Q.1.   Answer the following short questions.   (15x2=30)

1. Define electric potential energy and write its expression.
2. How can we relate current density and drift velocity? What is the reason for negative sign?
3. Explain the right-hand rule for finding the direction of magnetic force on a moving charge.
4. What is the dot product of vectors? Define the flux of a vector.
5. What is the electric force on a test charge placed outside a hollow charged spherical shell of charge Q?
6. What is the angle between a vector and its parallel vector?
7. What do you know about Hall effect?
8. What is the relation for electric field due to a point charge?
9. Does the resistance of a semiconductor increase with temperature?
10. Describe conservative field.
11. Explain the law of reflection.
12. How you define Biot-savart law?
13. Explain total internal reflection.
14. What is diffraction grating?
15. Is light a wave or particle?

Solve the following questions.

Question No. 2   (7+3=10)

(a) If we have a current carrying conductor and magnetic field is applied then what will be the force on this conductor?

(b) Two charges one of +1.5nC and other 2.3nC are separated by 13cm. At which point between these two the field is zero?

Question No. 3   (7+3=10)

(a) Derive an expression for the electric force due to a line of charge along its perpendicular bisector.

(b) An alpha particle, the nucleus of a helium atom, has a mass of $6.64 * 10^{-27}$ kg and a charge of $+2e$. What are the magnitude and direction of the electric field that will balance its weight?

Question No. 4   (7+3=10)

(a) Define diffraction, wave theory. Give the detail of single slit diffraction.

(b) The refractive index of carbon di sulphide is 1.63. What is the meaning of this explanation in connection to speed of light? Find speed of light in this medium.