

Engineering Physics

SEMESTER - III						
Sl. No.	Course Code	Course Name	L	T	P	C
1	PH302T	<u>Classical Mechanics</u>	2	1	0	6
2	HS201T	<u>Economics</u>	2	1	0	6
3	ME201T	<u>Engineering Mechanics</u>	2	1	0	6
4	EE204T	<u>Signals and Systems</u>	2	1	0	6
5	EE205T	<u>Introduction to Probability (Pre mid-sem)</u>	3	0	0	3
6	PH303T	<u>Quantum Mechanics - I</u>	2	1	0	6
7	EE207T	<u>Data Analysis (Post mid Sem)</u>	2	1	0	3
8	PH201L	<u>Introduction to Probability</u>	0	0	3	3
	Third Semester Total Credits					39

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1	Title of the course (L-T-P-C)	Classical Mechanics (2-1-0-6)
2	Pre-requisite courses(s)	Nil
3	Course content	<p>Review of Newtonian Mechanics - Newton's Laws of Motion and Conservation Laws.</p> <p>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.</p> <p>Central Force: Equations of motion Virial Theorem, Kepler's Laws, Scattering in a Central Force Field.</p> <p>Rigid Body: Euler angles, Coriolis Effect, Euler equations, moment of inertia tensor, motion of asymmetric top.</p> <p>Small Oscillations: Eigen value problem, frequencies of free vibrations and normal modes, forced vibration, dissipation.</p> <p>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.</p> <p>Hamiltonian Equation, Gauge transformation, canonical transformation, Infinitesimal transformation, Poisson brackets, Hamilton-Jacobi equations, Separation of variables.</p> <p>Lagrangian and Hamiltonian formulation of continuous systems.</p>
4	Texts/References	<ol style="list-style-type: none"> 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.

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1	Title of the course (L-T-P-C)	Economics (2-1-0-6)
2	Pre-requisite courses(s)	--
3	Course content	<p>Basic economic problems. resource constraints and Welfare maximizations. Nature of Economics: Positive and normative economics; Micro and macroeconomics, Basic concepts in economics. The role of the State in economic activity; market and government failures; New Economic Policy in India.</p> <p>Theory of utility and consumer choice. Theories of demand, supply, and market equilibrium. Theories of firm, production, and costs. Market structures.</p> <p>Perfect and imperfect competition, oligopoly, monopoly. An overview of macroeconomics, measurement, and determination of national income. Consumption, savings, and investments. Commercial and central banking.</p> <p>Relationship between money, output, and prices. Inflation - causes, consequences, and remedies. International trade, foreign exchange and balance payments, stabilization policies: Monetary, Fiscal and Exchange rate policies.</p>
4	Texts/References	<ol style="list-style-type: none"> 1. P. A. Samuelson & W. D. Nordhaus, Economics, McGraw Hill, NY, 1995. 2. A. Koutsoyiannis, Modern Microeconomics, Macmillan, 1975. R. Pindyck and D. L. Rubinfeld, Microeconomics, Macmillan publishing company, NY, 1989. 3. R. J. Gordon, Macroeconomics 4th edition, Little Brown and Co., Boston, 1987. 4. William F. Shughart II, The Organization of Industry, Richard D. Irwin, Illinois, 1990. 5. R.S. Pindyck and D.L. Rubinfeld. Microeconomics The (7thEdition), Pearson Prentice Hall, New Jersey,2009. 6. R. Dornbusch, S. Fischer, and R. Startz. Macroeconomics (9th Edition), McGraw-Hill Inc. New York, 2004.

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1	Title of the course (L-T-P-C)	Engineering Mechanics (2-1-0-6)
2	Pre-requisite courses(s)	--
3	Course content	<p>Module 1: Introduction to Engineering Mechanics covering, Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy</p> <p>Module 2: Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack;</p> <p>Module 3: Basic Structural Analysis covering, Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines;</p> <p>Module 4: Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook;</p> <p>Module 5: Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.</p> <p>Module 6: Particles dynamics- Kinematics of Particles: Rectilinear motion, Plane curvilinear motion - rectangular coordinates, normal and tangential coordinates, polar coordinates, Space curvilinear - cylindrical, spherical (coordinates), Relative and Constrained motion. Kinetics of Particles: Force, mass and acceleration – rectilinear and curvilinear motion, work and energy, impulse and momentum – linear and angular; Impact – Direct and Oblique. Kinetics of System of Particles: Generalized Newton's Second Law, Work-Energy, Impulse-Momentum, Conservation of Energy and Momentum</p> <p>Module 7: Introduction to Rigid body dynamics Kinematics of Planar Rigid Bodies: Equations for rotation of a rigid body about a fixed axis, General plane motion, Instantaneous Center of Rotation in Plane Motion Plane Motion of a Particle Relative to a Rotating Frame. Coriolis Acceleration Kinetics of Planar Rigid Bodies: Equations of Motion for a Rigid Body, Angular Momentum of a Rigid Body in Plane Motion, Plane Motion of a Rigid Body and D'Alembert's Principle, Systems of Rigid Bodies, Constrained Plane Motion; Energy and Work of Forces Acting on a Rigid Body, Kinetic Energy of a Rigid Body in Plane Motion, Systems of Rigid Bodies, Conservation of Energy, Plane Motion of a Rigid Body - Impulse and Momentum, Systems of Rigid Bodies, Conservation of Angular Momentum.</p>

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		<p>Module 8: Mechanical Vibrations covering, Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums</p>
4	Texts/References	<p>Textbooks:</p> <ol style="list-style-type: none"> 1. J. L. Meriam and L. G. Kraige, Engineering Mechanics, Vol I – Statics, Vol II – Dynamics, 6th Ed, John Wiley, 2008. 2. F. P. Beer and E. R. Johnston, Vector Mechanics for Engineers, Vol I - Statics, Vol II – Dynamics, 9th Ed, Tata McGraw Hill, 2011. 3. R. C. Hibbler, Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press, 2006. <p>References:</p> <ol style="list-style-type: none"> 1. S. P. Timoshenko and D. H. Young, Engineering Mechanics. Fourth Edition. McGraw-Hill, New York, 1956. 2. I. H. Shames, Engineering Mechanics: Statics and dynamics, 4th Ed, PHI, 2002. 3. Robert W. Soutas-Little; Daniel J. Inman; Daniel Balint, Engineering Mechanics: Dynamics – Computational Edition, 1st Ed., Cengage Learning, 2007 4. Robert W. Soutas-Little; Daniel J. Inman; Daniel Balint, Engineering Mechanics: Statics-Computational Edition, 1st Ed., ,Cengage Learning, 2007

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1	Title of the course (L-T-P-C)	Thermodynamics (2-1-0-6)
2	Pre-requisite courses(s)	Nil
3	Course content	<p>Thermodynamic Systems, properties & state, process & cycle</p> <p>Heat & Work: Definition of work and its identification, work done at the moving boundary, Zeroth law,</p> <p>Properties of pure substance: Phase equilibrium, independent properties, and equations of state, compressibility factor, Tables of thermodynamic properties & their use, Mollier Diagram</p> <p>First law: First law for control mass & control volume for a cycle as well as for a change of state, internal energy & enthalpy, Specific heats; internal energy, enthalpy & specific heat of ideal gases. SS process, Transient processes.</p> <p>Second Law of Thermodynamics: Reversible process; heat engine, heat pump, refrigerator; Kelvin- Planck & Clausius statements, Carnot cycle for pure substance & ideal gas, Concept of entropy; the Need of entropy definition of entropy; entropy of a pure substance; entropy change of a reversible & irreversible processes; principle of increase of entropy, thermodynamic property relation, corollaries of second law, Second law for control volume; SS & Transient processes; Reversible SSSF process; principle of increase of entropy, Understanding efficiency.</p> <p>Irreversibility and availability: Available energy, reversible work & irreversibility for control mass and control volume processes; second law efficiency.</p> <p>Thermodynamic relations: Clapeyron equation, Maxwell relations, Thermodynamic relation for enthalpy, internal energy, and entropy, expansively and compressibility factor, equation of state, generalized chart for enthalpy.</p> <p>Thermodynamic Cycles: Otto, Diesel, Dual and Joule Third Law of Thermodynamics</p>
4	TextReference	<ol style="list-style-type: none"> 1. Sonntag R., Claus B. & V. Wylen G, Fundamentals of Thermodynamics, John Wiley, 2000. 2. G Rogers, YR Mayhew, Engineering Thermodynamics Work and Heat Transfer, Pearson 2003 3. J.P Howell, P.O. Bulkins, Fundamentals of Engineering Thermodynamics, McGraw Hill, 1987 4. Y Cengel, M A Boles, Thermodynamics: An Engineering Approach, Tata McGraw Hill, 2003. 5. Michael J. & H.N. Shapiro, Fundamentals of Engineering Thermodynamics, John Wiley, 2004.

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1	Title of the course (L-T-P-C)	Signals and Systems (2-1-0-6)
2	Pre-requisite courses(s)	--
3	Course content	<ul style="list-style-type: none">• Continuous-time and Discrete-time signal (and system) classification and properties.• Impulse response, LTI / LSI system and properties; Continuous-time and Discrete-time convolution.• Linear constant coefficient differential (and difference) equations.• Continuous – time Fourier series and Continuous – time Fourier Transform. Their properties.• Discrete – time Fourier series and Discrete – time Fourier Transform. Their properties.• Sampling and Aliasing in time and frequency. Discrete Fourier Transform.• Laplace Transform and its Properties. Z-Transform and its Properties.
4	Texts/References	<ol style="list-style-type: none">1.Signals and Systems, Authors: Alan V. Oppenheim, Alan S. Willsky, Edition: 2, illustrated, Publisher: Pearson, 2013.2.Signal Processing and Linear Systems, Author: Bhagawandas P. Lathi, Edition: 2, illustrated, Publisher: Oxford University Press, 2009.3.Signals and Systems, Authors: Simon S. Haykin, Barry Van Veen, Edition: 2, illustrated, Publisher: Wiley, 2003.

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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	<ol style="list-style-type: none">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.

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1	Title of the course (L-T-P-C)	Introduction to Probability (3-0-0-3)
2	Pre-requisite courses(s)	Basic calculus
3	Course content	<p>Introduction: Motivation for studying the course, revision of basic math required, connection between probability and length on subsets of the real line, probability-formal definition, events and σ-algebra, independence of events, and conditional probability, sequence of events, and <i>Borel-Cantell</i> Lemma.</p> <p>Random Variables: Definition of random variables, and types of random variables, CDF, PDF and its properties, random vectors and independence, brief introduction to transformation of random variables, introduction to Gaussian random vectors.</p> <p>Mathematical Expectations: Importance of averages through examples, definition of expectation, moments and conditional expectation, use of MGF, PGF and characteristic functions, variance and k-th moment, MMSE estimation.</p> <p>Inequalities and Notions of convergence: Markov, Chebychev, Chernoff and Mcdiarmid inequalities, convergence in probability, mean, and almost sure, law of large numbers and central limit theorem.</p> <p>A short introduction to Random Process: Example and formal definition, stationarity, autocorrelation, and cross correlation function, definition of ergodicity.</p>
4	Texts/References	<ol style="list-style-type: none"> 1. Robert B. Ash, "Basic Probability Theory," Reprint of the John Wiley & Sons, Inc., New York, 1970 edition. 2. Sheldon Ross, "A first course in probability," Pearson Education India, 2002. 3. Bruce Hayek, "An Exploration of Random Processes for Engineers," Lecture notes, 2012. 4. D. P. Bertsekas and J. Tsitsiklis, "Introduction to Probability" MIT Lecture notes, 2000 (link: https://www.vfu.bg/en/e-Learning/Math--Bertsekas-Tsitsiklis-Introduction-to-probability.pdf)

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1	Title of the course (L-T-P-C)	Quantum Mechanics - I (3-1-0-8)
2	Pre-requisite courses(s)	PH101 MA101
3	Course content	<p>Review of Wave mechanics, Schrodinger equation, Uncertainty principle, wave packets, group velocity and phase velocity.</p> <p>Postulates of quantum mechanics, probability and probability current density, operators, eigenvalues and eigenfunctions. Bound states, delta-function potential, and harmonic oscillator.</p> <p>Formalism: Hilbert space, Observables, Eigenfunctions of Hermitian operator, Dirac's notation, matrix representations of vectors and operators, parity operation, matrix theory of harmonic oscillator.</p> <p>Theory of Angular Momentum: Spherical harmonics, eigenvalues of L^2 and L_z, addition of angular momentum, commutation relations, degeneracies.</p> <p>Hydrogen atom, quantum numbers, two particle systems.</p>
4	Texts/References	<ol style="list-style-type: none"> 1. Introduction to Quantum Mechanics, D. J. Griffiths and D. F. Schroeter, Cambridge University Press, 3rd edition, 2019. 2. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press, 2017. 3. Principles of Quantum Mechanics, R. Shankar, Springer, 2014. 4. Quantum Physics, S. Gasiorowicz, John Wiley, 2000. 5. Quantum Mechanics, L. D. Landau and E.M. Lifshitz, Pergamon press, 1965