



ADVANCED CONDENSED MATTER PHYSICS

PROF. SAURABH BASU

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IIT Guwahati

PRE-REQUISITES : Solid State Physics Course

INTENDED AUDIENCE : UG and PG students of Electrical and Electronics Engineering/
Engineering Physics/Physics

COURSE OUTLINE :

The Course deals with the prerequisite material for studying advanced level research in Condensed Matter Physics. The course begins with a preliminary discussion on second quantization, followed by zero temperature and Matsubara Greens functions. Applications to Hubbard model, Kane Mele model and superconductivity are discussed.

ABOUT INSTRUCTOR :

Prof. Saurabh Basu is a professor at the Department of Physics, IIT Guwahati. The area of expertise is Theoretical Condensed Matter Physics, with special emphasis on the correlated boson and fermion systems, topological insulators. He has about 80 research publications in different refereed international journals.

COURSE PLAN :

Week 1: Second quantisation

Week 2: Applications of second quantisation to free particle systems

Week 3: Applications: Quantum Theory of magnetism, Hubbard model

Week 4: Greens functions at zero temperature

Week 5: Wick's theorem, Feynman diagrams

Week 6: Finite temperature Greens functions-Matsubara formalism

Week 7: Applications of Greens functions to superconductivity

Week 8: Meissner effect, non-local electrodynamics, BCS theory