Semester I						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	CH 102	Fundamental concepts and applications of chemistry	3	0	0	6
2	MA 109	Calculus I (1st Half)	3	1	0	4
3	MA 121	Calculus II (2nd Half)	3	1	0	4
4	PH 101	Quantum Physics and Applications	2	1	0	6
5	BB 103	Introduction to Modern Biology	2	1	0	6
6	CS 103	Introduction to Programming - 1 (Using C) (1st Half)	3	0	2	4
7	EE 103	Introduction to Programming - 2 (Using Python) (2nd Half)	3	0	2	4
8	PH 113	Hands-on Science Laboratory - I	0	0	3	3
9	HS 103	Introduction to Fine Arts				PP/NP
10	HS 106	Design Thinking and Creativity				PP/NP
11	NO 101/ NO 103	National Sports Organization (NSO)/National Service Scheme (NSS)				PP/NP
		Total Credits				**37**

1	**Title of the course** (L-T-P-C)	**Fundamental Concepts &Applications of Chemistry** **(3-0-0-6)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	**Organic and Inorganic** **(Inorganic): a. Harness the power of periodic table** Periodic properties: trends in size, electron affinity, ionization potential and electronegativity • Role of chemical elements in water contamination • Hardness of water • Desalination of brackish and sea water • Role of silicon in semiconducting applications • metal atom (Cu, Au, Pt, Pd etc.) based nanoparticles **b. Coordination complexes** Transition metal chemistry: inorganic complexes, bonding theories, magnetism, bonding aspects and structural distortion **(Organic): a. M.O. theory and π-conjugated compounds** Molecular orbitals of common functional groups, Qualitative Huckel MOs of conjugated polyenes and benzene. Aromaticity. Configuration, molecular chirality and isomerism, Conformation of alkanes and cycloalkanes **b. Polymers** Types and classification of polymers • polymerization techniques • Structure-property relationships of polymers • Conducting polymers **Physical Chemistry:** **a. Quantum chemistry** Schrodinger equation, Origin of quantization, Born interpretation of wave function, Hydrogen atom: solution to □-part, Atomic orbitals, many electron atoms and spin orbitals. Chemical bonding: MO theory: LCAO molecular orbitals, Structure, bonding and energy levels of diatomic molecules. Concept of sp, sp^2 and sp^3 hybridization; Bonding and shape of many atom molecules; Intermolecular Forces; Potential energy Surfaces-Rates of reactions; Steady state approximation and its applications; Concept of pre-equilibrium; Equilibrium and related thermodynamic quantities **b. Electrochemistry** Electrochemical cells and Galvanic cells • EMF of a cell Single electrode potential • Nernst equation • Electrochemical series • Types of electrodes • Reference electrodes • Batteries • Modern batteries • Fuel cells • corrosion
4	**Texts/References**	1. J. D. Lee, "Concise Inorganic chemistry" 5th Edition. Wiley India. Ed. 2. J. E. Huheey, E. A. Keiter, R. L. Keiter, O. K. Medhi, "Inorganic Chemistry: Principles of structure and reactivity" 4th Edition, Person. 3. P. Atkins, J. de Paula, "physical chemistry" 5th Edition, Oxford. 4. J. Clayden, N. Greeves, S. Warren, "Organic chemistry" 2th Edition, Oxford. 5. George Odian, Principles of polymerization, 4th edition, Wiley student edition, Wiley India Pvt Ltd. 6. F. W. Billmeyer, Text book of Polymer Science, 3rd edition, Wiley student edition, Wiley India Pvt Ltd. 7. A. K. De, Environmental Chemistry, 8th edition, New Age International publishers. 8. B. K. Sharma, Environmental Chemistry, 16th edition, Krishna Prakashan Media Pvt Ltd. 9. A. R. West, Solid State Chemistry and Its Applications, Wiley student edition, Wiley India Pvt Ltd. 10. T. Pradeep, Nano: The essentials, McGraw-Hill Education publishers. 11. Geoffrey A Ozin and André Arsenault, Nanochemistry: A Chemical Approach to Nanomaterials, 2nd edition, RSC publishing.

1	**Title of the course** (L-T-P-C)	**Calculus I** **(3-1-0-4)**
2	**Pre-requisite courses(s)**	Nil
3	**Course content**	Review of limits, continuity, differentiability. Mean value theorem, Taylor's Theorem, Maxima and Minima. Riemann integrals, Fundamental theorem of Calculus, Improper integrals, applications to area, volume. Convergence of sequences and series, power series.
4	**Texts/References**	1. B. V. Limaye and S. Ghorpade, A Course in Calculus and Real Analysis, Springer International Publishing (2004) 2. James Stewart, Calculus (5th Edition), Thomson Brooks/Cole (2003) 3. T. M. Apostol, Calculus, Volume 1, Wiley Eastern (1980)

1	**Title of the course** (L-T-P-C)	**Calculus II** **(3-1-0-4)**
2	**Pre-requisite courses(s)**	Calculus I
3	**Course content**	Partial Derivatives, gradient and directional derivatives, Chain rule, Maxima and Minima, Lagrange multipliers. Double and Triple integration, Jacobians and change of variables formula. Parametrization of Curves and Surfaces, Vector fields, Line and Surface integrals. Divergence and Curl, Theorems of Green, Gauss, and Stokes.
4	**Texts/References**	1. B.V. Limaye and S. Ghorpade, A Course in Multivariable Calculus and Real Analysis, Springer International Publishing (2010) 2. James Stewart, Calculus (5th Edition), Thomson Brooks/Cole (2003) 3. T. M. Apostol, Calculus, Volume 2, Wiley Eastern (1980) 4. Marsden and Tromba, Vector calculus (First Indian Edition), Springer (2012)

1	**Title of the course** (L-T-P-C)	**Quantum Physics and Applications** **(2-1-0-6)**
2	**Pre-requisite courses(s)**	Nil
3	**Course content**	• Quantum nature of light: Photoelectric Effect and Compton Effect. • Stability of atoms and Bohr`s rules. • Wave particle duality: De Broglie wavelength, Group and Phase velocity, Uncertainty Principle, Double Slit Experiment. • Schrödinger Equation. • Physical interpretation of Wave Function, Elementary Idea of Operators, Eigen-value Problem. • Solution of Schrödinger equation for simple boundary value problems. • Reflection and Transmission Coefficients. Tunneling. • Particle in a three dimensional box, Degenerate states. • Exposure to Harmonic Oscillator and Hydrogen Atom without deriving the general solution. • Quantum Statistics: Maxwell Boltzmann, Bose Einstein and Fermi Dirac Statistics by detailed balance arguments. • Density of states. • Applications of B-E statistics: Lasers. Bose-Einstein Condensation. • Applications of F-D statistics: Free electron model of electrons in metals. Concept of Fermi Energy. • Elementary Ideas of Band Theory of Solids. • Exposure to Semiconductors, Superconductors, Quantum Communication and Quantum Computing.
4	**Texts/References**	1. Quantum Physics: R. Eisberg and R. Resnick, John Wiley 2002, 2nd Edition. 2. Introduction to Modern Physics: F. K. Richtmyer, E. H. Kennard and J.N. Cooper, Tata Mac Graw Hill 1976, 6th Edition. 3. Modern Physics: K. S. Krane, John Wiley 1998, 2nd Edition. 4. Introduction to Modern Physics: Mani and Mehta, East-West Press Pvt. Ltd. New Delhi 2000. 5. Elements of Modern Physics: S. H. Patil, Tata McGraw Hill, 1984. 6. Concepts of Modern Physics, A Beiser, Tata McGraw Hill, 2009.

1	**Title of the course** (L-T-P-C)	**Introduction to Modern Biology** **(2-1-0-6)**
2	**Pre-requisite courses(s)**	Nil
3	**Course content**	Quantitative views of modern biology. Importance of illustrations and building quantitative/qualitative models. Role of estimates. Cell size and shape. Temporal scales. Relative time in Biology. Key model systems – a glimpse. Management and transformation of energy in cells. Mathematical view – binding, gene expression and osmotic pressure as examples. Metabolism. Cell communication. Genetics. Eukaryotic genomes. Genetic basis of development. Evolution and diversity. Systems biology and illustrative examples of applications of Engineering in Biology.
4	**Texts/References**	Campbell Biology 12th edition, Pearson publication by Lisa Urry,Michael Cain,Steven Wassserman

1	**Title of the course** (L-T-P-C)	**Introduction to Programming – 1** **(3-0-2-4)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	This course provides an introduction to problem solving with computers using C Topics covered will include: **Utilization**:Developer fundamentals such as editor, integrated programming environment, Unix shell, modules, libraries. **Programming features**: Machine representation, data types, arrays and records, objects, expressions, control statements, iteration, procedures, functions and recursion, Pointers, Structures and basic I/O. **Applications**: Sample problems in engineering, science, text processing, and numerical methods.
4	**Texts/References**	The C Programming Language Brian W Kernighan, Dennis M Ritchie, Prentice Hall India , 2nd edition, 1988 Programming with C (Second Edition) Byron Gottfried, Schaum's Outlines Series, Tata-Mcgraw Hill, 2011 How to Solve It by Computer, by G. Dromey, Prentice- Hall, Inc., Upper Saddle River, NJ, 1982. How to Solve _It (2nd ed.), by Polya, G., Doubleday and co, 1957. Let Us C, by Yashwant Kanetkar, Allied Publishers, 1998.

1	**Title of the course** (L-T-P-C)	**Introduction to Programming-2** **(3-0-2-4)**
2	**Pre-requisite courses(s)**	Nil
3	**Course content**	This is a continuation of the CS101 (first half semester) course. In the first half semester, the students are introduced to basic programming. This course (second half semester) provides an introduction to problem solving with computers using python language. Topics covered will include: Basic python programming: variables, expression and statements, Functions, conditional and recursions, iterations, strings, lists/NumPy and dictionaries. Other topics: Introduction to object oriented programming, classes and objects in python, polymorphisms, introduction to different libraries in python. Applications: Sample problems in engineering, data pre- processing, and plotting tools.
4	**Texts/References**	1.Python Programming: An Introduction to Computer Science, 3rd edition by John M. Zelle, Franklin, Beedle and Associates. 2.Think Python: How to Think Like a Computer Scientist, 2nd edition, by Allen B. Downey, O'Reilly, 2015.

1	**Title of the course** (L-T-P-C)	**Introduction to Fine Arts: Urban Dance in India: A Brief & Partial Introduction in Theory & Practice**
2	**Pre-requisite courses(s)**	--
3	**Course content**	Body and Movement, Classical Dance in India, Contemporaneity: Modern & Postmodern Forms & Modes of Sustenance for a Dancer, Experimenting, Making Your Own Dance Work (Dance-pieces)
4	**Texts/References**	--

1	**Title of the course** (L-T-P-C)	**Design thinking and Creativity** **(1-0-0-0)**
2	**Pre-requisite courses(s)**	Nil
3	**Course content**	1.Problem Exploration- Students move around and find problems that need solutions. 2.They analyse the problem (not solution) and evolve a problem space. The problem space is converted into a story boar and presented in a poster session. 3.Feedback at the poster session is used to refine the problem definition(s). 4.Solution Exploration: Creative solutions (solution space) are now explored and presented using story boards. 5.The solutions are converted into "embodiments"
4	**Texts/References**	1."Stuff Matters" Prof. Mark Miodownik, Penguin 2. "Design and Technology" by James Garratt, Cambridge University Press. 3. How it works in the home: Walt Disney :9780894340482- Amazon.com. 4.How it works in the City (Walt Disney available on Amazon.com) 5.Change by design – Tim Brown There are some additional books in this "How it Works" series.

Semester II						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	MA 102	Linear Algebra (1st Half)	3	1	0	4
2	MA 103	Differential Equations - I (2nd Half)	3	1	0	4
3	ME 111	Engineering Graphics Laboratory	1	0	3	5
4	EE 101	Introduction to Electrical Systems and Electronics	3	0	0	6
5	CS 106	Data Structures and Algorithms	3	0	0	6
6	CS 111	Data Structures and Algorithms Laboratory	0	0	3	3
7	ME 113	Hands on Engineering Laboratory	0	0	3	3
8	PH 102	Electricity and magnetism	2	1	0	6
9	NO 102/ NO 104	National Sports Organization (NSO)/National Service Scheme (NSS)				PP/NP
		Total Credits				**37**

1	**Title of the course** (L-T-P-C)	**Linear Algebra** **(3-1-0-4)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	Vectors in R^n, notion of linear independence and dependence, linear span of a set of vectors, vector subspaces of R^n, basis of a vector subspace. Systems of linear equations, matrices and Gauss elimination, row space, null space, and column space, rank of a matrix. Determinants and rank of a matrix in terms of determinants. Abstract vector spaces, linear transformations, matrix of a linear transformation, change of basis and similarity, rank-nullity theorem. Inner product spaces, Gram-Schmidt process, orthonormal bases, projections and least squares approximation. Eigenvalues and eigenvectors, characteristic polynomials, eigenvalues of special matrices (orthogonal, unitary, hermitian, symmetric, skew-symmetric, normal). Algebraic and geometric multiplicity, diagonalization by similarity transformations, spectral theorem for real symmetric matrices, application to quadratic forms.
4	**Texts/References**	1. H. Anton, Elementary linear algebra with applications (8th Edition), John Wiley (1995). 2. G. Strang, Linear algebra and its applications (4th Edition), Thomson (2006) 3. S. Kumaresan, Linear algebra - A Geometric approach, Prentice Hall of India (2000) 4. E. Kreyszig, Advanced engineering mathematics (10th Edition), John Wiley (1999)

1	**Title of the course** (L-T-P-C)	**Differential Equations -I** **(3-1-0-4)**
2	**Pre-requisite courses(s)**	Nil
3	**Course content**	Exact equations, integrating factors and Bernoulli equations. Orthogonal trajectories. Lipschitz condition, Picard's theorem, examples on non-uniqueness. Linear differential equations generalities. Linear dependence and Wronskians. Dimensionality of space of solutions, Abel-Liouville formula. Linear ODE's with constant coefficients, the characteristic equations. Cauchy-Euler equations. Method of undetermined coefficients. Method of variation of parameters. Laplace transform generalities. Shifting theorems. Convolution theorem.
4	**Texts/References**	1. E. Kreyszig, Advanced engineering mathematics (10th Edition), John Wiley (1999) 2. W. E. Boyce and R. DiPrima, Elementary Differential Equations (8th Edition), John Wiley (2005)

1	**Title of the course** (L-T-P-C)	**Engineering Graphics Lab** **(1-0-3-5)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	Engineering Graphics with mini-drafter: Around half a semester and bit more with following topics to be covered. • Introduction to Engineering Graphics • Curves • Projections of Points • Projection of Lines • Projection of Planes • Projections on Auxiliary Planes • Projections of Solids • Sections of Solids • Intersections of Solids Engineering Graphics with 2D Drafting Software: 5 weekly computer laboratory sessions covering above using AutoCAD® as a drafting software, 5th session on Isometric Projections.
4	**Texts/References**	1. N. D. Bhatt, revised and enlarged by V. M. Panchal and P. R. Ingle, Engineering Drawing, 53rd Edition, 2014, Charotar Publishers, Anand. 2. Warren J. Luzadder and Jon M. Duff, Fundamentals of Engineering Drawing, Prentice-Hall of India. 3. Gopalakrishna K. R., Engineering Drawing Vol. I & II Combined., Subhas Stores, 25th Edition, 2017. 4. Narayana. K. L., and Kannaiah, P. E., Text Book on Engineering Drawing, 2nd Edition, 2013, Scitech Publications, Chennai. 5. Venugopal K. and Prabhu Raja V., Engineering Drawing + AutoCAD, New Age International Publishers, 5th Edition, 2011.

1	**Title of the course** (L-T-P-C)	**Introduction to Electrical Systems and Electronics** **(3-0-1-7)**
2	**Pre-requisite courses(s)**	Exposure to Calculus
3	**Course content**	**From Physics to Electrical Engineering** (a) Lumped matter discipline (b) Batteries, resistors, current sources and basic laws (c) I-V characteristics and modeling physical systems **Basic Circuit Analysis Methods** (a) KCL and KVL, voltage and current dividers (b) Parallel and serial resistive circuits (c) More complicated circuits (d) Dependent sources, and the node method (e) Superposition principle (f) Thevenin and Norton method of solving linear circuits (g) Circuits involving diode. **Analysis of Non-linear Circuits** (a) Toy example of non-linear circuit and its analysis (b) Incremental analysis (c) Introduction to MOSFET Amplifiers (d) Large and small signal analysis of MOSFETs (e) MOSFET as a switch **Introduction to the Digital World** (a) Voltage level and static discipline (b) Boolean logic and combinational gates (c) MOSFET devices and the S Model (d) MOSFET as a switch; revisited (e) The SR model of MOSFETs (f) Non-linearities: A snapshot **Capacitors and Inductors** (a) Behavior of capacitors, inductors and its linearity (b) Basic RC and RLC circuits (c) Modeling MOSFET anomalies using capacitors (d) RLC circuit and its analysis (e) Sinusoidal steady state analysis (f) Introduction to passive filters **Operational Amplifier Abstraction** (a) Introduction to Operational Amplifier (b) Analysis of Operational amplifier circuits (c) Op-Amp as active filters (d) Introduction to active filter design **Transformers and Motors** (a) AC Power circuit analysis (b) Polyphase circuits (c) Introduction to transformers (d) Introduction to motors
4	**Texts/References**	1. Anant Agarwal and Jefferey H. Lang, “Foundations of Analog and Digital Electronics Circuits,” Morgan Kaufmann publishers, 2005 2. Wlilliam H. Hayt, Jr., Jack E. Kemmerly and Steven M. Durbin, “Engineering Circuit Analysis,” Tata McGraw-Hill 3. Theodore Wildi, “Electrical Machines, Drives and Power Systems,” Pearson, 6-th edition. 4. V. Del. Toro, “Electrical Engineering Fundamentals,” Pearson publications, 2nd edition.

1	**Title of the course** (L-T-P-C)	**Data Structures and Algorithms** **(3-0-0-6)**
2	**Pre-requisite courses(s)**	Exposure to Computer Programming
3	**Course content**	Introduction: data structures, abstract data types,analysis of algorithms. Creation and manipulation of data structures: arrays,lists, stacks, queues, trees, heaps, hash tables, balanced trees,tries, graphs. Algorithms for sorting and searching, order statistics, depth-first and breadth-first search, shortest paths and minimum spanning tree.
4	**Texts/References**	1. Introduction to Algorithms, 3rd edition, by T. Cormen, C. Leiserson, R. Rivest, C. Stein, MIT Pressand McGraw-Hill, 2009. 2. Data structures and algorithms in C++, by Michael T. Goodrich, Roberto Tamassia, and David M. Mount,Wiley, 2004.

1	**Title of the course** (L-T-P-C)	**Data Structures and Algorithms Laboratory** **(0-0-3-3)**
2	**Pre-requisite courses(s)**	Exposure to Computer Programming (CS 102)
3	**Course content**	Laboratory course for CS 211 is based on creatingand manipulating various data structures and implementation of algorithms.
4	**Texts/References**	1. Introduction to Algorithms, 3rd edition, by T. Cormen, C. Leiserson, R. Rivest, C. Stein, MIT Press and McGraw-Hill, 2009. 2. Data structures and algorithms in C++, by Michael T.Goodrich, Roberto Tamassia, and David M. Mount, Wiley, 2004.

1	**Title of the course** (L-T-P-C)	**Electricity and Magnetism** **(2-1-0-6)**
2	**Pre-requisite courses(s)**	Nil
3	**Course content**	Review of vector calculus: Spherical polar and cylindrical coordinates; gradient, divergence and curl; Divergence and Stokes` theorems; Divergence and curl of electric field, Electric potential, properties of conductors; Poisson's and Laplace's equations, uniqueness theorems, boundary value problems, separation of variables, method of images, multipoles; Polarization and bound charges, Gauss` law in the presence of dielectrics, Electric displacement D and boundary conditions, linear dielectrics; Divergence and curl of magnetic field, Vector potential and its applications; Magnetization, bound currents, Ampere`s law in magnetic materials, Magnetic field H, boundary conditions, classification of magnetic materials; Faraday's law in integral and differential forms, Motional emf, Energy in magnetic fields, Displacement current, Maxwell's equations, Electromagnetic (EM) waves in vacuum and media, Energy and momentum of EM waves, Poynting`s theorem; Reflection and transmission of EM waves across linear media.
4	**Texts/References**	(1) Introduction to Electrodynamics (4th ed.), David J. Griffiths, Prentice Hall, 2015. (2) Classical Electromagnetism, J. Franklin, Pearson Education, 2005.

Semester III						
S.No	Course Code	Course Name	L	T	P	C
1	PH 201	Electrodynamics	2	1	0	6
2	EE 221	Introduction to Probability (1st Half)	3	0	0	3
3	EE 229	Electronic Devices (1st Half)	3	0	0	3
4	EE 202	Introduction to Analog Circuits (2nd Half)	3	0	0	3
5	EE 210	Signals and Systems	2	1	0	6
6	ME 201	Engineering Mechanics	2	1	0	6
7	ME 207	Thermodynamics	2	1	0	6
8	PH 211	Introductory Physics Laboratory	0	0	3	3
		Total Credits				**36**

1	**Title of the course** (L-T-P-C)	**Electrodynamics** **(2-1-0-6)**
2	**Pre-requisite courses(s)**	Successful completion of PH102
3	**Course content**	Review of electrostatics and magnetostatics. Electrodynamics: Differential and integral forms of Maxwell's equations, Scalar and vector potentials, gauge transformations, Coulomb and Lorentz Gauge; Maxwell's equations in terms of potentials. Energy and momentum in electrodynamics. Electromagnetic waves: Electromagnetic waves in non-conducting media: Monochromatic plane waves in vacuum, propagation through linear media; Boundary conditions; Reflection and transmission at interfaces. Fresnel's laws; Electromagnetic waves in conductors: Modified wave equation, monochromatic plane waves in conducting media, Dispersion: Dispersion in non-conductors, free electrons in conductors and plasmas. Guided waves. Retarded potentials, Electric dipole radiation, magnetic dipole radiation. Radiation from a point charge: Lienard-Wiechart potentials, fields of a point charge in motion, power radiated by a point charge. Electrodynamics and Relativity: Review of special theory of relativity, Lorentz transformations, Minkowski four vectors, energy-momentum four vector, covariant formulation of mechanics; Transformation of electric and magnetic fields under Lorentz transformations, field tensor, invariants of electromagnetic field, Covariant formulation of electrodynamics, Lorentz force on a relativistic charged particle. Waveguides, Resonant Cavities and Optical Fibers, Basics of Antennas.
4	**Texts/References**	(1) D. J. Griffith: Introduction to Electrodynamics, 4th edition, Pearson, 2015. (2) J.D. Jackson: Classical Electrodynamics, Wiley student edition, 3rd edition, 2007. (3) Modern Electrodynamics, Andrew Zangwill, Cambridge University Press, 2012. (4) Foundations of Electromagnetic Theory, J. R. Reitz, F. J. Milford, and R. W. Christy, Addison-Wesley, 4th edition, 2008. (5) W K H Panofsky and M Philips: Classical Electricity and Magnetism Addison Wesley, 2nd edition, 1962. (6) W Greiner: Classical Electrodynamics, Springer, 1998. (7) Hayt, William H., Jr., and John A. Buck, "Engineering Electromagnetics", 7th ed. McGraw-Hill, 2006. (8) M.A. Heald and J.B. Marion, Classical Electromagnetic Radiation, Saunders, 1983.

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**	**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 *Borel-Cantell* Lemma. **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. **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. **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. **A short introduction to Random Process:** Example and formal definition, stationarity, autocorrelation, and cross correlation function, definition of ergodicity.
4	**Texts/References**	**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. Tsitisklis, “Introduction to Probability” MIT Lecture notes, 2000 (*link*: https://www.vfu.bg/en/e-Learning/Math--Bertsekas_Tsitsiklis_Introduction_to_probability.pdf)

1	**Title of the course** (L-T-P-C)	**Electronic Devices** **(3-0-0-3)**
2	**Pre-requisite courses(s)**	EE 102
3	**Course content**	• Introduction of Semiconductor Equations: Fermi-Dirac Distribution, Boltzmann's approximation • Semiconductor Diodes: Barrier formation in metal- semiconductor junctions, PN homo- and hetero- junctions; CV characteristics and dopant profiling; IV characteristics; Small signal models of diodes; Some Applications of diodes. • Field Effect Devices: JFET/HFET, MIS structures and MOSFET operation; JFET characteristics and small signal models; MOS capacitor CV and concept of accumulation, depletion and inversion; MOSFET characteristics and small signal models. Bipolar transistors: IV characteristics and Elers-Moll model; small signal models; Charge storage and transient response
4	**Texts/References**	1. D. A. Neamen, Semiconductor Physics and Devices, 4e Edition, McgrawHill, 13th reprint, 2016. 2. E.S. Yang, Microelectronic Devices, McGraw Hill, Singapore, 1988. 3. B.G. Streetman, Solid State Electronic Devices, 7th Edition, Pearson, 2016. 4. J. Millman and A. Grabel, Microelectronics, II edition 34th reprint McGraw Hill, International, 2017. 5. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, 1991. 6. R.T. Howe and C.G. Sodini, Microelectronics : An integrated Approach, Prentice Hall International, 1997.

1	**Title of the course** (L-T-P-C)	**Introduction to Analog Circuits** **(3-0-0-3)**
2	**Pre-requisite courses(s)**	Network theory, Electronic Devices
3	**Course content**	Part 1: Linear circuits • Introduction to feedback control – Integral control and proportional control • Linear circuits using Op-amps (amplifiers, arithmetic circuits, filters and oscillators) Part 2: Need for Non-linearity for amplification Single stage amplifiers, frequency response, Current mirror circuits, Differential amplifier.
4	**Texts/References**	1) J.V.Wait, L.P.Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, 2nd edition, McGraw Hill, New York, 1992. 2) J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988. 3) Ramakant Gayakwad, Op-amps and Linear Integrated Circuit, 4th edition, Pearson, 2000. 4) P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989. 5) Behzad Razavi , “Fundamentals of Microelectronics,” John Wiley, 2013.

1	**Title of the course** (L-T-P-C)	**Signals and Systems** **(2-1-0-6)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	• 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**	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.

1	**Title of the course** (L-T-P-C)	**Engineering Mechanics** **(2-1-0-6)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	**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 **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; **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; **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; **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. 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 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. 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
4	**Texts/References**	**Textbooks:** 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. R. C. Hibbler, Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press, 2006.

		References: 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

1	**Title of the course** (L-T-P-C)	**Thermodynamics** **(2-1-0-6)**
2	**Pre-requisite courses(s)**	Nil
3	**Course content**	Thermodynamic Systems, properties & state, process &cycle **Heat & Work**: Definition of work and its identification, work done at the moving boundary, Zeroth law, **Properties of pure substance**: Phase equilibrium, independent properties, and equations of state, compressibility factor, Tables of thermodynamic properties & their use, Mollier Diagram **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. **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. **Irreversibility and availability**: Available energy, reversible work & irreversibility for control mass and control volume processes; second law efficiency. **Thermodynamic relations**: Clapeyron equation, Maxwell relations, Thermodynamic relation for enthalpy, internal energy, and entropy, expansively and compressibility factor, equation of state, generalizedchart for enthalpy. **Thermodynamic Cycles**: Otto, Diesel, Duel and Joule Third Law of Thermodynamics
4	**Texts/References**	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 Cengal, M A Boles, Thermodynamics: An Engineering Approach, Tata McGraw Hill, 2003. 5. Michael J. & H.N. Shapiro, Fundaments of Engineering Thermodynamics, John Wiley, 2004.

Semester IV						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	PH 202	Classical Mechanics	2	1	0	6
2	PH 203	Quantum Mechanics - I	2	1	0	6
3	EE 224	Digital Systems	2	1	0	6
4	PH 211	General Physics Laboratory	0	0	3	3
5	EE 214	Digital Circuits Laboratory	0	0	3	3
6	EE 212	Devices and Circuits Laboratory	0	0	3	3
		Total Credits				**27**

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 MA101
3	**Course content**	Review of Wave mechanics, Schrodinger equation, Uncertainty principle, wave packets, group velocity and phase velocity. Postulates of quantum mechanics, probability and probability current density, operators, eigenvalues and eigenfunctions. Bound states, delta-function potential, and harmonic oscillator. Formalism: Hilbert space, Observables, Eigenfunctions of Hermitian operator, Dirac's notation, matrix representations of vectors and operators, parity operation, matrix theory of harmonic oscillator. Theory of Angular Momentum: Spherical harmonics, eigenvalues of L^2 and L_z, addition of angular momentum, commutation relations, degeneracies. Hydrogen atom, quantum numbers, two particle systems.
4	**Texts/References**	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

1	**Title of the course** (L-T-P-C)	**Digital Systems** **(2-1-0-6)**
2	**Pre-requisite courses(s)**	None
3	**Course content**	• Introduction to Digital Systems • Number systems and Logic: Number Systems, Different Codes, Boolean logic, basic gates, truth tables • Introduction to Logic families: TTL, CMOS etc. • Boolean Algebra: Laws of Boolean Algebra, logic minimization using K maps • Combinational Logic Circuits: Adders, Subtractors, Multipliers, MSI components like Comparators, Decoders, Encoders, MUXs, DEMUXs • Sequential circuits: Latches, Flipflops, Analysis of clocked sequential circuits, Registers and Counters (Synchronous and Asynchronous), State Machines • Introduction to Hardware Description Languages • Array based logic elements: Memory, PLA, PLD, FPGA Special Topics: Asynchronous State machines, Testing and Verification of Digital Systems
4	**Texts/References**	1. J. F. Wakerly: Digital Design, Principles and Practices,4th Edition,Pearson Education, 2005 2. M. Moris Mano; Digital Design, 4th Edition, Pearson,2009 3. Ronald J. Tocci; Digital System, Principles and Applications, 10th Edition, Pearson, 2009 4. H.Taub and D. Schilling; Digital Integrated Electronics, McGraw Hill, 1977 Charles H Roth; Digital Systems Design using VHDL, Thomson Learning, 1998.

1	**Title of the course** (L-T-P-C)	**Digital Circuits Laboratory** **(0-0-3-3)**
2	**Pre-requisite courses(s)**	Digital Systems Theory (EE224)
3	**Course content**	This purpose of this lab is to complement the Digital Systems Theory Course. The following is the tentative list of experiments for this lab: Experiments with discrete ICs 1. Introduction of digital ICs 2. Realizing Boolean expressions 3. Adder/Subtractor 4. Shift registers 5. Synchronous Counters 6. Asynchronous Counters + 7- segment display 7. Finite State Machines (2 weeks) Experiments with CPLDs 1. Arithmetic and Logic Unit 2. LCD, Buzzer Interfacing Pipelining
4	**Texts/References**	1. M. Moris Mano; Digital Design, 5th Edition, Pearson, 2009 2. J.F.Wakerly: Digital Design, Principles and Practices,4th Edition,Pearson Education, 2005 Ronald J. Tocci; Digital System, Principles and Applications, 10th Edition, Pearson, 2009

1	**Title of the course** (L-T-P-C)	**Devices and circuits Lab** **(0-0-3-3)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	This lab will reinforce concepts thought in Electronic devices and analog circuits. It will have experiments on Device characterization and circuits design and characterization. The following is the tentative list of experiments for this lab: 1. LED and Photodiode characterization 2. BJT biasing and CE amplifier 3. Solar cell characterization 4. Diode Temperature characteristics 5. NMOS characterization and CS amplifier 6. MOS differential amplifier 7. basic opamp circuits 8. Active filters 9. Multivibrators 10. Audio amplifiers
4	**Texts/References**	. J.V.Wait, L.P.Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, 2nd edition, McGraw Hill, New York, 1992. . J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988. . Behzad Razavi, Fundamentals of microelectronics, Wiley Publications . A.S.Sedra and K.C. Smith,Microelectronic Circuits, Saunder's College Publishing, Edition IV, 2017. . Ramakant Gayakwad, Op-amps and Linear Integrated Circuit, 4th edition, Pearson, 2000.

Semester V						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	PH 304	Statistical Physics	2	1	0	6
2	PH 302	Quantum Mechanics - II	2	1	0	6
3	EE 321	Digital Signal Processing (1st Half)	3	0	0	3
4	EE 227	Data Analysis (2nd Half)	3	0	0	3
5	CS 301	Computer Architecture	3	0	0	6
6	ME 203	Fluid Mechanics	3	0	0	6
7	CS 311	Computer Architecture lab	0	0	3	3
8	EE 315	Digital Signal Processing Lab (2nd Half)	0	0	4	2
		Total Credits				**35**

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)	**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. 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**	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.

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 summarising 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)	**Computer Architecture** **(3-0-0-6)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	The Language of Bits, Assembly Language, LogicGates, Registers, and Memories, Processor Design, Principles of Pipelining, The Memory System, Multiprocessor Systems, I/O and Storage Devices. Each concept will be first taught on the basis of the fundamental driving principles. Following this, real world examples (e.g., ARM processors) will be used toemphasize the content.
4	**Texts/References**	6. Computer Organization and Architecture, by SmrutiRanjan Sarangi, McGraw Higher Ed, 2017. 7. Computer Architecture A Quantitative Approach,Sixth edition, by David Patterson and John L. Hennesy,Morgan Kaufmann, 2017.

1	**Title of the course** (L-T-P-C)	**Fluid Mechanics** **(3-0-0-6)**
2	**Pre-requisite courses(s)**	Nil
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)	**Computer Architecture Laboratory** **(0-0-3-3)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	The lab will closely follow the theory course. The idea isto have the students develop a software model of a simple processor, capturing both functionality and timing aspects. Theywill implement modules as the concepts aretaught in class.
4	**Texts/References**	Nil

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.

Semester VI						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	CE 301	Environmental Studies	3	0	0	6
2	PH 306	Condensed Matter Physics	2	1	0	6
3		HSS Elective – 1	2	1	0	6
4		Institute Elective – 1	2	1	0	6
5	PH 311	Advanced Physics Lab	0	0	3	3
6		Seminar – 1	0	0	3	3
7	ME 330	Mechanics and Measurement Laboratory	1	0	3	5
		Total Credits				**35**

1	**Title of the course** (L-T-P-C)	**Environmental studies** **(3-0-0-6)**
2	**Pre-requisite courses(s)**	Nil
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) Redclift, 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)	**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)	**Mechanics and Measurement Lab** **(1-0-3-5)**
2	**Pre-requisite courses(s)**	No
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 visualisation 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 orificemeter, venturimenter 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.

Semester VII						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	HS 201	Economics	3	0	0	6
2		HSS Elective - II	3	0	0	6
3		Seminar – 2	0	0	4	4
4		Institute Elective – 2	2	1	0	6
5		Institute Elective – 3	2	1	0	6
6		Institute Elective – 4 / Project – 1	2	1	0	6
		Total Credits				**34**

1	**Title of the course** (L-T-P-C)	**Economics** **(3-0-0-6)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	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. Theory of utility and consumer's choice. Theories of demand, supply and market equilibrium. Theories of firm, production and costs. Market structures. Perfect and imperfect competition, oligopoly, monopoly. An overview of macroeconomics, measurement and determination of national income. Consumption, savings, and investments. Commercial and central banking. 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.
4	**Texts/References**	. 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. 6. 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 Th (7 Edition), Pearson Prentice Hall, New Jersey, 2009. . 6. R. Dornbusch, S. Fischer, and R. Startz. Macroeconomics (9th Edition), McGraw-Hill Inc. New York, 2004.

Semester VIII						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1		Institute Elective – 5	2	1	0	6
2		Institute Elective – 6	2	1	0	6
3		Institute Elective – 7/ Project – 2	2	1	0	6
		Total Credits				**18**