

## BSMS-Physics

Semester VI						
S.No	Course Code	Course Name	L	T	P	C
1	PH401T	Quantum Mechanics-II	2	1	0	6
2	PH305T	Statistical Physics	2	1	0	6
3	PH402T	Condensed Matter Physics	2	1	0	6
4		Institute Elective-3/RnD Project-1				6
5		Institute Elective – 1	2	1	0	6
6		Institute Elective – 2	0	0	6	6
7		<b>ALO</b>				
		Total Credits				36

## BSMS-Physics

1	<b>Title of the course (L-T-P-C)</b>	<b>Quantum Mechanics-II (2-1-0-6)</b>
2	<b>Pre-requisite courses(s)</b>	PH101-Quantum Physics and Applications Quantum Mechanics - I
3	<b>Course content</b>	<p>Time independent Perturbation Theory – Zeeman and Stark effects. Wentzel Kramers–Brillouin approximation</p> <p>Variational method Time dependent perturbation theory, Scattering Theory, Born Approximation, Partial Wave analysis, Path Integral approach to Quantum Mechanics, Relativistic Quantum Mechanics</p> <p>Introduction to Quantum Field Theory, Quantization of free scalar field. Master equations, open and closed quantum system dynamics.</p>
4	<b>Texts/References</b>	<ol style="list-style-type: none"> <li>1. Modern Quantum Mechanics, J J Sakurai, Addison-Wesley, Reading, MA, 1994</li> <li>2. Advanced Quantum Mechanics, J J Sakurai, Pearson, 1967.</li> <li>3. Quantum Mechanics (Vol 1 and 2), C. Cohen-Tannoudji, B. Diu, and F. Laloe, Wiley VH; 2nd edition 2019.</li> <li>4. R. Shankar, Principles of Quantum Mechanics, 2nd Ed. (Plenum Press, New York, 1994)</li> <li>5. Quantum Mechanics and Path Integrals, R. P. Feynman and A. R. Hibbs, McGraw-Hill, New York, 1965.</li> <li>6. An Introduction to Quantum Field Theory, M.E. Peskin, D. V. Schroeder, Westview Press, 1995.</li> <li>7. The theory of open quantum systems, H. P. Breuer and F. Petruccione, Oxford University Press, 2002.</li> </ol>

## BSMS-Physics

1	<b>Title of the course (L-T-P-C)</b>	<b>Statistical Physics (2-1-0-6)</b>
2	<b>Pre-requisite courses(s)</b>	None
3	<b>Course content</b>	<p>Thermodynamics: Thermal equilibrium, the laws of thermodynamics; temperature, energy, entropy, and other functions of state.</p> <p>Probability Theory: Probability densities, cumulants and correlations; central limit theorem; laws of large numbers.</p> <p>Kinetic Theory: Phase space densities; Liouville's theorem, the Boltzmann equation; transport phenomena.</p> <p>Classical Statistical Mechanics: Postulates; microcanonical, canonical and grand canonical ensembles; Gibb's paradox, non-interacting examples. Maxwell Boltzmann distribution, ideal gas.</p> <p>Quantum Statistical Mechanics: Indistinguishability, Bose-Einstein and Fermi-Dirac distributions and Applications</p> <p>Interacting Systems: Virial and cluster expansions; van der Waals theory; liquid-vapor condensation.</p> <p>Quantization effects in molecular gases; phonons, photons; density matrix formulation.</p> <p>Identical Particles: Degenerate quantum gases; Fermi liquids; Bose condensation; superfluidity.</p>
4	<b>Texts/References</b>	<ol style="list-style-type: none"> <li>1. Huang, Kerson. Statistical Mechanics. 2nd ed. Wiley, 1987.</li> <li>2. Baierlein, Thermal Physics (Cambridge University Press, 1999).</li> <li>3. Pathria, R. K. Statistical Mechanics. Pergamon Press, 1972.</li> <li>4. Ma, Shang-keng. Statistical Mechanics. Translated by M. K. Fung. World Scientific Publishing Company, 1985.</li> <li>5. J. K. Bhattacharjee, Statistical Physics: Equilibrium and Non-Equilibrium Aspects, Allied Publishes, 2000</li> <li>6. F. Reif, Fundamentals of Statistical and Thermal Physics Statistical Physics :Amit and Verbin, Word Scientific, 1999.</li> </ol>

## BSMS-Physics

1	<b>Title of the course (L-T-P-C)</b>	<b>Condensed Matter Physics (2-1-0-6)</b>
2	<b>Pre-requisite courses(s)</b>	Successful completion of the first two semesters
3	<b>Course content</b>	<p>Crystal structure: Miller indices, Bravais and reciprocal lattice, Bragg and von Laue diffraction, structure factor;</p> <p>Lattice vibration and thermal properties: harmonic approximation, monatomic and diatomic lattices, Brillouin zone, density of states, acoustic and optical modes, phonons, crystal momentum, Debye model of specific heat, thermal expansion and conductivity;</p> <p>Free electron theory: Fermi gas, specific heat, Ohm's law, magneto- resistance, thermal conductivity;</p> <p>Band theory: Electrons in a periodic potential, Nearly free electron model, Bloch's theorem, Kronig Penny model, effective mass, concept of hole, classification of metal, insulator and semiconductor;</p> <p>Semiconductor: Intrinsic and extrinsic semiconductors, mobility and electrical conductivity, Fermi level, Hall effect;</p> <p>Magnetism: Diamagnetism, Hund's rules, Lande g-factor, quantum theory of paramagnetism, Pauli paramagnetism, exchange interaction, ferromagnetism, hysteresis;</p> <p>Superconductivity: Meissner effect, London equations, type-I and type-II superconductors, Outlines of BCS theory, flux quantization, Josephson tunneling, high temperature superconductors.</p>
4	<b>Texts/References</b>	<ol style="list-style-type: none"> <li>1. C. Kittel, Introduction to Solid State Physics, 8th Edition, Wiley</li> <li>2. N. W. Ashcroft, N. D. Mermin, Solid State Physics, CENGAGE</li> <li>3. A. J. Dekker, Solid State Physics, Mcmillan, 1986.</li> <li>4. J. R. Christman, Fundamentals of Solid State Physics, Wiley, 1988.</li> </ol>