PHY9105: CLASSICAL ELECTRODYNAMICS II 2(2-0)

1. Course Name: Classical Electrodynamics II

2. Course Code: PHY9105

3. Credit Units: 2

4. Course Description:

This course builds on the graduate course of Classical Electrodynamics I by reviewing the time-varying fields. The equation of the wave equation is applied to wave guides and resonant cavities and radiation is treated from both localized and moving charges. Finally, special relativity is used on charged particles in electromagnetic fields.

5. Course Objectives:

At the end of the course, the students should be able to:

- Apply the wave equation to materials' characterization and in communication appliances.
- Obtain energy transfer from collisions between charged particles.
- Apply special relativity to charged particles in electromagnetic fields.

6. Course Outline:

Content	Hours
Review of Time varying Fields: Solution of the wave equation using Green's function technique; Kirchhoff's integral.	5
Wave guides and Resonant Cavities: Review of Bessel functions; Rectangular and cylindrical waveguides; Resonant Cavities; Klystrons and microwave sources; Applications in materials; characterization and communication.	8
Radiation: Radiation from a localized source; Monopole and Dipole sources; Centre-fed antenna; Diffraction; Radiation by moving charges; Thomas scattering; Cerenkov radiation.	7
Collisions: Collisions between charged particles; Energy transfer e.g. in Coulomb collision scattering from atoms.	5
Magnetodynamics and plasma Physics: The plasma state; Equation of motion of a charged particle, some characteristic scales in a plasma; Conservation of charge, energy and momentum; Magneto-hydrodynamic equations; Some examples of magnetic moments and drift velocities.	10
Special Relativity: Particle kinematics and dynamics; Transformation properties of electromagnetic fields; Thomas precession; Momentum and energy of a particle; Decay products and reaction threshold; Motion in electromagnetic fields; Particle field; Adiabatic invariance of flux.	10
Total	**45**

7. Mode of Delivery:

This course will consist mainly of lecture sessions.

8. References:

1. Jackson, J. D.: Classical Electrodynamics (1998): (3rd Edition. John Wiley & Sons, New York.

2. Landau, L. D., and E. M. Lifshitz. The Classical Theory of Fields (1980). Elsevier Science Ltd, Burlington.