Course Title: Applications of Plasma
Course Code: PHYS 412
Level: B.Sc. (Applied Physics)
Year: IV
Semester: II
Cr. Hrs: 3

Course Objectives: Plasmas have become indispensable for advanced materials processing. This is due to the ability to control the micro-and nanoscale structure of materials at low synthesis temperatures, and also produce micro-and nanoscale patterns in materials by plasma etching techniques. This course covers plasma-surface interactions in chemically reactive systems and selected industrial applications plasmas. It also includes the principles and application of plasma as a source of energy. These topics will be illustrated by presenting examples of current research and important technological applications.

1. Collision Phenomena: Collision phenomena: velocity distribution of particles, elastic and inelastic collisions, collision frequency and mean free path, reaction cross section. [4 Hrs.]

2. Excitation and ionization: Internal energy, excitation and ionization of atoms and molecules by electron collision, excitation and ionization by energetic ions or neutral particles; thermal ionization, penning ionization and photo ionization and photo excitation, ion-electron recombination, ion-ion recombination. [6 Hrs.]

3. Cold plasma for thin film deposition: Interaction of cold plasma with solid surface, Physical Vapor Deposition (PVD) under plasma condition: sputter deposition, ion plating. Plasma Enhanced Chemical Vapor Deposition (PECVD): plasma polymerization, plasma stream transport, chemical transport in plasma.[12 Hrs.]

4. Surface modification by cold plasma: Surface treatment for metals and semiconductors, plasma nitriding, plasma oxidation and plasma anodization, polymer surface modification and surface characterization.[10 Hrs.]

5. Ionosphere plasma: The ionosphere, effect of collision on reflection of radio waves, effect of magnetic field on the radio wave propagation, radio sounding of ionosphere, maximum useable frequency and the skip distance, formation of different ionospheric layers. [8 Hrs.]

6. Plasma for energy production: Thermonuclear power generation in controlled fusion, nuclear reaction rate, criteria for reactor system, plasma production, heating of the plasma, confinement of plasma Lawson criterion, magnetic confinement fusion and inertial confinement fusion. Basic theory, principle and working of MHD generator, fuels in MHD. [8 Hrs.]

References


