Subject Code: **EP-406** Course Title: **INTRODUCTION TO SPINTRONICS**

1. Contact Hours : L : 3 T : 1 P : 0
2. Examination Duration (Hrs.) : Theory : 3 T:1 Practical : 0
3. Relative Weight : CWS : 25 PRS : 0 MTE : 25 ETE : 50 PRE : 0
4. Credits : 4
5. Semester : Even
6. Subject Area : DEC-7
7. Pre-requisite : Basic knowledge of quantum mechanics, and semiconductor, magnetic material
8. Objective: Objective of this course is to study the properties of material at nanoscale, and to highlight applications of nanomaterial in spintronics. Fundamental of spintronics

S. No.	Contents	Contact Hours (hrs)
1.	**UNIT-I:** Stern-Gerlach experiments with electron spins, Zeeman Effect, Pauli spin Matrices, Pauli equation and spinors	**04**
2.	**UNIT-II:** Spin-Orbit Interaction and coupling, Zeeman splitting, Dresselhaus and Rashba spin splitting, Magnetization, Bloch states with SO coupling, Electronic structure of GaAs, orientation and spin pumping, GMR, CMR, TMR, , Spin injection, Spin detection	**08**
3.	**UNIT-1II:** Stoner-Wohlafarth Model, Two resister model, Density of states of minority and majority spin tunneling magnetosresistance (TMR), JMR, MR1, MR2, MR3, spin valve Hysteresis in spin valve magnetoresistance, Spin accumulation,	**08**
4.	**UNIT-1V:** Bloch equations, T1 and T2 times, Elliot-Yafet mechanism with phonons, Dyakonov-Perel, Bir-Aronov-Pikus, hyperfine coupling mechanisms, density matrix, pure and mixed states, spin kinetic equation, motional narrowing.	**08**
5.	**UNIT-V:** Spin-polarized transport, Intrinsic spin Hall effect Electrochemical potential, Spin diffusion, FN junction, Rashba formalism of linear spin injection, Equivalent circuit model, Silsbee-Johnson spin-charge coupling.	**08**
6	**UNIT-VI:** Datta-Das spin-FET, P-N junctions, Magnetic bipolar diode, Magnetic bipolar transistor, Magnetic tunneling devices	**06**
	Total	**42**

9. Details of Course :

DRAFT SCHEME OF STUDY
(Year 2,3,4 B. Tech Program

11.Suggested Books

S.No.	Name of Books/ Authors	Year of Publication/ Reprint
1.	Igor Zutic, J. Fabian, and S. Das Sarma, *Spintronics: Fundamentals and Applications*, Rev. Mod. Phys. **76**, 323 (2004).	2004
2.	D.D. Awschalom, N. Samarath, and D. Loss, *Semiconductor Spintronics and Quantum Computation* (Springer, Berlin, 2004). Springer	2004
3.	S. Datta, *Electronic Transport in Mesoscopic Systems* (Cambridge University Press, Cambridge, 1995).	1995
4.	I. Zutic, J. Fabian, and S. Das Sarma, Spintronics: Fundamentals and applications, Rev. Mod. Phys. 76, 323 (2004)	2004

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