UG Odd Semester Examination, 2022

EDUCATION B.Sc. B.Ed

(7th Semester)

Course No.: BSPH-703

(Molecular Physics, Condensed Matter Physics & Quantum Mechanics)

Full Marks: 50

Pass Marks: 20

Time: 2 hours

The figures in the right margin indicate full marks for the question.
Answer the following five (5) questions

1. (a) Derive an expression for the rotational-vibrational energy level of a diatomic molecule.

   (b) Hence derive an expression for the frequency of P, R branch.

   (c) Write short notes on : Morse-Potential

   5+3+2=10

Or

2. (a) Explain Frank-condon principle

   (b) Write short notes on the following :

   (i) Dissociation and Predissociation

   (ii) Flurescence and Phosphorescence

   2+4x2=10

3. (a) Describe an expression for the interplanner spacing in 3d-Bravice lattice.

(b) Justify the statement :

"Five fold rotational axis is absent in bravice lattice".

(c) Derive the c:a ratio of a hcP lattice. Hence calculate the Packing fraction of hcP lattice. 3+3+4=10

Or

4. (a) Prove the following IDENTITYe

(i) σ_{kkl} in normal to (hkl) plane.

(ii) Reciprocal of Bce lattice is Fce lattice

(b) Cu has Fee structure with density $P=P_o$ kg/ m^3. Calculate the unit cell dimension. It is given, mass of cu atom $M_{eu}= M_o$ amu. 2+3+5=10

5. (a) Derive the expression of the following parameters applying free-electron theory :

(i) Electron density (n)

(ii) Fermi energy at 0K (E_{F_0})

(iii) Avarage energy $\overline{E_0}$

(b) Explain Hall effect. 6+4=10

Or

6. (a) Describe Bloch theorem.

(b) Derive an expression for the effective mass of an electron in a bond.

Hence justify the importance of –ve effective mass. 3+7=10

7. (a) Derive an expression for the bonding energy of solid. Hence evaluate the value of Madelung constant.

(b) Write short notes on Hydrogen bond. 8+2=10

Or

8. (a) Compare the nature of specific heat of both normal and superconducting state.

(b) Explain 'Cooper pair'.

(c) Derive an expression for magnetic susceptibility of a superconductor. 4+4+2=10

9. (a) Derive an expression for de-Broglie wavelength of an electron with energy E_0 ev.

(b) Calculate the kinetic energy of a proton whose de-Broglie wavelength is 1.5 fm.

(Rest energy of Proton= 0.938 Gev)

(1Gev= 1.6 x 10^{-10} Joule) 4+6=10

Or

10. (a) The lifetime of an axcited state of an atom is about 10–8 sec. Determine the uncertainity in energy calculation.

(b) Explain the Davisson-Garmer's experiment. 5+5=10

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