(4)

B Sc Eng.EEE/2nd Sem.

Date:3 July 2025
10:00 am - 12:00 pm [Morning]

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF NATURAL SCIENCES

Course Number: PHY 4221
Course Title: Physics II
Semester: Midterm Examination

Summer Semester: 2023 - 2024
Full Marks: 120
Time: 2 Hours

Answer all the **4 (Four)** questions. The symbols have their usual meanings. Marks of each question and the corresponding CO and PO are written in the brackets.

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1. a) State the differences among overdamping, light damping and critical damping along with examples. (6) (CO1) (PO1)

b) A system executing damped simple harmonic motion is subjected to an external periodic force. Describe the expression for the forced vibration and discuss the condition for resonance. Illustrate your answer with example. (18) (CO2) (PO2)

c) A particle of mass of 10 g performs S.H.M. of period 5 s and has an amplitude of 8 cm. Find its velocity when it is at a distance of 6 cm from the equilibrium position. Find also the maximum velocity and maximum force acting on it. (6) (CO3) (PO2)

2. a) Define wave motion. State how the wave velocity differs from particle velocity in wave motion. (6) (CO1) (PO1)

b) Discuss the case of a plane-progressive wave propagating along positive x axis and obtain its general equation. Extend your answer to demonstrate that the energy density of a plane progressive wave is given by $E = 2\pi^2 a^2 n^2 \rho$. (9+9) (CO2) (PO2)

c) A wave in a string has an amplitude of 2 cm, travelling to the +ve x axis with a speed of 12 m/sec and it is noted that 5 complete waves fit in 4 cm length of the string. Find out the equation describing the wave. (6) (CO3) (PO2)

3. a) Define reverberation and reverberation time. (6) (CO1) (PO1)

b) Explain Sabine's formula for reverberation time with derivation and discuss its significance. Draw a schematic diagram of a proper auditorium considering all the acoustic factors. (18) (CO2) (PO2)

c) The volume of the room is 800 m^3. The wall, floor and ceiling area of the room are 230 m^2, 130 m^2 and 130 m^2, respectively. The absorption co-efficient of the wall, floor and ceiling are 0.05, 0.75 and 0.09, respectively. Calculate total absorption, average absorption and reverberation time. (6) (CO3) (PO2)

4. a) List the differences between transverse and longitudinal wave motion. (6) (CO1) (PO1)

b) Considering a cylinder with a piston filled with a gas, with ρ being the density of the gas molecules, illustrate Newton's formula and Laplace's correction for speed of sound through the gas. (18) (CO2) (PO2)

c) Show that the kinetic energy of a damped harmonic oscillator falls exponentially with time. (6) (CO3) (PO2)