Semester VI						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	PH402T	Condensed Matter Physics	2	1	0	6
2	PH401T	Quantum Mechanics-II	2	1	0	6
3	PH305T	Statistical Physics	2	1	0	6
4		Institute Elective – I	2	1	0	6
5		Institute Elective – II	0	0	6	6
6		Program Elective-I	2	1	0	6
		Total Credits				**36**

1	**Title of the course** (L-T-P-C)	**Quantum Mechanics-II** **(2-1-0-6)**
2	**Pre-requisite courses(s)**	PH101-Quantum Physics and Applications Quantum Mechanics - I
3	**Course content**	Time independent Perturbation Theory – Zeeman and Stark effects. Wentzel–Kramers–Brillouin approximation Variational method Time dependent perturbation theory, Scattering Theory, Born Approximation, Partial Wave analysis, Path Integral approach to Quantum Mechanics, Relativistic Quantum Mechanics Introduction to Quantum Field Theory, Quantization of free scalar field. Master equations, open and closed quantum system dynamics.
4	**Texts/References**	1. Modern Quantum Mechanics, J J Sakurai, Addison-Wesley, Reading, MA, 1994 2. Advanced Quantum Mechanics, J J Sakurai, Pearson, 1967. 3. Quantum Mechanics (Vol 1 and 2), C. Cohen-Tannoudji, B. Diu, and F. Laloe, Wiley VH; 2nd edition 2019. 4. R. Shankar, Principles of Quantum Mechanics, 2nd Ed. (Plenum Press, New York, 1994) 5. Quantum Mechanics and Path Integrals, R. P. Feynman and A. R. Hibbs, McGraw-Hill, New York, 1965. 6. An Introduction to Quantum Field Theory, M.E. Peskin, D. V. Schroeder, Westview Press, 1995. 7. The theory of open quantum systems, H. P. Breuer and F. Petruccione, Oxford University Press, 2002.

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

1	**Title of the course** (L-T-P-C)	**Condensed Matter Physics** **(2-1-0-6)**
2	**Pre-requisite courses(s)**	Successful completion of the first two semesters
3	**Course content**	Crystal structure: Miller indices, Bravais and reciprocal lattice, Bragg and von Laue diffraction, structure factor; 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; Free electron theory: Fermi gas, specific heat, Ohm's law, magneto- resistance, thermal conductivity; 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; Semiconductor: Intrinsic and extrinsic semiconductors, mobility and electrical conductivity, Fermi level, Hall effect; Magnetism: Diamagnetism, Hund's rules, Lande g-factor, quantum theory of paramagnetism, Pauli paramagnetism, exchange interaction, ferromagnetism, hysteresis; Superconductivity: Meissner effect, London equations, type-I and type-II superconductors, Outlines of BCS theory, flux quantization, Josephson tunneling, high temperature superconductors.
4	**Texts/References**	1. C. Kittel, Introduction to Solid State Physics, 8th Edition, Wiley 2. N. W. Ashcroft, N. D. Mermin, Solid State Physics, CENGAGE 3. A. J. Dekker, Solid State Physics, Mcmillan, 1986. 4. J. R. Christman, Fundamentals of Solid State Physics, Wiley, 1988.