

**2009****M.Sc.****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) What are the differences between Photoconduction and photoemission?
  - (b) How can you improve the threshold voltage of a semiconductor laser?
  - (c) What is a photo multiplier?
  - (d) Using time independent perturbation theory derive the 1st order perturbation in energy.
  - (e) Discuss the physical significance of Fermi-Golden rule.
  - (f) Discuss the merit of MQW laser in comparison to Quantum well laser.

*(Turn Over)*

- (g) Distinguish between graded gap and staircase APDs.
- (h) What is separate confinement Hetero-structure ?
2. (a) Derive the expression of 1st order perturbation in wave function  $|\pi^1\rangle$  considering time independent perturbation theory.
- (b) State and prove the variational principle. 5+5
3. (a) Write down the wave function  $\psi(t)$  in Schrödinger picture and in Hiesenberg picture.
- (b) Prove that

$$|\psi, t\rangle_I = |\psi, t_0\rangle_I + \frac{1}{i\hbar} \int_{t_0}^t dt' V_I(t') |\psi, t'\rangle_I$$

where the symbols have their usual meaning.

4. (a) How  $\frac{\alpha_e}{\alpha_n}$  can be increased in an APD ?
- (b) Describe the principle of operation of a super lattice APD.
- (c) Discus with a neat Energy band diagram the mechanism of a semiconductor laser. 2+3+5
5. (a) Show that the density of state function in two dimension is independent of Energy and also show its graph.
- (b) Discuss the principle of operation of a quantum well Laser. (5+1)+4
6. (a) What are the advantages of SAM-APD over an ordinary APD ? What is GRIN-SCH ?
- (b) Write a short note an MASER. (3+2)+5