Program: B.Sc.in Mechanical Engineering/IPE Semester : 2nd Semester	Date : 23 February, 2023 Time: 2:00 PM-3:30 PM

ISLAMIC UNIVERSITY OF TECHNOLOGY(IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

Mid Semester Examination Course Number : Phy4213 Course Title : Physics	Summer Semester: 2021-2022 Full Marks : 75 Time: 1.5

There are 3 (THREE) questions. Answer all questions. The symbols have their usual meaning. Marks of each question and the corresponding CO and PO are written in the brackets

1.a	Define simple harmonic motion (SHM). Name different types of pendulums. Discuss oscillations of a torsional pendulum	5
b	A block of mass m tied with a fixed wall by a spring of spring constant k is resting on a frictionless surface and is fixed to a wall. i) Describe its motion . ii)Determine the total energy of the mass spring system.iii)Draw a diagram showing the potential and kinetic energies as a function of its displacement. iv)Discuss the correlation of this mechanical system with its corresponding electrical analogy.	12
c	Define the damping force. A mass 'm' tied to a spring is executing vertical oscillation with a frequency ω. A circular disc is attached to the mass and immersed in a liquid. Show that the new frequency of oscillation is given by $\omega' = \sqrt{(k/m) - (\frac{b}{2m})}$ where the symbols have their usual meaning.	8
2.a	Discuss Lissajous figures and hence show how two perpendicular waves of certain amplitudes, and phases could combine to form Lissajous figures.	8
b	What do you mean by reduced mass ? Two bodies of masses m_1 and m_2 are connected to each other by a massless spring whose uncompressed length is ' l ' . Show that the equation of motion of the combined system of masses can be represented by $d^2x/dt^2 + (k/\mu)\, x = 0$, where the symbols have their usual meaning.	12
c	Electrons in an oscilloscope are deflected by two mutually perpendicular electric fields in such a way that at any time 't' the displacement is given by $x = A\cos\omega t$, and $y = A\cos(\omega t + \varphi)$, describe the path of the electrons and determine the equation when $\varphi = 0, 30, 90$ degrees	5
3.a	What do you understand by converging and diverging lenses ? Show that the Lens makers formula for a real image by a convex lens is given by $1/f = (\mu-1)[1/R_1 - 1/R_2]$, where the symbols have their usual meaning	10
b	What is lens aberration ? What are the causes of lens aberration ? Show that the approximate value of longitudinal spherical aberration caused by a spherical surface is given by $\Delta f_h = h^2/2(\mu - 1)^2 f_p$ where the symbols have their usual meaning	10
c	A convex lens of focal length 20 cm is in contact with a concave lens of focal length 25 cm. Calculate the focal length and power of the combination of lenses.	5