B.Sc. Semester-II Examination, 2022-23

ELECTRONICS [Honours]

Course ID : 21712 Course Code : SH/ELC/202/C-4(T4)

Course Title : Applied Physics

Time : 1 Hour 15 Minutes Full Marks : 25

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer any **three** from the following questions: 1×3=3

   a) What is wave particle duality?

   b) What do you mean by matter waves?

   c) What is an ideal crystal?

   d) What is Fermi level of energy?

   e) Draw T-S indicator diagram for thermodynamic process?

   f) What is Compton's effect?

2. Answer any **three** from the following questions: 2×3=6

   a) Express Plank's radiation formula in terms of wavelength (λ).

   b) Construct time-independent Schrodinger's wave equation in one-dimension for a free particle with mass 'm' in a force field.

   c) Write down the expression for probability distribution function for the B-E and F-D statistics.

   d) What is Packing fraction? Write down the value of packing fraction in a FCC (Face centered cubic) crystal lattice.

   e) What are Miller indices? What is its importance?

   f) By which experiment the existence of de Broglie wavelength was confirmed? Give one basic postulate of quantum mechanics.

3. Answer any **two** from the following questions: 5×2=10

   a) On the basis of quantum theory, define (i) Eigen function (ii) Eigen operator and (iii) Eigen values with proper examples. Give the probabilistic interpretation of the wave function ψ(x, t).

   b) What do you understand by reciprocal lattice? Show that a reciprocal lattice of f-c-c is a b-c-c (body centred cubic) structure.

c) Derive an expression for the perpendicular separation d_{hkl} between an identical set of parallel planes. How many types of Bravis lattices are there in an orthorhombic crystal?

d) i) State Hesenberg's uncertenty principle.

ii) Write down the Einstein's equation explaning the terms involved.

iii) What is quantum mechanical tunneling?

$1\frac{1}{2}+1\frac{1}{2}+2=5$

4. Answer any **one** of the following questions: $6\times1=6$

a) Give P-V indicator diagram for an (i) isothermal process and (ii) adiabatic process. Hence derive the expression for efficiency of a Carnot engine from P-V indicator diagram. 3+3=6

b) Derive an expression for the energy of an electron in its n-th orbit in a one-dimensional box problems. Hence find the expression of wave function ψ at the same orbit. 4+2=6

c) Plot the graph of the simplified equation obtained by Kronig Penny model in periodic crystal lattice with periodic potential after nacssary approximation and correction. What conclusions were drawn from that plot? Finally plot the E-K curve from there and classify the solid with metal and insulator of a semiconductor from that E-K curve.

2+2+2=6

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