B. Sc. in EEE
2nd semester

15 April, 2022
Time: 10:0 AM – 1:00 PM

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Semester Final Examination — **Summer Semester: 2020 - 2021**
Course Number: Phy 4221 — **Full Marks: 150**
Course Title: Engineering Physics II — **Time: 3 Hours**

There are **8 (Eight)** questions. Answer **6 (Six)** questions according to the instructions mentioned in Sec A and Sec B. The symbols have their usual meanings. Marks of each question and corresponding CO and PO are written in the brackets.

Sec A
Q1 is compulsory. Answer any Two questions from the rest.

1. (a) Discuss classification of solids from the crystallographic point of view. [6+13+6]
(b) Distinguish between cubic and hexagonal crystal systems. Sketch all Bravais lattices in these crystal systems and calculate number of atoms per unit cells for these Bravais lattices. Formulate relationships between atomic radii and lattice parameters for these crystal systems. (CO 1, CO 2, CO 3) (PO 1, PO 2, PO 3)
(c) Evaluate c/a ration for hexagonal crystal system.

2. (a) Briefly analyze the statement 'Real crystals are never perfect'. [6+13+6]
(b) Describe the classification of defects observed in solids. (CO 2, CO 3, CO 4)
(c) Consider the energy required to create a vacancy in copper crystal is 0.9 eV and the density of copper is 8960 kgm^{-3}. Evaluate the equilibrium number of vacancies in 1 m^3 copper crystal at 1050 °C. (PO 2, PO 3, PO 4)

3. (a) Discuss the characteristics of simple harmonic motion. Write an equation of simple harmonic motion and explain each term on it. Sketch displacement, velocity and acceleration as a function of time for a particle executing simple harmonic motion. Evaluate the total mechanical energy of a linear oscillator and illustrate that it is independent of time and position of the oscillator [16+9] (CO 2, CO 3, CO 4) (PO 2, PO 3, PO 4)
(b) Sketch the followings:
(i) Two simple harmonic motion having same frequency and period but different amplitudes, (ii) Two simple harmonic motion having same

amplitudes but different frequency (iii) Two simple harmonic motion having same amplitude and frequency but different phases.

(c) Starting from the displacement of a simple harmonic motion

4. (a) Explain the term Lissajous figures. Evaluate the resultant of two mutually perpendicular simple harmonic motion of equal frequency, differing amplitude and pahse. [16+9] (CO 2, CO 3, CO 4) (PO 2, PO 3, PO 4)

(b) Formulate the differential equation of forced vibration with damping. Develop the steady state solution of this vibration. Illustrate amplitude and phase of this vibration as a function of frequency.

Sec B

Question 5 and 6 are compulsory. Answer any one from questions 7 and 8.

5. (a) Write down the postulates of the special theory of relativity. 05 CO-5 PO-5

(b) What is relativistic mass? Deduce Einstein's mass energy relation considering relativistic effect. 15 CO-6 PO-6

(c) What is length contraction? A crew member on a spaceship that flies past at a speed of 0.98c relative to the earth, measures its length obtaining 300 m. What length the observer will measure on earth? 05 CO-6 PO-6

6. (a) What is a thermocouple? Draw schematically the standard configuration of a Chromel–alumel thermocouple. 08 CO-7 PO-7

(b) How can Thomson effect provide a link between Seebeck effect and Peltier effect? What are positive, negative and zero Thomson effect? 08 CO-7 PO-7

(c) What is the significance of neutral temperature and inversion temperature for a thermocouple? Explain Seebeck and Peltier effect using free electron theory. 09 CO-7 PO-7

7. (a) Describe briefly different types of waves with appropriate examples. 10 CO-8 PO-8

(b) Draw schematically the potential energy, kinetic energy, and mechanical energy as a function of time for a linear harmonic oscillator. At which position energy is all kinetic and at which position it is all potential? 10 CO-8 PO-8

(c) Find the mechanical energy of a block–spring system having a spring constant of 1.3 N/cm and an oscillation amplitude of 2.4 cm. 05 CO-8 PO-8

8. (a) Distinguish between transverse and longitudinal waves? 05 CO-8 PO-8

(b) How can you prove that the wave speed is one wavelength per period? 05 CO-8 PO-8

(c) Show that the average power of a wave depends on the square of its amplitude and also on the square of its angular frequency. 15 CO-8 PO-8