SEMESTER - VI						
Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	PH402T	Condensed Matter Physics	2	1	0	6
2	CE301T	Environmental studies	3	0	0	6
3		HSS Elective - I	3	0	0	6
4		Institute Elective – 1 / RnD Project	2	1	0	6
5	PH401T	Quantum Mechanics-II	2	1	0	6
6	ME207L	Mechanics and Measurement Lab	1	0	3	5
7	PH401S	Seminar – 1	0	0	3	3
	Sixth Semester Total Credits					**35**
	Total Cumulative Credits after 3rd Year					**213**

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.

1	**Title of the course (L-T-P-C)**	**Environmental studies (3-0-0-6)**
2	**Pre-requisite courses(s)**	**Nill**
3	**Course content**	**Module A:** Natural Resources, Ecosystems, Biodiversity, and its conservation: Natural resources and ecosystems, Forest, grassland, desert and aquatic ecosystems, biodiversity at global, national and local levels, conservation of biodiversity **Module B:** Air Pollution Introduction to understanding air quality management, fundamental processes of meteorology, Air Pollutants – Gaseous and particulate, Criteria for pollutants, ambient and source standards, Aerosols: Characterisation of aerosols, size distributions, measurement methods; Transport behaviour: diffusion, sedimentation, inertia; Visibility; principles of particulate control systems. **Module C:** Water Treatment Discussion of water quality constituents and introduction to the design and operation of water and wastewater treatment processes. **Module D:** Solid Waste Management and Climate Change Different aspects of solid and hazardous waste management. Climate change and greenhouse gas emissions, technologies would reduce the greenhouse gas emissions. Climate change and its possible causes. **Module E:** Sociology/Environmentalism Description: Environmentalism in sociological tradition, Sustainability, North-South divide, Political economy approaches in environmental studies, Debates over environmental issues. **Module F:** Economics Energy economics and financial markets, Market dynamics, Energy derivatives, Energy Efficiency; Sustainable Development: Concept, Measurement & Strategies, Interaction between Economic Development and the Environment **Module G:** Philosophy Environmental ethics, Deep ecology, Practical ecology, Religion and attitude towards environmental ethics, Ecofeminism, and its evolution. **Module H:** Field work and project: visit to a local area to document environmental assets, case studies of a simple ecosystem and group discussions on current environmental issues.

4	**Texts/References**	**1.** Cunningham W.P. and Cunningham M.A. (2002), Principles of Environmental Science, Tata McGraw-Hill Publishing Company, New Delhi. **2.** Dasgupta, P. and Maler, G. (eds.), (1997), The Environment and Emerging Development Issues, Vol. I, Oxford University Press, New Delhi. **3.** Jackson, A.R.W. and Jackson, J.M. (1996), Environmental Sciences: The Environment and Human Impact, Longman Publishers. **4.** Nathanson, J.A., (2002), Basic Environmental Technology, Prentice Hall of India, New Delhi. **5.** Red clift, M. and Woodgate, G. (eds.), (1997), International Handbook of Environmental Sociology. **6.** Srivastava, K.P. (2002), An Introduction to Environmental Study, Kalyani Publishers, Ludhiana. **7.** Review articles from literature.

1	**Title of the course (L-T-P-C)**	**Mechanics and Measurement Lab (1-0-3-5)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	We are looking for 10 to 12 experiments for engineering physics programme from the set of experiments listed below, taken out of the existing list of Mechanical engineering experiments**.:** **1.** Measurement of convective heat transfer coefficient **2.** Boiling and Condensation **3.** Critical heat flux measurement **4.** Heat transfer in the tubular heat exchanger. **5.** Reynolds experiment for laminar/turbulent flow visualization **6.** Demonstration of Bernoulli's principle **7.** Demonstration of linear momentum and impact forces of Jet for different deflection angles **8.** Major losses in Pipe system: Effect of pipe material, dimensions **9.** Study of the working of orifice meter, venturi meter and rotameter **10.** Steady state and transient calibration of temperature sensors (thermocouple and RTD) **11.** Steady state and transient calibration of pressure sensors **12.** Measurement of stress/strain through strain gage rosettes **13.** Tensile and Compression Test **14.** Deflection of springs and beams **15.** Polariscope SCF Determination **16.** Rockwell, Vickers and Brinell
4	**Texts/References**	**1.** Yunus A. Cengel, John M. Cimbala, Fluid Mechanics, Tata McGraw Hill Education, 2011. **2.** F.M.White, Fluid Mechanics, Seventh Edition, Tata McGraw Hill Education, 2011. **3.** Philip J.Pritchard, Alan T.Mcdonald, Robert W.Fox, Introduction to Fluid Mechanics, Wiley, 2009. **4.** John F. Douglas, J. M. Gasoriek, Lynne Jack and John Swaffield, Fluid Mechanics, Pearson, 2008. **5.** E.O. Doebelin, Measurement systems: Application and Design, Fourth Ed., 1990, McGrawHill. **6.** Richard S. Figliola, Donald E. Beasley, Theory and Design for Mechanical Measurements, John Wiley and Sons. **7.** Incropera F. P. and Dewitt D. P., Fundamentals of Heat and Mass Transfer, 5th Ed., Wiley and Sons, New York, 2002. **8.** Gayler J. F. W. and C. R Shotbolt, Metrology for Engineers, ELBS, 1990.

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.