

**Jimma University**  
**Department of Physics**  
**Assignment II for the course Electronics I Phys (2062 )**

**Section II : Semiconductor devices and their application**

1. Explain the fundamental difference (a) between a conductor and an insulator, (b) between an extrinsic semiconductor and an intrinsic semiconductor. Illustrate your answer with energy-band diagrams. How does the conductivity vary in each case as the temperature is increased ?
2. Explain donor ion, acceptor ion, majority carriers, minority carriers, doping and dopants in a semiconductor.
3. Define what is meant by an intrinsic semiconductor and extrinsic semiconductor.
4. What is meant by the energy gap of a semiconductor? The energy gap of gallium phosphide is 2.25 eV. What is the longest wavelength of incident electromagnetic energy which could promote conduction?
5. Describe carefully the distinction between "acceptor" and "donor" impurities, and give two examples of each. State from which of the groups of chemical elements they come, and why.
6. Under what circumstances can the addition of impurities to a semiconductor decrease its electrical conductivity.
7. What type of impurity atom is added during the doping process to create a(n)
  - a. n -type semiconductor material?
  - b. p -type semiconductor material?
8. What are the majority and minority current carriers in a(n)
  - a) n -type semiconductor?    b) p -type semiconductor?
9. Explain why an n -type semiconductor material is electrically neutral and not negatively charged.
10. Why is a diode called a unidirectional device?
11. Sketch the V/I characteristic for a junction diode and indicate (a) how it is affected by temperature
12. Can a silicon diode be forward-biased if the anode voltage is negative? Explain your answer.
13. Explain why a bridge rectifier would be used instead of a two-diode full-wave rectifier
14. What is the difference between an ordinary semiconductor diode and a Zener diode?
15. For a reverse-biased diode, what is meant by the breakdown voltage,  $V_{BR}$  ?
16. How do the biasing polarities differ between npn and pnp transistors?
17. Explain the characteristics and purpose of each of the following regions in a transistor:
  - a. emitter.    b. base.    c. collector.

18. In an npn transistor, what are the majority and minority current carriers in the above regions
19. Explain how the BE and CB junctions of a transistor must be biased for a transistor to function properly as an amplifier.
20. In an npn transistor, explain why most of the emitter injected electrons pass through the base region and on to the collector.
21. Why are junction transistors called bipolar devices?
22. The emitter region of the transistor is more heavily doped compared to the base region. Why?
23. Discuss the mechanism of amplification obtained in a transistor. What is the origin of the name “transistor”?
24. Why is a transistor temperature-sensitive?