Semester - V						
Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	PH302T	Classical Mechanics	2	1	0	6
2	PH303T	Quantum Mechanics-I	2	1	0	6
3	EE305T	Digital Signal Processing	3	0	0	3
4	EE207T	Data Analysis	2	1	0	3
5	ME203T	Fluid Mechanics	2	1	0	6
6	EE304L	Digital Signal Processing Lab (Post mid-sem)	0	0	2	2
7	PH401L	Advance Physics Laboratory	0	0	3	3
	Fifth Semester Total Credits					29

1	**Title of the course** (L-T-P-C)	Classical Mechanics **(2-1-0-6)**
2	**Pre-requisite courses(s)**	Nil
3	**Course content**	Review of Newtonian Mechanics - Newton's Laws of Motion and Conservation Laws. Principles of Canonical Mechanics - Constraints and generalized coordinates, Alembert's principle, Lagrange's equation, Hamilton's variational principle, canonical systems, symmetries and conservation laws, Noether's theorem, Liouville's Theorem. Central Force: Equations of motion Virial Theorem, Kepler's Laws, Scattering in a Central Force Field. Rigid Body: Euler angles, Coriolis Effect, Euler equations, moment of inertia tensor, motion of asymmetric top. Small Oscillations: Eigen value problem, frequencies of free vibrations and normal modes, forced vibration, dissipation. Special Theory of Relativity: Newtonian relativity, Michelson-Morley experiment, Special theory of relativity, Lorentz transformations and its consequences, addition of velocities, variation of mass with velocity, mass-energy relation, Minkowski four-dimensional continuum, four vectors. Hamiltonian Equation, Gauge transformation, canonical transformation, Infinitesimal transformation, Poisson brackets, Hamilton-Jacobi equations, Separation of variables. Lagrangian and Hamiltonian formulation of continuous systems.
4	**Texts/References**	1. Classical Mechanics: H. Goldstein, C. P. Poole, and J. Safko, Pearson 2011. 2. Classical Mechanics: N. C. Rana and P. S. Joag, Tata McGraw Hill, 2017. 3. Introduction to Classical Mechanics: David Morin, Cambridge University Press, 2008. 4. Mechanics: L.D. Landau and E. M. Lifshitz, Butterworth- Heinemann, 3rd edition, 1982. 5. Mechanics: From Newton's Laws to Deterministic Chaos, F. Scheck, Springer, 5th edition, 2010. 6. Introduction to Classical Mechanics, R G Takwale and P S Puranik, Tata McGraw Hill, 2008.

1	**Title of the course** (L-T-P-C)	**Quantum Mechanics-I** **(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. 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)**	**Digital Signal Processing (3-0-0-3)**
2	**Pre-requisite courses(s)**	**Signals and Systems**
3	**Course content**	Review of basic signal processing, and sampling, introduction to DSP, Z transform, DFT, FFT, Implementation of discrete time systems, and Introduction to digital filters.
4	**Texts/References**	• Proakis and Manolokis, "Digital Signal Processing," 4th edition, Prentice Hall, 2006. • S K Mitra, "Digital Signal Processing," McGraw Hill, Inc., 4th edition, 2017. • Alan V Oppenheim, "Digital Signal Processing," Prentice Hall, 1975.

1	**Title of the course (L-T-P-C)**	**Data Analysis** **(3-0-0-6)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	The role of statistics. Graphical and numerical methods for describing and summarizing data. Probability. Population distributions. Sampling variability and sampling distributions. Estimation using a single sample. Hypothesis testing a single sample. Comparing two populations or treatments. Simple linear regression and correlation. Case studies. .
4	**Texts/References**	**1.** Introduction to Probability and Statistics for Engineers and Scientists by Sheldon M. Ross, Elsevier, New Delhi, 3rd edition (Indian), 2014. **2.** Probability, Random Variables and Stochastic processes by Papoulis and Pillai, 4th Edition, Tata McGraw Hill, 2002. **3.** An Introduction to Probability Theory and Its Applications, Vol. 1, William Feller, 3rd edition, Wiley International, 1968.

1	**Title of the course (L-T-P-C)**	**Fluid Mechanics (3-0-0-6)**
2	**Pre-requisite courses(s)**	**Nill**
3	**Course content**	**Introduction:** Scope, definition of fluid as continuum, fluid properties. (2hr) **Fluid Statics:** Pressure at a point, basic equation for pressure field, pressure variation **(fluid at rest):** standard atmosphere, Measurement of pressure manometer, Hydrostatics force on a plane and curve surface, Buoyancy, flotation and stability, pressure variation in a fluid with rigid body motion linear motion, rigid body rotation(4hr) **Elementary Fluid Dynamics:** Statics, stagnation pressure, Bernoulli Equation assumptions(4hr) **Fluid Kinematics The velocity filed:** Eulerian and Largrangian flow descriptions, steady and deformation, **Acceleration field:** material derivative, unsteady and convective effects. **Control volume and system representation:** Reynolds' Transport Theorem, physical interpretation, steady, unsteady effects, moving control volume, potential function(6Hr) Integral approach Conservation of mass derivation of continuity, fixed, non-deforming control volume, moving non-deforming control volume, deforming control volume. **Conservation of momentum:** linear momentum and moment of momentum equation and their application., comparison of energy equation with Bernoulli's equation(6hr) **Differential approach:** linear motion and angular motion with deformation, **Conservation of mass:** differential form of continuity equation, stream function, Conservation of linear momentum, Inviscid flows, Irrotational flow(6hr) **Viscous flow:** Stress relationships, NS Equations, Simple solutions for viscous flows(4hr) Dimensional analysis Buckingham's II-theorem, Dimensionless groups & their importance (3hr) **Viscous Flow in Pipes:** General characteristics of pipe flow, fully developed laminar and turbulent flow, turbulent shear stress, turbulent velocity profile, Pipe Flow rate measurement. (4hr) **Boundary layer:** Boundary layer characteristics boundary layer structure and thickness on a plate, Blasius boundary layer, momentum integral boundary layer equation for a flat plate(4hr)
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.** Kundu, Pijush K., and Ira M.Cohen.Fluid Mechanic, Elsevier,2001

1	**Title of the course (L-T-P-C)**	**DSP Lab** **(0-0-4-2)**
2	**Pre-requisite courses(s)**	DSP
3	**Course content**	• Overview of DSP kit • generation of waveform • Convolution and correlation • DFT and FFT Design of digital filters
4	**Texts/References**	1. Proakis and Manolokis, "Digital Signal Processing," 4th edition, Prentice Hall, 2006. 2. S K Mitra, "Digital Signal Processing," McGraw Hill, Inc., 4th edition, 2017. 3. Alan V Oppenheim, "Digital Signal Processing," Prentice Hall, 1975.