

Plasma physics and applications Syllabus

Introduction :

The fourth state of matter, Plasmas in nature, Saha equation, Comparison between real gaseous and plasma, plasma examples.

Plasma definition

Plasma definition, , Collective behavior, Plasma quasineutrality, Concept of plasma temperature, Debye shielding, Plasma frequency, Criterion of plasma.

Plasma applications

Controlled thermonuclear fusion, Equations of thermonuclear fusions, Lawson criteria, Confinement systems, Gravitational confinement, Magnetic confinement, Inertial confinement, Open magnetic field confinement system, Closed magnetic field confinement system, Gas discharges, Ionizations in gases, Astrophysics, Modern physics, M.H.D. systems for energy conversion and Ion propulsion.

Single particle motion:

The effect of considering single particle motion on plasma properties, Equation of motion, Lorentz forces, Cyclotron motion, Cyclotron frequency, Larmor radius, Diamagnetism of plasma.

Effect of homogeneous magnetic and electrical fields:

Drift motion due to the effect of electrical field normal to magnetic field, due to external forces, due to gravitational forces.

Effect of inhomogeneous magnetic and electrical fields:

Drifts due to gradient in magnetic field normal and parallel to magnetic field lines, magnetic mirrors and its applications, earth magnetic mirror, The loss cone, The effect of time dependent electric and magnetic

fields, The polarization drift and current , Adiabatic compression
Heating by adiabatic compression.

Plasma as fluid:

Introductory, Convective derivative, Equation of motion , force of magnetic pressure, Static and magnetic pressures, Beta factor, Drifts of fluid plasma, Diamagnetic plasma.

Diffusions and Receptivity in plasmas:

Diffusion and mobility in ionized atoms, Collisions and its parameters, diffusion parameters,

Plasma diagnostic:

Electrostatic probes, Magnetic probes, Laser diagnostic.

Plasma apparatuses (systems) and future progress:

Pinch effect, dense plasma focus, Radio frequency plasma , plasma laboratory apparatuses.