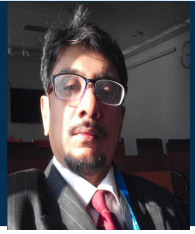

DYNAMICS OF CLASSICAL AND QUANTUM FIELDS

PROF. GIRISH S. SETLUR
Department of Physics
IIT Guwahati

PRE-REQUISITES : Classical Mechanics, Quantum Mechanics, Special Relativity,Statistical Mechanics

INTENDED AUDIENCE : MSc. and beginning Ph.D students and other interested individuals

COURSE OUTLINE :

This course covers introductory topics in Classical and Quantum Fields that are typically not given due importance in the M.Sc. coursework. There is a considerable knowledge gap between the present day M.Sc. level courses and actual PhD level research in theoretical physics. The contents of this course are carefully chosen to fill this gap and help aspiring/early stage PhD scholars come up to speed with research level topics in theoretical physics.

ABOUT INSTRUCTOR :

Prof.Girish S. Setlur works in the field of Theoretical Condensed Matter Physics. He is interested in understanding and accounting for the properties of everyday bulk materials from a knowledge of the fundamental constituents of the substance and the fundamental physical laws governing those constituents. He was the inventor of a new technique called 'non-chiral bosonization' which is uniquely suited to study strongly inhomogeneous Luttinger liquids. He also invented the notion of a non-local particle hole creation operator and showed that it may be used to diagonalize interacting Fermi systems in any dimension. He is also interested in topological materials, specifically their nonlinear optical properties.

COURSE PLAN :

Week 1: Review of Lagrangian mechanics and the Hamiltonian formulation.
Week 2: Symmetries and Noether’s theorem.
Week 3: The Electromagnetic Field and Stress Energy Tensor.
Week 4: Elasticity Theory and Fluid Mechanics.
Week 5: Toward Quantum Fields: Scalar and Spinor Fields.
Week 6: Concept of Functional Integration.
Week 7: Quantum Mechanics Using Lagrangians: Path Integrals.
Week 8: Creation and Annihilation Operators in Fock Space.
Week 9: Quantum Fields on a Lattice.
Week 10: Green Functions: Matsubara and Nonequilibrium.

Week 11: Coherent State Path Integrals.
Week 12: Non-local operators in Quantum Many Body Physics.