

9. The magnetic field at a perpendicular distance of 2 cm from an infinite straight current carrying conductor is  $2 \times 10^{-6}$  T. The current in the wire is,  
 a. 0.1A                      b. 0.2A                      c. 0.3A                      d. 0.4A
10. The metals used in making transformer cores have,  
 a. High coercivity high retentivity                      b. Low coercivity high retentivity  
 c. High coercivity low retentivity                      d. Low coercivity low retentivity
11. The fraction of radioactive particle that will remain undecayed after 4 half-life period is,  
 a.  $\frac{1}{16}$                       b.  $\frac{15}{16}$                       c.  $\frac{3}{4}$                       d.  $\frac{1}{2}$

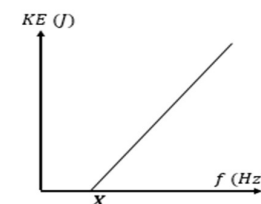
[GROUP B]

[8 × 5 = 40]

1. The principle of conservation of angular momentum is the fundamental law of nature.  
 a. Define angular momentum. Write its vector expression. 1  
 b. State and explain the principle of conservation of angular momentum with suitable example. 2  
 c. A ballet dancer spins about a vertical axis at 1 rpm with her arms outstretched. With her arms folded, her moment of inertia about the axis decreases by 40%. Calculate the new rate of revolution. 2
2. Due to surface tension, the surface of liquid behaves like an elastic stretched membrane and the liquid tends to occupy minimum surface area.  
 a. A tiny liquid drop is spherical but a larger drop is oval, why? 2  
 b. Define surface energy. Prove that surface energy and surface tension are numerically same. 3
- OR**
- a. Define coefficient of viscosity. Explain, in brief, how the coefficient of viscosity of a viscous liquid be determined. 3  
 b. A helicopter of mass  $2 \times 10^4$  Kg has total wings area  $400 \text{ m}^2$  and is flying horizontally with average speed of 250 m/s. Find:  
 i. The pressure difference between the lower and upper surfaces of the wings. 1  
 ii. Velocity difference between the upper and lower surface of the wings. 1  
 [ density of air =  $1.3 \text{ Kg/m}^3$ ;  $g = 10 \text{ m/S}^2$ ]
3. a. What is calorific value? A petrol engine consumes 25 Kg of petrol per hour. The calorific value of petrol is  $11.4 \times 10^6 \text{ Cal/Kg}$ . If the power of the engine is 99.75 KW, find the efficiency of the engine. 3  
 b. What is isothermal process? Derive an expression for work done in an isothermal process. 2
4. Huygen's theory is applicable to explain the wave nature of light.  
 a. Write Huygen's principle. 1  
 b. Verify the laws of reflection using Huygen's principle. 2  
 c. Explain, in brief, how can you convert a spherical wave front into plane wave front. 2

**OR**

- Polarization property determines the Nature of wave either as transverse or as longitudinal.
- a. Show that light is transverse in nature. 2  
 b. Write mathematical form of Brewster's law. 1  
 c. A monochromatic light of wavelength  $5896 \text{ \AA}$  in air is passed to a transparent medium so that the wavelength changes to  $3931 \text{ \AA}$ . At what angle of incidence, the reflected ray becomes completely polarized? 2
5. Galvanometer is a very useful device during the detection of presence of current in an electric circuit.  
 a. At what condition galvanometer shows the null deflection? 1  
 b. The zero point of galvanometer is kept at the center of scale, rather than at one edge, why? 1  
 c. What is shunt? Write necessary theory for the conversion of galvanometer into an ammeter with necessary circuit diagram. 3
6. The Hall effect in metal offered the first real proof that electric currents in metals are carried by moving electrons, not by protons.  
 a. Deduce the expression for hall voltage. 2  
 b. Hall voltage in a semiconductor is more than that in metals, why? 1  
 c. A strip of metal is 10 mm wide and 2 mm thick. It carries a current of 6 A, and is placed so that a magnetic field of 0.09 T is passing at right angles through it surface. The metal has  $8 \times 10^{28}$  charge carriers per cubic meter. Calculate the velocity of the charge carriers, and the Hall voltage that would be produced. 2
7. Photoelectric effect provides the basic concept of quantum nature of light.  
 a. What happens to the kinetic energy of photoelectrons if the work function of surface is increased? Explain with suitable relation. 1  
 b. An electron at the surface of the metal of work function 1.9 eV is emitted with a kinetic energy of  $4.5 \times 10^{19}$  J. Calculate the energy of the incident photon. 2  
 c. In the graph aside,  
 i. What does the slope of the graph give? 1  
 ii. What is the significance of point X in the graph? 1



8. a. In 1916, in general theory of relativity (GTR), Albert Einstein theorized (predicted) that when objects move through space, they create waves in space time around them.  
 i. What are gravitational waves? 1  
 ii. What are the basic properties of gravitational waves (any two)? 2  
 b. What is seismic wave? What major difference is there in P and S wave? 2