3 + 2 + 1 + 1 + 3