

B. ENGG. 1ST YEAR 2ND SEM. EXAM. 2017(OLD)

Subject : PHYSICS IIB(OLD)

Time : Three Hours

Full Marks : 100

Answer any five questions

1. a) Write down Maxwell's equation of electromagnetic theory and explain the experimental laws they represent.

b) Show that in a dielectric medium Maxwell's equations become wave equations for electric and magnetic field.

c) Prove that plane wave solution of Maxwell's equation is transverse and their electric and magnetic fields are mutually perpendicular.

8+6+6

2. a) Discuss conditions for resonance in series LCR circuits? Find an expression for power dissipation in such circuits. Mention the importance of power factor.

b) Explain the growth and decay of current in an LR series circuit if a dc source is switched on at $t=0$ and switched off after a long time.

10+10

3. a) Derive the conditions for sustained interference for light waves and explain why such interference is usually not observed for light coming from two physically different sources.

b) Describe the formation of interference fringes in Fresnel's biprism experiment and calculate the fringe width,

c) How the distance between coherent sources is measured in this experiment.

6+10+4

4. a) Derive the expression intensity for Fraunhofer diffraction pattern of a single slit.

b) Discuss methods of determination of wavelength of monochromatic light from diffraction pattern of a single slit.

14+6

5. a) What is meant by a plane polarized light, elliptically polarized light and circularly polarized light. How each of them can be identified and differentiated from unpolarized light?

b) What is double refraction? Describe the properties of ordinary rays and extra ordinary rays.

c) State Brewster's law of polarization. Calculate polarizing angle of water if its refractive index is 1.33.

8+6+6

6. a) Draw a schematic curve of energy distribution of black body radiation and explain its main features.

b) How this energy distribution can be explained using qu Planck's quantum hypothesis.

c) Derive Wien's Displacement law from Planck's radiation formula.

4+12+4

7. a) What is photo electric effect? How Einstein explained it using Planck's quantum hypothesis.

b) Explain the effects on a photoelectric effect if we double i) the frequency of light, ii) wavelength and iii) intensity.

c) Evaluate the energy range in eV of photons in the wavelength range 400-800 nm.

9+6+5

8. a) Write down the Shrodinger equation for a particle of mass m in an infinite square well potential of width a . What will be the boundary conditions for wave functions?

b) Calculate the energy eigenvalues and wave functions for the particle.

c) Estimate the probability of getting particle in domain $\frac{1}{4}a \leq x \leq \frac{3}{4}a$ for ground state and first two excited states.

5+8+7

Values of some useful constants:

($e=1.60 \times 10^{-19} \text{C}$, $h=6.626 \times 10^{-34} \text{ JS}$, $m_0=9.11 \times 10^{-31} \text{ Kg}$, $\epsilon_0=8.854 \times 10^{-12} \text{ F/m}$, $\mu_0=4\pi \times 10^{-7} \text{ N/A}^2$).