



Reg. No. :

Name :

Sixth Semester B.Sc. Degree Examination, April 2014

First Degree Programme under CBCSS

PHYSICS

Core Course – IX

PY 1641 : Solid State Physics

Time : 3 Hours

Max. Weights : 30

SECTION – A

(This Section contains **four** bunches **each** of **four** questions. Answer **all 16** questions.
Each bunch carries a weightage of **one**.) :

(16 × ¼ = 4 Weights)

- I. 1) The strongest bond is
a) Metallic bond
b) Ionic bond
c) Covalent bond
d) Vand der Waals bond
- 2) The number of molecules present in the unit cell of sodium chloride is
a) 5
b) 2
c) 4
d) 1
- 3) The density of state is proportional to
a) $E^{1/2}$
b) $E^{3/2}$
c) $E^{2/3}$
d) E^2
- 4) At low temperature the variation of lattice specific heat capacity (C_v) with temperature is T is given by
a) $C_v \propto T$
b) $C_v \propto T^2$
c) $C_v \propto T^3$
d) $C_v \propto T^{-3}$
- II. 5) The relation between flux density and electric field is
a) $D = \epsilon + E$
b) $D = \epsilon - E$
c) $D = \epsilon/E$
d) $D = \epsilon \times E$
- 6) The factor responsible for spontaneous polarization is
a) free electron
b) atoms
c) permanent dipoles
d) ions

P.T.O.



7) If a is lattice constant and λ wavelength of the X-rays then for no diffraction to occur the condition is

- a) $\lambda > 2a$ b) $\lambda < a$ c) $\lambda > a$ d) $a < \lambda < 2a$

8) Substances with negative susceptibility are called

- a) paramagnetic b) diamagnetic
c) ferro magnetic d) anti ferro magnetic

III. Fill in the blanks :

9) A Bloch wall in a crystal is the transition layer that separates adjacent domains magnetized in _____ directions.

10) The effective mass of electron $m^* = \frac{\hbar^2}{?}$.

11) A Fermi surface is the surface in K space inside which all the states are occupied by _____ electrons.

12) According to Ohms law the current density $J =$ _____.

IV. State whether the statements are **true** or **false** :

13) The reciprocal lattice of bcc lattice is fcc lattice.

14) All piezoelectric materials exhibit ferro electricity.

15) Above Curie temperature the ferromagnetic materials become diamagnetic.

16) MnO and MnS are examples of antiferromagnetic materials.

SECTION – B

(Answer **any eight** questions. **Each** question carries a weightage of **one**.)

17) Why electron diffraction is preferred for surface studies ?

18) Discuss the importance of reciprocal lattice.

19) Discuss the significance of Hall coefficient.



- 20) Obtain the relation between inter planar spacing in crystals and the wavelength of the scattering radiation.
- 21) What are the basic assumptions of Drude – Lorentz theory ?
- 22) Explain dipolar polarization.
- 23) Write note on antiferromagnetism.
- 24) Explain Meissner effect.
- 25) Explain photoluminescence.
- 26) Discuss Josephson tunnelling.
- 27) Explain the phenomenon of magneto-resistance.
- 28) Write note on Fermi surface.

SECTION – C

(Answer **any five** questions. **Each** question carries a weightage of **two**)

- 29) Calculate the glancing angle on the (1 1 1) plane of a crystal with spacing $a = 0.451$ nm corresponding to the first order diffraction maximum for X-rays of wavelength 0.154 nm.
- 30) An electric field of 200 V/m is applied to a sample of n-type semiconductor whose hall coefficient is -0.0125 m³/coulomb. Determine the current density. Given the electron mobility is 0.36 m²/V-s.
- 31) In a crystal lattice, a plane intercepts the axes at distances $2a$, $3b$ and c (where a , b and c are the magnitudes of the basis vectors). Calculate the Miller indices of the plane.
- 32) Show that the packing factor for bcc structure is 0.68 .
- 33) Calculate the critical field temperature 4.2 K for a wire of lead. Given T_c for lead is 7.18 K and $H_0 = 6.5 \times 10^4$ A/m.
- 34) A paramagnetic substance has 10^{28} atoms/m³. The magnetic moment of each atom is 2×10^{-23} . Determine the paramagnetic susceptibility at 300 K.



- 35) The critical temperature of a superconductor at zero magnetic field is T_c . Determine the temperature at which the critical field becomes half of its value at 0K.
- 36) Show that the volume of the unit cell of the reciprocal lattice is inversely proportional to the volume of a unit cell of direct lattice.

SECTION – D

(Answer **any two** questions. **Each** question carries a weightage of **four**.)

- 37) With the help of neat diagram explain the basic features of different types of Bravais lattice.
- 38) Discuss the theory of superconductivity and the effect of magnetic field in superconductors.
- 39) Explain Bloch theorem and discuss the origin of energy gap using Kronig-Penney mode.