

Spintronics and Nanomagnetism

ECS 521/641, 2022-23 Semester II, IISER Bhopal
Infinity/AB1-308, Mon and Thu: 5:00 pm – 6:25 pm

* The syllabus and contents may be changed to align it with the pace of the class

Schedule and Syllabus

Day	Date	Topic
1 (Mon)	02-Jan-23	Introduction and overview
2 (Thu)	05-Jan-23	Quantum mechanics of spin, Pauli and Dirac equation
3 (Mon)	09-Jan-23	Bloch sphere
4 (Thu)	12-Jan-23	Spinor in Bloch sphere
5 (Mon)	16-Jan-23	Density matrix, Bloch ball
6 (Thu)	19-Jan-23	Landau-Lifshitz-Gilbert (LLG) equation of magnetization dynamics
7 (Mon)	23-Jan-23	MATLAB session on LLG dynamics (bring laptops)
(Thu)	26-Jan-23	Holiday
1 (Mon)	30-Jan-23	Spin-orbit interaction (SOI) - Rashba and Dresselhaus
2 (Thu)	02-Feb-23	Subbands in quantum confined structures with SOI
3 (Mon)	06-Feb-23	Subbands with SOI in 2D electron gas
4 (Thu)	09-Feb-23	Subbands with SOI in 1D electron gas
5 (Mon)	13-Feb-23	Subbands with SOI in 0D electron gas
6 (Thu)	16-Feb-23	Exchange interaction and nanomagnets
(Mon)	20-Feb-23	Midterm week
(Thu)	23-Feb-23	Midterm week
15 (Mon)	27-Feb-23	Spin Hall effect
16 (Thu)	02-Mar-23	Spin transfer-torque (STT)
(Mon)	06-Mar-23	Midterm recess
(Thu)	09-Mar-23	Midterm recess
17 (Mon)	13-Mar-23	Ferromagnetic resonance
18 (Thu)	16-Mar-23	Spin pumping
19 (Mon)	20-Mar-23	Spin relaxation, spin-waves, magnons
20 (Thu)	23-Mar-23	Spin diffusion equation and spin circuits
21 (Mon)	27-Mar-23	Giant magnetoresistance (GMR) and spin valves, magnetic tunnel junction and tunneling magnetoresistance (TMR)
(Thu)	30-Mar-23	Holiday
21 (Mon)	03-Apr-23	Topological insulators
22 (Thu)	06-Apr-23	Multiferroics and magnetoelectric coupling
23 (Mon)	10-Apr-23	Spin field effect transistor (SpinFET), spintronic logic
24 (Thu)	13-Apr-23	Spin-based quantum computing
25 (Mon)	17-Apr-23	Experimental methods (VSM/MOKE/EBL/MFM/Sputtering)
26 (Thu)	20-Apr-23	Summary
23-Apr-23	30-Apr-23	Final assessment