

Total No. of Questions : 4]

SEAT No. :

P871

[Total No. of Pages : 3

[5315] -468

T.Y.B.Sc.

ELECTRONIC SCIENCE

EL - 344 : Foundation of Nano Electronics

(2013 Pattern) (Paper - IV) (Semester - IV)

Time : 2 Hours]

[Max. Marks :40

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Neat diagram must be drawn wherever necessary.
- 4) Use of calculator is allowed.

Given : i) Mass of electron, $m_e = 9.1 \times 10^{-31} \text{ kg}$
ii) Planck's constant, $h = 6.625 \times 10^{-34} \text{ J.S.}$
iii) Charge on electron $e = 1.6 \times 10^{-19} \text{ C.}$

Q1) Attempt all of the following :

- a) Write an expression for equation of continuity. [1]
- b) What is tunneling effect? [1]
- c) What is Gaussian Distribution? [1]
- d) Define Lithography. [1]
- e) Write Schrodinger's time independent equation. [2]
- f) Define cyclotron frequency and write its expression. [2]
- g) What is density of states of electrons? [2]
- h) What is bottom up approach in nanoelectronics? [2]

P.T.O.

Q2) Attempt any two of the following :

- a) Write a note on electron transport in quantum wire. [4]
- b) Explain maxwell - boltzmann statistics. [4]
- c) Obtain an expression for wave equation for E in conducting medium? [4]

Q3) Attempt any two of the following :

- a) Describe the construction of resonant tunneling diode with proper diagram. [4]
- b) Obtain schrodinger time dependent wave equation. [4]
- c) Obtain an expression for density of states of electron in 2 D nanostructure. [4]

Q4) Attempt any two of the following.

- a) State poynting vector theorem and obtain expression for it. [6]
- b)
 - i) State and explain Pauli's exclusion principle. [3]
 - ii) Write the comparision between energy of electron in an atom and energy of electron in infinite potential well. [3]
- c)
 - i) Explain Bose - Einstein statistics. [3]
 - ii) Write any three applications of quantum dot. [3]

OR

[5315] - 468

2

Attempt all of the following

- a) Calculate the de - Broglie wave length of an electron moving with the velocity of 10^6 m/s. **[4]**
- b) Calculate the skin - depth for conducting medium for a wave of frequency 60 Hz, conductivity of 3×10^4 mho/m and permeability of $4 \pi \times 10^{-7}$ H/m. **[4]**
- c) Calculate the ground state energy of an electron in infinite potential well of width 2\AA **[4]**

