## Course Contents for Nano-Scale Electronic Devices (part of EE4001)

1. Wave functions, Schrodinger equation, real-space Hamiltonian matrix (H), infinite potential well and periodic boundary conditions, Eigen-energy matrix ($H_D$) and Eigen-vector matrix (V), equilibrium density matrix, tight binding model, atomistic Hamiltonian matrix [h(k)], reciprocal space lattice, Brillouin zone, sub-bands, zigzag and arm-chair nanotubes, density of states (DOS), effective mass Hamiltonian h(k) for 1D, 2D and 3D crystals.
2. Open system like FET, device (channel) and reservoir (contact), self-energy, retarded Green's function, local density of states, total density of states, spectral function, energy broadening, finite life time of electron wave-function, advanced Green's functions, non-equilibrium spatial density matrix, Buttiker probes, transmission function, current in a nanowire FET.

## Reference Books for Nano-Scale Electronic Devices (part of EE4001)

1. **Supriyo Dutta, Quantum Transport: Atom to Transistor, Cambridge University Press, 2005.** This is the main text book from where we learn the non-equilibrium Green's function (NEGF) technique to formulate the transmission function and finally the current in a nano-transistor. This is an excellently written book at the end of which given all the MATLAB codes used to generate the figures in the book. Available in Central Library.
2. **Supriyo Dutta, Electronic Transport in Mesoscopic Systems, Cambridge University Press, 1995.** This is also a nicely written book which deals with the basic quantum mechanical concepts and mathematical tools required to understand the nano-structured devices.
3. **D. Vasileska, S. M. Goodnick, G. Klimeck, Computational Electronics: Semiclassical and Quantum Device Modeling and Simulation, CRC Press, 2010.** This is a detailed work on computational electronics in recent past. The book elaborates the concepts, applications, modeling and design challenges of the modern nano-devices with simulation details. Fundamentals behind the numerical simulations are also elaborated.
4. **M . Lundstrom, Fundamentals of Carrier Transport, Cambridge University Press, 1990.** This is a well cited book which gives detailed perspectives on carrier transport mechanisms covering the classical, semi-classical and quantum mechanical fundamentals.
5. **A. F. J. Levi, Applied Quantum Mechanics, Cambridge University Press, 2003.** This is a well written text on fundamentals and few applications of quantum mechanics.
6. **N. W. Ashcroft and N. D. Mermin, Solid State Physics, Brooks/Cole Cengage Learning.** This classic will be useful to understand the tight binding energy band model of semiconductor. Available in IITM Central Library.