B. Sc. in EEE, 2nd Semester 22 February, 2023 (Morning)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid Semester Examination **Summer Semester: 2021 - 2022**
Course Number: Phy 4221 **Full Marks: 75**
Course Title: Engineering Physics II **Time: 90 minutes**

Answer **All** questions. The symbols have their usual meanings. Marks of each question and the corresponding CO and PO are written in brackets.

Sec A

1. (a) Distinguish between crystalline and amorphous solids. Briefly explain the terms space lattice and the basis of a crystal. 6 (CO1) (PO1)

(b) Mention the lattice parameters of the cubic crystal system. Sketch the unit cell of various space lattices in this crystal system. Evaluate the number of atoms per unit cell in various space lattices in an orthorhombic crystal system. 7.5 (CO2) (PO1)

(c) What is the crystalline nature of tungsten crystal? Draw a typical unit cell of this crystal. How many atomic sites are in a tungsten crystal sheet of length *2.5 cm*, breadth *1.5 cm*, and thickness 1.5 *mm*? The lattice constant of tungsten is 0.3165 *nm*. 6 (CO3) (PO1, PO2)

2. (a) Define coordination number. Evaluate the coordination numbers of (i) face-centered cubic and (ii) hexagonal closed-packed crystals; Explain with the help of neat sketches. 6 (CO1) (PO1)

(b) Assuming the atoms are hard spheres, show that for simple cubic, body-centered cubic, and face-centered cubic crystal structures, the lattice constants are related to the radius of the atoms, r, by the relation: 6 (CO2) (PO1)

(i) $a_{sc} = 2r$, (ii) $a_{bcc} = \frac{4r}{\sqrt{3}}$ and (iii) $a_{fcc} = \frac{4r}{\sqrt{2}}$.

(c) Calculate the c/a ratio for an ideal hexagonal crystal structure. 6 (CO3) (PO1, PO2)

Sec B

3.	(a)	Discuss briefly the failure of Classical Physics to describe the experimental facts of a blackbody radiation. Draw the energy of a blackbody radiation as a function of wavelength for different temperatures.	5 (CO1) (PO1)
	(b)	What is photoelectric effect? Draw schematically the experimental arrangement for observing the photoelectric effect. Write down Einstein's equation for the photoelectric effect.	8 (CO2) (PO1)
	(c)	Light of wavelength 4900 Å is incident on (i) nickel surface of work function 8 eV and (ii) potassium surface of work function 2.7 eV. Find out the maximum velocity of the emitted electrons in each case.	6.5 (CO3) (PO2)
4.	(a)	What are the inertial and non-inertial frames of reference? Write down a few consequences of the postulates of the special theory of relativity.	5 (CO4) (PO1)
	(b)	What is relativistic mass? Deduce Einstein's mass energy relation considering the relativistic effect.	8 (CO4) (PO1)
	(c)	A stationary body explodes into two fragments, each of rest mass 1.0 Kg that move apart at speeds 0.6c relative to the original body. Find the rest mass of the original body.	5 (CO4) (PO2)