	Question Bank Physics -3110018
Unit 1	**Superconductivity**
1	What is superconductor? Discuss effect of temperature on superconductor and normal conductor?
2	Explain: Persistent current, Critical current, Critical current density, Isotope effect, Critical magnetic field.
3	What is the effect of pressure and impurity on superconductors?
4	Write a short note on BCS theory.
5	Discuss with equations and graph London penetration depth.
6	Draw graphs and explain difference between type 1 and type 2 superconductors.
7	What is Josephson junction? Discuss difference between AC & DC Josephson effect?
8	Write a short note on SQUID, Cryotron.
9	What is Meissner effect prove that superconductors are completely diamagnetic.
10.	What is the effect of temperature on normal conductor and superconductor?
Unit 2	**Free Electron Theory**
1	Discuss postulates and drawbacks of classical free electron theory.
2	Discuss postulates and drawbacks of quantum free electron theory.
3	Discuss Bloch theorm.
4	Discuss Kronig-Penny model with necessary derivations and graph.
5	What is density of states? Derive equation for density of sates for 3dimension.
6	What is effective mass? Derive necessary relation for effective mass.
7	Discuss formation of energy bands in solids.
8	Discuss difference between conductor, semiconductor, and insulator on the basis of band theory of solids.
9	Differentiate between direct and indirect band gap semiconductors.
10	Discuss Fermi-Dirac distribution function and probability of occupation with necessary graphs and derivations.
11	Write a short note on EK diagram.
12	Write a short note on Phonon.
Unit 3	**Semiconductors**
1	What is Intrinsic semiconductor? Write and explain equation for conductvity in Intrinsic semiconductor?
2	What is semiconductor? Write main properties of semiconductors?
3	What is carrier concentration in an intrinsic semiconductor? Draw energy band diagrams for T=0k and T>0k.
4	Derive expression for density of electrons in conduction band for Intrinsic semiconductor.
5	Derive expression for density of holes in valance band for Intrinsic semiconductor.

6	Derive equation for fermi level and discuss its variation with temperature for intrinsic semiconductor.
7	Derive the equation for intrinsic carrier concentration ni.
8	What is extrinsic semiconductor? Discuss P type and N type semiconductors with necessary energy band diagrams.
9	Derive expression for carrier concentration in N type semiconductor and variation in fermi level with temperature and impurity concentration.
10.	Derive expression for carrier concentration in P type semiconductor and variation in fermi level with temperature and impurity concentration.
11	Write a short note on carrier generation and recombination processes in semiconductor.
12	Discuss carrier transport diffusion and drift and derive equation for Jn.
13	Discuss metal semiconductor junction (Ohmic and Schottky) with VI characteristics and energy band diagrams.
14	What is difference between nearly ohmic and Schottky junction with help of energy band diagrams.
15	Discuss PN junction with help of necessary energy band diagram.
16.	Discuss optoelectronic devices like LED,LDR, Photodiode.
17	Write a short note on Solar cell.
18	List out semiconductor materials with its band gap and possible application used for optoelectronic devices.
Unit 4	**Measurements**
1	Discuss Four-point probe method and Van Der Pauw measurements for measurement of resistivity
2	Discuss Hot-point probe measurement method semiconductor conductivity type.
3	Discuss Parameter extraction from diode I-V characteristics.
4	Write a short note on band gap by UV-Vis spectroscopy.
5	Discuss capacitance-voltage measurements for doping concentration.
6	Write a short note on DLTS.
7	Discuss absorption/transmission for semiconductors.
Unit 5	**Light Semiconductor Interaction.**
1	Discuss Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission.
2	Discuss Joint density of states and derive necessary relation.
3	Discuss Density of states for photons and derive necessary relation.
4	Discuss Fermi's golden rule
5	Write as short note on Optical loss and gain, Photovoltaic effect, Exciton
6	With necessary derivation explain Drude model