1. The average of the function \( f(x) = \sin x \) in the interval \((0, \pi)\) is
   (a) \( \frac{1}{2} \)
   (b) \( \frac{2}{\pi} \)
   (c) \( \frac{1}{\pi} \)
   (d) \( \frac{4}{\pi} \)

2. In a p-type semiconductor, the Fermi Level lies 0.4 eV above the valence band. If the conduction of the acceptor atom is tripled. Find the new position of the Fermi level
   (a) 0.367 eV  
   (b) 0.734 eV  
   (c) 0.183 eV  
   (d) 0.052 eV

3. Approximately how large must be the magnetic induction for the orientation energy to be comparable to the thermal energy at room temperature for \( \mu_n = 5 \mu_B \)
   (a) 89.32 W/m²  
   (b) 10.32 W/m²  
   (c) 52.45 W/m²  
   (d) 78.27 W/m²

4. To produce single electron tunneling, the thermal energy of the particle must be
   (a) much smaller than Coulomb energy  
   (b) much higher than Coulomb energy  
   (c) equal to the Coulomb energy  
   (d) not related to Coulomb energy

5. In case of homogeneous nucleation, the critical radius and the free energy barrier for nucleation
   (a) decrease as the undercooling increases  
   (b) increases as the undercooling increases  
   (c) decrease as the undercooling decreases  
   (d) increase as the undercooling decreases

6. An elementary crystal with a facet centered cubic structure (FCC), each surface atom in the \{100\} facet will have ............... broken bonds.
   (a) two  
   (b) three  
   (c) four  
   (d) five

7. In a cyclic process, heat transfers are + 14.7 kJ, – 25.2 kJ, – 3.56 kJ and +31.5 kJ. Calculate the net work for this cyclic process.
   (a) 12.45 kJ  
   (b) 17.44 kJ  
   (c) -19.24 kJ  
   (d) 2.4 kJ

8. For a steel alloy, a carburizing heat treatment of 10 h duration will raise the carbon concentration to 0.45 wt% at a point 2.5 mm from the surface. Estimate the time to achieve the same concentration at a 5.0 mm position for an identical steel and at the same carburizing temperature.
   (a) 10 h  
   (b) 5 h  
   (c) 40 h  
   (d) 35 h

9. The number-average molecular weight of a polypropylene is 1,000,000 g/mol. Compute the number-average degree of polymerization.
   (a) 20,700  
   (b) 40,000  
   (c) 23,700  
   (d) 55,000

10. Pi (\(\pi\))-bond is formed by the overlapping of
    (a) \( p-p \) orbitals along their axis
(b) s-p orbitals along the axis of p-orbitals
(c) p-p orbitals along the perpendicular to their axis
(d) s-s orbitals

11. Optical Fibers are based on the phenomenon of
   (a) Total Internal reflection
   (b) Stefan’s Law of radiation
   (c) Photoelectric effect
   (d) Refraction

12. The criterion for the spontaneity of a process is
   (a) $\Delta S_{\text{sys}} > 0$
   (b) $\Delta S_{\text{surr}} > 0$
   (c) $\Delta S_{\text{sys}} + \Delta S_{\text{surr}} > 0$
   (d) $\Delta S_{\text{sys}} - \Delta S_{\text{surr}} > 0$

13. Creep curve is a plot of
   (a) Strain versus time
   (b) Strain versus temperature
   (c) Stress versus strain
   (d) Elastic modulus versus temperature

14. Time dependent deformation in which the material does not recover its original dimension is called
   (a) Elasticity
   (b) Plasticity
   (c) Viscoelasticity
   (d) Anelasticity

15. Polymers are ................................... in nature.
   (a) Organic
   (b) Inorganic
   (c) Both (a) and (b)
   (d) Ceramic