Roll No._____

M.Sc. (PHYSICS) – 4th SEMESTER
PHYSICS OF NANOMATERIALS - 09020402
END TERM THEORY EXAMINATION

Time: 03:00 Hrs **Max. Marks: 80**

Instructions:
1. Write Roll No. on the Question Paper.
2. Candidate should ensure that they have been provided with correct question paper. Complaint(s) in this regard, if any, should be made within 15 minutes of the commencement of the exam. No complaint in this regard will be entertained thereafter.
3. Attempt **5** Questions in all. Students are required to attempt atlest one question from each unit. Marks are indicated against each question.
4. Draw diagram wherever required.

UNIT-I

Q.1. **(a)** What is quantum confinement? How does it affect the band gap in nanostructures? **(8)**

(b) Briefly describe how melting point of materials depends upon their sizes **(8)**

Q.2. **(a)** What do you understand by density of states? Plot density of states in 0D, 1D, 2D and 3D giving examples of nanostructures in all the dimensions. **(8)**

(b) Explain the different novel properties of materials at nanoscale. **(8)**

UNIT-II

Q.3. **(a)** What is meant by a self assembled monolayer? Give some examples. How any nanoparticle can be synthesized by this technique? **(8)**

(b) Explain in details of top down and bottom up approaches for fabrication of nanomaterials. **(8)**

Q.4. **(a)** How plasma processes are utilized in nanomaterial fabrication. What is the basic difference between cathode sputtering and plasma chemical vapor deposition. **(8)**

(b) Differentiate between electrode deposition and sol gel technique for the thin films deposition **(8)**

UNIT-III

Q.5. **(a)** What is meant by X-ray photoelectron spectroscopy? Explain their working principle. **(8)**

(b) What are the advantages and disadvantages of contact and non-contact methods of surface characterization? **(8)**

Q.6. **(a)** Describe the working principle of scanning tunneling microscopy for contact and non-contact modes. **(8)**

(b) What is meant by secondary ion mass spectroscopy? Explain their working principle. **(8)**

UNIT-IV

Q.7. **(a)** Explain schematically different types of CNT. Describe arc method of CNT formation giving also typical processing parameters **(8)**

(b) What is Coulomb blockade? Describe it with the help of suitable schematics. **(8)**

Q.8. **(a)** What is Graphene? How carbon nanotubes are made from Graphene sheets **(8)**

(b) How can nanomaterials be used in chemical and bio-chemical sensors? Mention some of the advantages of using nano-chemical and bio-chemical sensors instead of conventional ones. **(8)**

Roll No._____

M.Sc.(Physics) 4th Semester
ELECTRONICS – II, – 09020404
ENDTERM THEORY EXAMINATION

Time: 03 Hrs. **Max. Marks: 80**

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3. Attempt five (5) questions in all selecting at least one question from each section. 5th question may be attempted from any section. Marks are indicated against each question.
4. Draw the diagram wherever required.

SECTION - A

Q.1 Explain the various oxidation processes in IC Fabrication. Give their relative advantages and disadvantages. **(16)**

Q.2 (a) Explain Etching process and factorsaffecting it. **(8)**
(b). Explain any two of the following **(2x4=08)**
(i) Diffusion and Fick's law. (ii). CVD (iii). Ion Implantation

SECTION - B

Q.3 Describe monolithic IC Technology. Discuss in detail the fabrication of Bi-polar Junction Transistor. **(16)**

Q.4 Explain any two of the followings. **(2x8=16)**
(a). IC fabrication of Schottky Transistor
(b). Fabrication of CMOS devices.
(c). Fabrication of Monolithic Diode

SECTION – C

Q.5 Distinguish between Schottky contacts and Ohmic contacts. Explain how the Band model gets modified when metal semiconductor contact is made. Give band model diagram. **(16)**

Q.6 (a) Give basic MOS Structure and its biasing. Give necessary Energy level diagram. **(8)**
(b) Explain SPICE and its evaluations. Discuss its DC analysis giving various commands. **(8)**

SECTION – D

Q.7 Construct a Shift Register from S-R Flip-Flops or D Flip-Flops and explain its operation. How a shift register can be used as a Ring counter. **(16)**

Q.8 Explain synchronous counter design. Discuss various steps involved in designing a synchronous counter. Illustrate with an example. **(16)**

Roll No._____

M.Sc.(Physics) 4th Semester
ELECTRONICS – II, – 09020404
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**********ETE MAY 2018**********

Roll No._____

M.Sc.(Physics) - 4th Semester
ELECTRODYNAMICS & PLASMA PHYSICS – 09020409
END TERM THEORY EXAMINATION

Time: 03 Hrs. **Max. Marks: 80**

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4. Draw the diagram wherever required.

SECTION - A

Q.1 Explain the followings.

(a). Non uniqueness of Electromagnetic Potentials and concepts of Gauge. **(8)**

(b). Solution of Laplace Equation in rectangular coordinates. **(8)**

Q.2 What are Dirichlet and Neumann boundary conditions? Discuss formal solution of boundary value problem with Green's function. **(16)**

SECTION - B

Q.3 Discuss the point charge in the presence of a grounded conducting sphere by the method of images.Point charge +q situated at distance a away from the center of a grounded conducting sphere of radius R < a. Find the potential outside the sphere. **(16)**

Q.4 Explain the followings in relation to method of Images.

(a) Point charge near a conducting sphere at fixed potential. **(8)**

(b) Conducting sphere in a uniform electric field. **(8)**

SECTION – C

Q.5 What do you mean by power radiated by a point charge? Discuss Larmor's formula and its relativistic generalization **(16)**

Q.6 (a) What do you mean by Retarted potentials? Discuss Lienard-Wiechart Potentials for a point charge. **(8)**

(b). Derive an expression of propagation of Electromagnetic wave in a conductive media and discuss the result. **(8)**

SECTION – D

Q.7 (a) Explain Electron oscillation in a Plasma. How the results changes, when motion of ion is also considered. **(8)**

(b). Explain the terms Confinement of Plasma and Plasma instabilities. **(8)**

Q.8 (a). Explain the propagation of Electromagnetic waves in Plasma containing a magnetic field. **(8)**

(b) Discuss Quasi-neutrality of plasma and Debye shielding distance. **(8)**

**********ETE MAY 2018**********

Roll No._____

M.Sc.(Physics) - 4th Semester
ELECTRODYNAMICS & PLASMA PHYSICS – 09020409
END TERM THEORY EXAMINATION

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**********ETE MAY 2018**********

Roll No. _____

M. Sc (Physics) 4th Semester
Condensed Matter Physics II - 9020411
END TERM THEORY EXAMINATION

Time: 03:00 Hrs **Max. Marks: 80**

Instructions:

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3. Attempt **5** Questions in all. Students are required to attempt at least one question from each unit. Marks are indicated against each question.
4. Draw diagram wherever required.

UNIT-I

Q.1. Describe the motion of electron in band in terms of Wannier functions, i.e., wave packets of Bloch functions. Introduce effective mass tensor in the above derivation. How is the effective mass different from rest mass? **(10+4+2=16)**

Q.2. Using scattering electrons by lattice defects and phonons, and Boltzmann transport equation with relaxation time ansatz, derive expression for electrical conductivity in metals, in presence of external electrical field. Compare the result with that from Drude model. **(12+4=16)**

UNIT-II

Q.3. Explain tunneling effect in quantum mechanics. Explain the working principles and modes of operation of scanning tunneling microscope. Can nano-sized sample be measured by standard optical microscope and why? **(4+8+4=16)**

Q.4. Define quantum 0 D, 1 D, 2-D and 3-D structures in terms of delocalization and confinement dimensions, with examples for each. Explain electrical transport and Coulomb blockade in 0-D nano-structure.

(8+8=16)

UNIT-III

Q.5. Derive ground-state energy of atoms with conduction electrons in solids in Hartree-Fock approximation, within first quantization approach. **(16)**

Q.6. Explain origin of screening of nuclear charge by electrons in atoms in solids. Explain Thomas-Fermi screening. **(8+8=16)**

UNIT-IV

Q.7. Explain single-particle quantum states basis and occupation number basis. Define with properties, the number operator for Fermions and Bosons, in terms of creation and annihilation operators. Why was the need for introduction of number operator felt? **(6+6+4=16)**

Q.8. Describe the field operators and number density operators for Fermions and Bosons in second quantization. Write down the kinetic and potential energy operators in many-body system in second quantized form. Comment on these expressions for operators in second quantized form. **(6+6+4=16)**