M.Sc. 4th Semester Examination, 2010

PHYSICS

PAPER—PH-2203 (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—PH-2203 A

[*Marks* : 20]

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

1. Answer any *two* bits : 2x2

(*a*) What is the basic requirements to obtain negative differential mobility region in the $v_d - \varepsilon$ curve of a two valley conduction band of a semiconductor ?

(*b*) Why CdTe shown maximum efficiency, if solar cell is made with it ?

(*c*) Prove that in a lightly doped *n*-type semiconductor the conductivity minimum corresponds to

$$n = \left(\frac{\mu_p}{\mu_n}\right)^{1/2} n_i$$

where n_i is the intrinsic carrier concentration.

2. Answer any *two* bits : 3×2

(*a*) Prove that mobility (μ) in a nondegenerate semiconductor in the low temperature region is proportional to $T^{3/2}$.

(*b*) Explain how quantum well is formed by using a multilayer structure of semiconductor and describe its lasing action.

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

3. (*a*) Find an expression of barrier potential in an abrupt p - n junction.

(*b*) Derive Einstein's Relation assuming a p - n junction under equilibrium condition.

(*c*) Find an expression of width of the depletion region in a metal/n-type semiconductor junction. 5 + 3 + 2

4. (*a*) Find an expression of growth of carrier in a semiconductor when light falls on it.

(*b*) Describe the principle of Gunn effect oscillator.

(*c*) What is meant by quardratic recombination? 5 + 3 + 2

PAPER — PH-2203 B

[*Marks*: 20]

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

1. Attempt any *five* : 2 x 5

(*i*) What are the common method to generate X-ray?

(*ii*) What is "electron gun" ?

(*iii*) Give example of 0D, 1D, 2D and 3D structure.

(*iv*) What is the working voltage and resolution difference between TEM and SEM ?

(*v*) Match two pair :

(*i*) XPS	(*I*) Thermal analysis
(*ii*) AFM	(*II*) Chemical analysis
(*iii*) DTA	(*III*) Binding energy
(*iv*) LEED	(*IV*) Surface analysis
	(*V*) Surface micrograph.

(*vi*) What are the basic difference between piezo and ferroelectric materials ?

(*vii*) How will you distinguish the XRD spectra of amorphous and crystalline materials ?

2. (*a*) Discuss different section of a TEM instrument.

(*b*) What is photo-multiplier ?

(*c*) "STM is a tool to explore the atomic resolution"— Justify.

(*d*) What is graphene ? 4 + 2 + 3 + 1

3. (*a*) Write a short note on SEM.

(*b*) What is SOL-GEL technique ?

(*c*) What are the advantages of Neutron diffraction over X-ray diffraction ?

(*d*) Give basic idea of CVD. 4 + 2 + 2 + 2
