



Reg. No. : .....

Name : .....

III Semester M.Sc. Degree (CBSS-Reg./Suppl./Imp.)

Examination, October - 2019

(2014 Admission Onwards)

PHYSICS

PHY3C11 : SOLID STATE PHYSICS

Time : 3 Hours

Max. Marks : 60

## SECTION - A

Answer both Questions (Either a or b). (2×12=24)

- I. a) Discuss the Kronig-Penney model for the motion of an electron in a periodic potential.

(OR)

- b) Derive an expression for Phonon dispersion in a diatomic linear lattice. How is the optical and acoustic branches distinguished in Phonon vibrations.

- II. a) Give the basis of London theory. Derive the London equations. Mention its significance.

(OR)

- b) Describe Langevin's theory for a paramagnetic gas and obtain an expression for the paramagnetic susceptibility of a free electron gas. How does paramagnetic susceptibility vary with temperature?

## SECTION - B

Answer any **Four** questions 1 mark for part (a), 3 marks for part (b), and 5 marks for part (c). (4×9=36)

- III. a) What are Brillouin zones?  
b) How are they related to the energy of an electron in a metal?  
c) Explain the significance of Brillouin zones with reference to any cubic lattice.

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- IV.** a) What is lattice heat capacity?  
b) What are the experimentally observed facts about heat capacity?  
c) Explain Einstein's model of heat capacity.
- V.** a) What are quartz crystals?  
b) What are the different types of quartz crystals?  
c) Explain the applications of quartz crystals.
- VI.** a) What are Paramagnetic and diamagnetic materials?  
b) What does Paramagnetic susceptibility of a substance vary with temperature?  
c) Derive an expression for the paramagnetic susceptibility of a substance based on free electron theory.
- VII.** a) What is superconductivity?  
b) Explain Meissner effect.  
c) List out the properties that change below the transition temperature and those that do not change.
- VIII.** a) What are intrinsic semiconductors?  
b) How is the band model helpful in explaining the various properties of semiconductors.  
c) Give the theory of intrinsic semiconductors.
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