PH 552: SPINTRONICS (4-0-0: 4)

History of Spin
Spin, The Bohr planetary model and space quantization, the birth of spin, the Stern-Gerlach experiment.

Quantum Mechanics of Spin
Pauli spin matrices, the Pauli equation and spinors, more on the Pauli equation, extending the Pauli equation - the Dirac equation.

Spin Orbit Interaction
Spin orbit interaction in solid, Rashba interaction, Dresselhaus interaction.

Exchange Interaction
Direct exchange, Indirect exchange, superexchange interaction.

Spin Relaxation
Elliott-Yafet mechanism, D'yakonov Perel' mechanism, Bir-Aronov-Pikus mechanism, hyperfine interaction with nuclear spin.

Spin Dependent Electron Transport
Basic transport in continuous thin film, elastic scattering, inelastic scattering, basic transport in discontinuous film, thermoionic emission, tunneling, andreev reflection theory at ferromagnetic/semiconductor interface.

Spin Transfer Torque and its Magnetic Dynamics
Spin injection phenomena, dynamics of domain wall, magnetoresistance, giant magnetoresistance, tunnel magnetoresistance.

Text Books and References:

1. S. Bandyopadhyay and M. Cahay, "Introduction to Spintronics", CRC Press
2. Y. Xu, D. D. Awschalom and J. Nitta, "Handbook of Spintronics", Springer.
3. T. Dieti, D. D. Awschalom, M. Kaminska and H. Ohno, "Spintronics", Academic Press.
4. T. Shinjo, "Nanomagnetism and Spintronics", Elsevier.
5. C. Felser and G. H. Fecher, "Spintronics", Springer.