WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 2nd Semester Examination, 2020

ELSACOR04T-ELECTRONICS (CC4)

Time Allotted: 2 Hours | Full Marks: 40

The figures in the margin indicate full marks.
Candidates should answer in their own words and adhere to the word limit as practicable.
All symbols are of usual significance.

GROUP-A

1. Answer any ***five*** questions from the following: 2×5 = 10

   (a) What is photo electric effect?

   (b) State Heisenberg's uncertainty principle.

   (c) Define phase space and Γ-space.

   (d) State second law of thermodynamics.

   (e) What is the threshold frequency for photoelectric emission? On what factor does it depend?

   (f) What is the classical limit of quantum physics?

   (g) Define fermions.

   (h) What do you mean by statistical equilibrium?

GROUP-B

2. Answer any ***two*** of the following: 15×2 = 30

   (a) (i) Write down the time-dependent and time-independent Schrodinger wave equations for a particle. 3+6+6

   (ii) A particle of mass *m* is confined in a field free region between impenetrable walls at $x = 0$ and $x = a$. Show that the stationary energy levels of the particle are given by $E_n = \frac{n^2\pi^2h^2}{2ma^2}$.

   (iii) The wave function of a free particle is given by $\psi = Ae^{i(Rx-\omega t)}$, obtain the momentum and energy eigen values.

   (b) (i) How can one determine the maximum kinetic energy of a photo electron? 3+2+3+7

   (ii) Why it is found to be independent of the intensity of incident radiation?

   (iii) Discuss the method of determination of work function of a metal from experimental observations of photoelectric effect.

(iv) A particle of mass *m* is confined in a one dimensional infinite potential well of width *w.* Find the stationary energy levels and the energy eigenfunctions.

(c) (i) Prove the Boltzmann relationship between entropy *S* and the probability *W*. 5+(6+2+2)

(ii) Using B-E statistics, deduce the Planck's law for black body radiation and hence derive Wein's law and Rayleigh-Jeans law.

(d) (i) Give a comparative analysis of the basic postulates of M-B, B-E and F-D statistics. 5+(1+2+2)+5

(ii) What do you mean by Ensembles in statistical mechanics? Describe different types of ensembles. Compare time average and ensemble average.

(iii) An electron remains in excited state for 10^{-11} sec. What is the minimum uncertainty in energy of the excited state?

N.B. : *Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.*

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