Electronics and Statistical Mechanics I

Upon completion of Electronics and Statistical Mechanics I, students will be able to:

Group A: Electronics Semiconductor Physics
1. Define and differentiate between direct and indirect semiconductors, intrinsic and extrinsic semiconductors.
2. Analyze energy band diagrams and calculate carrier concentration in both non-degenerate and degenerate semiconductors.
3. Explain carrier transport phenomena including mobility, Hall effect, and diffusivity.
4. Apply continuity equation for steady state injection in semiconductors.

5. Describe the characteristics of P-N Junction diode under different biasing conditions.
6. Analyze depletion capacitance and capacitance voltage characteristics of a P-N Junction diode.
7. Explain breakdown mechanisms such as Avalanche and Zener breakdown in diodes.
8. Analyze the operation of Metal semiconductor junction, Schottky barrier and Bipolar junction transistor using the Ebers Moll model.
9. Explain the operation and characteristics of Tunnel diode and its applications.
10. Evaluate the characteristics and applications of Unijunction transistor (UJT), MOSFET, JFET, and logic families such as DTL, TTL, and CMOS.

Group B: Statistical Mechanics I
11. Define the objective and principles of statistical mechanics.
12. Analyze the specification of the state of a many particle system and calculate the number of microstates in phase space.
13. Explain the concept of statistical ensemble and Density of phase points.
14. Apply the postulate of equal a priori probability and Liouville's theorem in statistical mechanics.
15. Discuss the Microcanonical ensemble, Canonical ensemble, and Grand canonical ensemble in relation to thermal interactions and equilibrium systems.
16. Calculate mean values, entropy, and fluctuations in energy and particles in different ensembles.
17. Analyze the equilibrium properties of ideal systems such as ideal gas, Harmonic oscillators, and Para magnetism.

By the end of the course, students will be able to apply the principles of Electronics Semiconductor Physics and Statistical Mechanics to analyze and solve problems in the respective fields.