

2 marks each, Duration - 1 hour

- 1) Two waves of equal frequencies have their amplitude in the ratio of 5 : 3. They are superimposed on each other. Calculate the ratio of the maximum to minimum intensities of the resultant wave.
- 2) Two coherent sources  $A$  and  $B$  of radio waves are 5.00 m apart. Each source emits waves with wavelength 6.00 m. Consider points along the line between the two sources. At what distances, if any, from  $A$  is the interference (a) constructive (b) destructive?
- 3) A radio transmitting station operating at a frequency of 120 MHz has two identical antennas that radiate in phase. Antenna  $B$  is 9.00 m to the right of antenna  $A$ . Consider point  $P$  between the antennas and along the line connecting them, a horizontal distance  $x$  to the right of antenna  $A$ . For what values of  $x$  will constructive interference occur at point  $P$ ?
- 4) A convergent lens with a focal length of  $f = 10$  cm is cut into two halves that are then moved apart to a distance of  $d = 0.5$  mm (a double lens). Find the fringe width on screen at a distance of 60 cm behind the lens if a point source of monochromatic light ( $\lambda = 5000 \text{ \AA}$ ) is placed in front of the lens at a distance of  $a = 15$  cm from it.
- 5) A deuteron and an  $\alpha$ -particle have same kinetic energy. Find the ratio of their de-Broglie wavelengths.
- 6) Find the de-Broglie wavelengths of
  - (a) a 46 g golf ball with a velocity of 30 m/s
  - (b) an electron with a velocity of  $10^7$  m/s.
- 7) Derive the expression for potential energy and kinetic energy of electron in hydrogen like atom?
- 8) Find the longest wavelength present in the Balmer series of hydrogen.
- 9) Find the ionisation energy of a doubly ionized lithium atom.
- 10) A hydrogen atom is in a state with energy  $-1.51$  eV. In the Bohr model, what is the angular momentum of the electron in the atom with respect to an axis at the nucleus?