

Total No. of Questions : 12]

SEAT No. :

P1124

[4659]-340

[Total No. of Pages : 3

B.E. (Instrumentation Engineering)

b - NANO INSTRUMENTATION

(2008 Course) (Elective - II) (Semester - I) (406265)

Time : 3Hours]

[Max. Marks :100

Instructions to the candidates:

- 1) *Answer three question from each section.*
- 2) *Answers to the two sections should be written in seperate books.*
- 3) *Neat diagrams must be drawn wherever necessary*
- 4) *Figure to the right indicate full marks.*

SECTION-I

- Q1)** a) Explain the electron tunneling through potential barrier and give the parameters on which electron transport depends at Nano scale. [6]
- b) Explain qualitatively the energy subbands structure and state expressions for the density of states for an electron confined in [6]
- i) 2- D ii) 1- D iii) 0- D
- c) Explain the self-assembly techniques viz. [6]
- i) L- B technique
- ii) Electrostatic

OR

- Q2)** a) Give the two approaches of making Nano materials and explain the Nano-lithography. [6]
- b) Explain the PVD for the synthesis of Nano materials. [6]
- c) Explain the various types of Nano materials with their characteristics and applications. [6]
- Q3)** a) State and explain the important types of interatomic forces involved in the tip sample interaction of an AFM with different modes of operation.[8]
- b) Explain the origin of tunneling current and discuss the various modes of operation of a STM. [8]

OR

P.T.O.

- Q4)** a) Explain the principle, working of an SNOM. [8]
b) Describe Micro and Nano cantilevers or MEMS & NEMS cantilevers. [8]
- Q5)** a) What are CNTs? Give the structure and explain the parameters- Chiral vector (or chirality), chiral angle. How it leads to metallic or semiconducting behavior with base structure. [8]
b) Give the unique characteristics of CNTs that makes them ideal candidates for numerous device applications. [8]

OR

- Q6)** a) Describe the principle, working of a CNT based FET. [8]
b) Explain SWCNT based RTD in detail. [8]

SECTION-II

- Q7)** a) What is spin polarization and magnetic moment? Explain the primary processes involved in the spintronic devices. [8]
b) Explain the TMR effect with the help of FM materials and spin filtering device. [8]

OR

- Q8)** a) In spin diode, explain spin polarization, its operation when biases applied, energy band diagram and application. [8]
b) Describe the Bloch sphere representation of quantum states of an electron. Explain how spin based computer are different from computers based on regular transistors. [8]
- Q9)** a) Describe qualitatively the construction and working of an FET as a genuine switch. How does the downscaling of MOSFETs affect their functioning? [8]
b) Explain the concept of resonant tunneling and describe the resonant tunneling diode. [8]

OR

- Q10)** a) Write short notes on single electron transistor and coulomb blockade effect along with conditions required for discrete nature of the singles electron charge transfer. [8]
b) What are mesoscopic devices? Explain the ballistic rectifier with its structure & operation the device working at room temperature. [8]

- Q11)**a) Write a note on electrically controlled Nano actuators. [6]
b) Describe magnetic nanotransducers. [6]
c) Write a note on chemical Nano scale sensors. [6]

OR

- Q12)**a) Describe CNT based IR detector. [6]
b) Explain CNT based Nano Laser. [6]
c) Describe CNT based LED. [6]

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