Ref. No.: EX/BS/PH/T104/2023 (S)

B.E. CIVIL ENGINEERING FIRST YEAR FIRST SEMESTER SUPPLEMENTARY EXAM 2023

Subject: PHYSICS Time: Three Hours Full Marks: 100

Answer any **five** questions.

1. (a) Explain the interference in a thin transparent film of refractive index μ due to reflected light. Why an extended source of light is used in such experiment?
(b) Newton's rings are observed in reflected light of wavelength 5900 Å. The diameter of the 10^{th} ring is 0.5 cm. Find the radius of curvature of the lens and the thickness of the air film.
(c) Show that in a diffraction grating with grating element $1.5\text{x}10^{-6}$ m and light of wavelength 500 nm, the third and higher order principal maxima are not visible.
[(8+2)+6+4]

2. (a) What do you mean by polarization of light. What are the different states of polarization?
(b) State the Brewster's law of polarization. Obtain the relation between the angle of incidence and angle of refraction when the light is incident at the polarizing angle.
(c) What do you mean by polarization by double refraction? Discuss the properties of o-rays and e-rays.
[6+(3+5)+6]

3. (a) Starting from the assumptions of Bohr atom model, derive an expression for the energy of hydrogen atom in the n^{th} orbit.
(b) The wavelength of the first member of the Balmer series in hydrogen spectrum is 6563 Å. Find the wavelength of the second member of the Lyman series in the same spectrum.
(c) In the Bohr theory of hydrogen atom, the electron is in constant motion. How is it possible for such an electron to have a negative amount of energy?
(d) At what speed must the electron revolve round the nucleus of a hydrogen atom in order that it may not be pulled into the nucleus by electrostatic attraction? Take the radius of the orbit of the electron as 0.5×10^{-10} meter, $m=9.1\times10^{-31}$ kg and $e= 1.6\times10^{-19}$ coulomb.
[8+3+3+6]

4. (a) Briefly discuss the absorption of X-rays by an absorber and draw the variation of transmitted intensity as a function of thickness of the absorber.
(b) State and deduce Bragg's law of X-rays diffraction.
(c) The K_α line from molybdenum has a wavelength of 0.7078 Å. Calculate the wavelength of K_α line of copper.
[Given: Atomic number of molybdenum = 42 and Atomic number of copper = 29]
(d) What is Heisenberg uncertainty principle?
(e) Explain de-Broglie's matter wave. [5+5+4+3+3]

[Turn over

5. a) Write down the equation of motion for a particle executing damped simple harmonic motion. Solve it for the case of small damping. Show the solution graphically.
b) Why is damping usually taken to be proportional to instantaneous velocity?

c) A mass of 10 kg is acted upon by restoring force of 0.01 N/m and a resisting force of 0.002 N.s/m. Find out whether the motion is oscillatory or non-oscillatory. Also find the value of resisting force for the motion to be critically damped. (3+6+3)+2+6

6. a) Define (i) Young's modulus and (ii) shear modulus.

b) Establish a relation between Young's modulus and bulk modulus with the help of the necessary diagrams showing the nature of stress and strains.
c) What is the general equation for the depression (y) in case of a cantilever? Explain it's maximum value with a diagram. 5+10+5

7. a) What is the time of reverberation?

b) Derive Sabine's formula. Explain growth and decay of energy density with time and draw necessary diagrams.
c) Discuss some important parameters which are generally used for judging the acoustics of an auditorium . 3+12+5

8 .Write Short notes (**Any Two**)

(a) Internal bending moment
(b)Fraunhoffer Diffraction
(c) Compton Effect
(d) Young's double Slit experiment

[10+10]