

Bachelor of Engineering (Mechanical) Examination 2017
(Supplementary)
(First Year First Semester)
PHYSICS

Time: 3 hours

Full Marks: 100

Answer **any five** questions

1. 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.

3+6+3

b) What is forced vibration? What do you mean by resonance in a mechanical system? Distinguish between amplitude and velocity resonances.

2+3+3

2. a) State and explain Gauss's law in electrostatics. Apply it to show that the electrostatic field at any internal point of a uniformly charged spherical volume is directly proportional to its distance from the centre of the sphere.

3+ 7

b) State and explain Biot-Savart law in vector form. Apply the law to find the magnetic field due to a long straight current carrying conductor.

3+7

3. a) A dc source of voltage V is suddenly applied to a circuit consisting of a resistor R and a capacitor C in series. Write down the instantaneous emf equation and hence find the instantaneous charge on the capacitor.

3+8

b) Find the ratio of the energy stored in the capacitor and the energy dissipated in the resistor.

6

c) Write down Faraday's laws of electromagnetic induction in differential form.

3

4.a) State and explain the conditions for getting sustained interference fringes

b) Find the conditions for getting interference maxima and minima.

c) How can you measure the wavelength of light by using the phenomenon of interference?

d) Is interference shown by any type of wave?

6+6+6+2

[Turn over

5. a) What do you mean by diffraction of light? Distinguish between Fresnel and Fraunhofer class of diffraction.

b) Derive an expression for the intensity of Fraunhofer diffraction pattern due to a single slit.

c) State Brewster's law. A light of wavelength 546 nm gets plane polarized on reflection from a glass plate at an angle of incidence 60° . Find the refractive index of glass. 6+8+6

6. (a) What is de Broglie hypothesis?

(b) Calculate the de Broglie wavelengths of (i) an electron moving with the velocity 10^7 m/s and (ii) a golf ball of mass 50 gm moving with velocity 50 m/s.

(c) How can the existence of de Broglie wave be established experimentally?

(d) Using uncertainty relation show that an electron cannot exist within the nucleus of an atom. 3+6+7+4

7. (a) Write down Maxwell's electromagnetic equations.

(b) Using Maxwell's equations establish the electromagnetic nature of light and estimate the velocity of light in vacuum.

(c) What are the boundary conditions to express the discontinuity of electric field and magnetic field at boundary between two different media?

(d) What is Poynting vector? 6+8+4+2

8. (a) What do you mean by highly viscous liquid?

(b) Differentiate between streamline motion and turbulent motion of fluid?

(c) Deduce the velocity profile for the streamline flow of a liquid through a capillary tube of circular cross section (use Poiseuille's method).

(d) How do you determine the viscosity of a liquid by using Stoke's law of viscosity?

3+3+8+6