

B. ENGINEERING 1ST YEAR 2ND SEM. EXAM. 2018(OLD)

Subject : PHYSICS IIB(OLD)

Time : Three Hours

Full Marks : 100

Answer any five questions

1. a) Write down Coulomb's law of electrostatics. From the Coulomb's law derive Poisson's equation in its differential form.

b) Express Ampere's circuital law in differential form and show that it leads to violation of charge conservation.

c) Deduce the conditions satisfied by the normal and tangential component of electric field at boundary of two dielectric media.

8+6+6

2. a) Discuss conditions for resonance in series LCR circuits? Find an expression for power dissipation in such circuits. What is Q-factor of a resonance system? Discuss its physical significance.

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) What are the main features of two coherent sources? What inferences can be drawn from the fact that usually two physically different light sources are not coherent?

b) Describe the formation of interference fringes in Young's double slit experiment and calculate the fringe width.

c) How coherent sources of light are produced by division of wave front and division of amplitude?

5+10+5

4. a) Obtain an expression for intensity pattern in Fraunhofer diffraction due to a plane transmission grating. Find the conditions for principal maxima. What is absent spectra?

b) A grating with 12000 ruling/inch illuminated with a monochromatic light produces a second order maxima at 30° . Find the wavelength of the monochromatic light. Also find the highest order of maxima that will be visible.

12+8=20

5. a) Describe an experiment that suggests light is transverse wave.

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

c) Explain photo electric effect using Planck's quantum hypothesis.

5+8+7

6. a) What is Compton effect. Calculate the change in wavelength when a beam of monochromatic X-ray is scattered by a block of graphite? Why this change is not prominent in visible range?

b) An X-ray photon of wavelength of 0.1 \AA is scattered at an angle of 45° with its original direction after collision with a free electron. Find the wavelength of modified radiation and momentum of the recoil electron.

10+10=20

7. a) State Heisenberg uncertainty principle and explain its significance. Discuss de-Broglie hypothesis of wave particle duality.

b) Write down Bohr's postulate of hydrogen atom and find the stationary state energy levels of the same. Also calculate the expression of wave number ($1/\lambda$) for Balmer lines.

6+14 = 20

8. A particle of mass m is confined to $0 \leq x \leq L$ by two very high step potentials,

a) Write time independent Schrodinger equation and boundary conditions for the system.

b) Find the energy eigenvalues and normalized wave functions.

c) Calculate $\langle x \rangle$ and $\langle p \rangle$ for 1st excited state.

6+8+(3+3)