FDITE203 Advanced Plasma Physics

Topics:

1. **Introduction** (Definition of plasma, Plasma parameter, Debye Shielding, Criteria for plasmas)
2. **Single charged particle motion** in E and B fields (Uniform E and B fields, Nonuniform B- field, Nonuniform E-field, Time varying E- and B-fields)
3. **Fluid Description of Plasmas** (Fluid Equation of Motion, Fluid Drifts in B-fields, The Plasma Approximation)
4. **Plasma Waves** (Plasma Oscillations, Electron Plasma Waves, Sound Waves, Ion Waves, Effect of B-field on Electron and Ion Waves, Lower Hybrid Frequency, EM Waves, Cutoffs and Resonances, Effect of B-field on EM Waves, Hydromagnetic Waves, Magnetostatic Waves, the CMA diagram)
5. **Plasma Diffusion and Resistivity** (Diffusion and Mobility, Plasma Decay due to Diffusion, Recombination, Diffusion across B-fields, Collisions, MHD Equations, Diffusion Equation and its Solutions, Bohm Diffusion)
6. **Kinetic Theory of Plasmas** (Equations of Kinetic Theory, Landau Damping, BGK and Van Kampen Modes, Kinetic Effects in a B-Field)
7. **Selected Topics in ultrashort laser-plasma physics** (laser-driven particle acceleration and X-ray sources)

Literature:

1. Introduction to plasma physics and controlled fusion (2^{nd} edition, F.F. Chen)
2. Plasma Physics, An introductory Course (by R. Dendy)

Research articles on ultrashort laser-plasma physics