M.Sc.

2011

4th Semester Examination

ELECTRONICS

PAPER—EL-2203

Full Marks : 40

Time : 2 Hours

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.

Illustrate the answers wherever necessary.

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

1. Answer any *five* questions :   2×5

   (a) Discuss the physical significance of Fermi Golden Rule.

   (b) Amongst quantum dot and quantum wire lasers which one requires less threshold current and why ?

   (c) Distinguish between graded gap and stair case APDs.

   (d) Explain quasi-equilibrium condition of a semiconductor laser.

   (e) Mention the essential difference between photo conduction and photoemission.

   (f) Discuss the merits of MQW laser compared to QW laser.

2. (a) What do you mean by perturbation ? What are degenerate and non-degenerate systems ?

   (b) In case of time independent perturbation, deduce the expression of first order perturbation in wave function $|n'\rangle$. 5+5

3. (a) Explain why microwave emission of stimulated type could be obtained more easily than laser emission

   (b) What are the advantages of NH_3 MASER ?

   (c) Using time dependent perturbation theory explain the phenomena of absorption and emission. 2+3+5

4. (a) Discuss with a neat energy band diagram the mechanism of a semiconductor laser.

   (b) What are the drawbacks in a homojunction semiconductor laser ?

   We can get better optical confinement and lower threshold current by introducing hetero-junction — Explain why ? 4+(2+4)

5. (a) Discuss how threshold current can be reduced in quantum well.

   (b) Show that the density of state function in two dimension is independent of energy.

   Show graphically how density of states for quantum well differs for the bulk devices. 3+(5+2)

6. (a) Discuss how solid state photo multiplication could be obtained in a super lattice APD.

   (b) Compare p-n photodiode and p-i-n photodiode as regards their performance characteristics.

   (c) Mention different noises present in APDs. 5+3+2