SEMESTER - I (Common for all B.Tech Courses)						
S.No	**C. Code**	**Course**	**L**	**T**	**P**	**C**
1	MA 101	Calculus	3	1	0	8
2	PH 101	Quantum Physics and Applications	2	1	0	6
3	CH 102	Fundamental Concepts and Applications of Chemistry	3	0	0	6
4	BB 103	Introduction to Modern biology	3	0	0	6
5	PH 113	Hands on Science Laboratory - I	0	0	3	3
6	CS 101	Computer Programming	3	0	2	8
7	HS 103	Introduction to Fine Arts	0	0	1	PP/NP
8	HS 106	Design Thinking and Creativity	1	0	0	PP/NP
9	NO107/NO105	NSO/NSS	0	0	2	2
	First Semester Total Credits					39

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.

Name of Academic Unit: Mathematics

Level: B. Tech.

Programme: B.Tech.

i	**Title of the course**	MA 101 Calculus
ii	**Credit Structure (L-T-P-C)**	(3-1-0-8)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – specify course number(s)**	--
vii	**Course Content**	Review of limits, continuity, differentiability. Mean value theorem, Taylors Theorem, Maxima and Minima. Riemann integrals, Fundamental theorem of Calculus, Improper integrals, applications to area, volume. Convergence of sequences and series, power series. 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.
viii	**Texts/References**	1. B.V. Limaye and S. Ghorpade, A Course in Calculus and Real Analysis, Springer UTM (2004) 2. B.V. Limaye and S. Ghorpade, A Course in Multivariable Calculus and Analysis, Springer UTM (2010) 3. James Stewart, Calculus (5th Edition), Thomson (2003). 4. T. M. Apostol, Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern (1980). 5. Marsden and Tromba, Vector calculus (First Indian Edition), Springer (2012)

ix	**Name(s) of Instructor(s)**	BVL
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	This is a fundamental mathematics course which is essential for any branch of engineering

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

Name of Academic Unit: Computer Science and Engineering

Level: B. Tech.

Programme: B.Tech.

i	**Title of the course**	CS 101 Computer Programming
ii	**Credit Structure (L-T-P-C)**	(3-0-2-8)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Spring
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	Nil

vii	**Course Content**	This course provides an introduction to problem solving with computers using a modern language such as Java or C/C++. Topics covered will include: **Utilization**: Developer fundamentals such as editor, integrated programming environment, Unix shell, modules, libraries. **Programming features**: Machine representation, primitive types, arrays and records, objects, expressions, control statements, iteration, procedures, functions, and basic i/o. **Applications**: Sample problems in engineering, science, text processing, and numerical methods.
viii	**Texts/References**	1. An Introduction to Programming through C++, 1st edition, by Abhiram G. Ranade, McGraw Hill Education, 2014. 2. C++ Program Design: An introduction to Programming and Object-Oriented Design, 3rd Edition, by Cohoon and Davidson, Tata McGraw Hill, 2003. Other references 1. Thinking in C++ 2nd Edition, by Bruce Eckel (available online). 2. How to Solve It by Computer, by G. Dromey, Prentice-Hall, Inc., Upper Saddle River, NJ, 1982. 3. How to Solve _It (2nd ed.), by Polya, G., Doubleday and co, 1957. 4. Let Us C, by Yashwant Kanetkar, Allied Publishers, 1998. 5. The Java Tutorial, Sun Microsystems, Addison- Wesley, 1999.
ix	**Name(s) of Instructor(s)**	--
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA
xi	**Is/Are there any course(s) in the same/**	No

	other academic unit(s) which is/ are equivalent to this course? If so, please give details.	
xiii	**Justification/ Need for introducing the course**	Basic course in problem solving using computers.

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	1	7
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)	0	0	2	2
		Total Credits				**39**

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 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)	**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 creating and 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	EE 221	Introduction to Probability (1st Half)	3	0	0	3
2	EE 227	Data Analysis (2nd 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 205	Network Theory	2	1	0	6
6	EE 210	Signals and Systems	2	1	0	6
7	MA 201	Complex Analysis (1st Half)	3	1	0	4
8	MA 203	Differential Equations II (2nd Half)	3	1	0	4
9	HS 201	Economics	3	0	0	6
		Total Credits				**38**

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)	**Data Analysis** **(3-0-0-3)**
2	**Pre-requisite courses(s)**	Introduction to Probability
3	**Course content**	The role of statistics. Graphical and numerical methods for describing and summarizing data. Sampling variability and sampling distributions, Estimation using a single sample, Hypothesis testing using a single sample, Comparing two populations or treatments, Simple linear regression and correlation, and Case studies.
4	**Texts/References**	Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists," Elsevier, New Delhi, 3rd edition (Indian), 1987. Papoulis and Pillai, "Probability, Random Variables and Stochastic processes," 4th Edition, Tata McGraw Hill, 1991. William Feller , "An Introduction to Probability Theory and Its Applications," Vol. 1, 3rd edition, John Wiley International, 1968.

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)	**Network Theory** **(2-1-0-6)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	**Graphs of networks:** current and voltage spaces of graphs and their representations: incidence, cutset and circuit matrices; Tellegen's Theorem. Formal study of methods of analysis such as nodal, modified nodal, cutset, loop analysis for linear networks. Multiport representation for networks with particular emphasis on 2-ports. Time domain analysis of R, L, M, C, controlled sources, networks using state space methods. Introduction to s-domain methods.
4	**Texts/References**	1. Jerome P. Levine, Omar Wing, Classical Circuit Theory, Springer, 2009. 2. S. Ghosh, Network Theory: Analysis and Synthesis, Prentice Hall of India, 2005. 3. N Balabanian and T.A. Bickart, Linear Network Theory: Analysis, Properties, Design and Synthesis, Matrix Publishers, Inc. 1981. 4. L.O. Chua, C.A. Desoer, E.S. Kuh, Linear and Nonlinear Circuits, McGraw - Hill International Edition 1987.

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)	**Complex Analysis** **(3-1-0-4)**
2	**Pre-requisite courses(s)**	Exposure to Calculus (MA 101)
3	**Course content**	Definition and properties of analytic functions. Cauchy- Riemann equations, harmonic functions. Power series and their properties. Elementary functions. Cauchy's theorem and its applications. Taylor series and Laurent expansions. Residues and the Cauchy residue formula. Evaluation of improper integrals. Conformal mappings. Inversion of Laplace transforms.
4	**Texts/References**	1. E. Kreyszig, Advanced engineering mathematics (10th Edition), John Wiley (1999) 2. R. V. Churchill and J. W. Brown, Complex variables and applications (7th Edition), McGraw-Hill (2003) 3. Theodore Gamelin, Complex Analysis – Springer Undergraduate texts in Mathematics (2003)

1	**Title of the course** (L-T-P-C)	**Differential Equations – II** **(3-1-0-4)**
2	**Pre-requisite courses(s)**	Exposure to Calculus (MA 101) , Differential Equation-I (MA 104)
3	**Course content**	Review of power series and series solutions of ODE's. Legendre's equation and Legendre polynomials. Regular and irregular singular points, method of Fresenius. Bessel's equation and Bessel's functions. Strum- Liouville problems. Fourier series. D'Alembert solution to the Wave equation. Classification of linear second order PDE in two variables. Laplace, Wave, and Heat equations using • separation of variables. Vibration of a circular membrane. Heat equation in the half space.
4	**Texts/References**	1. E. Kreyszig, Advanced engineering mathematics (10th Edition), John Wiley (1999) W. E. Boyce and R DiPrima, Elementary Differential Equations (8^{th} Edition), John Wiley (2005)

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. 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 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 IV						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	EE 206	Introduction to Electrical Machines (1st Half)	2	1	0	3
2	EE 209	Introduction to Power Electronics (2nd Half)	2	1	0	3
3	EE 208	Engineering Electromagnetics (1st Half)	3	0	0	3
4	EE 223	Introduction to Power Systems (2nd Half)	3	0	0	3
5	EE 232	Introduction to Communication Systems (1st Half)	3	0	0	3
6	EE 216	Communications Lab (2nd Half)	0	0	4	2
7	EE 204	Digital Systems	2	1	0	6
8	EE 214	Digital Circuits Lab	0	0	3	3
9	EE 226	Control Systems and Laboratory	2	0	2	6
10	EE 212	Devices and Circuits Lab	0	0	3	3
		Total Credits				**35**

1	**Title of the course** (L-T-P-C)	**Introduction to Electrical Machines** **(2-1-0-3)**
2	**Pre-requisite courses(s)**	Network Theory
3	**Course content**	Transformer: Magnetic Circuits, principle of transformer action, equivalent circuits, phasor diagram, efficiency, basics of three phase transformer. Synchronous Machines: induced emf and torque in a rotating coil, rotating magnetic field, construction of synchronous Machines, induced emf, phasor diagram, equivalent circuit, OCC-SCC, power angle characteristics, V-curve and inverted V curve. Other topics: introduction to Induction Motor, introduction to DC Machine, Application 1. of Electrical Machines and special electrical motors.
4	**Texts/References**	1. P. S. Bimbhra, "Electrical machinery," Khanna Publishers, 7th edition, 1977. **2.** M. G. Say, "The Performance and Design of Alternating Current Machines," CBS, 3rd edition, 2002. 3. Stephen Chapman, "Electric Machinery Fundamentals," McGraw Hill, 4th edition, 2017. 4. D.P. Kothari, I.J. Nagrath, "Electric Machines," McGraw Hill, 5th edition, 2017. 5. A Fitzgerald, Charles Kingsley, and Stephen Umans, "Electric Machinery," McGraw Hill, 6th edition, 2017.

1	**Title of the course** (L-T-P-C)	**Introduction to Power Electronics** **(2-1-0-3)**
2	**Pre-requisite courses(s)**	Electric circuits, Devices
3	**Course content**	Introduction to power semiconductor devices, drive circuits, Rectifiers - single and three phase; basics of inverters - single and three phase; PWM generation, DC/DC converters - Buck, Boost and Buck Boost. Basics of magnetic circuits
4	**Texts/References**	1. L. Umanand, ``Power Electronics – essentials and applications," Wiley 2009. 2. M. H. Rashid " Power Electronics," Pearson. 4th edition, 2017. 3. Cyril W Lander, "Power Electronics" The McGraw-Hill Companies, 3rd ed, 1993.

1	**Title of the course** (L-T-P-C)	**Engineering Electromagnetics** **(3-0-0-3)**
2	**Pre-requisite courses(s)**	Exposure to Basic calculus and first year physics course (PH102).
3	**Course content**	Overview of Static Electric and Magnetic Fields, Steady Electric Currents. Time Varying Electromagnetic Fields, Maxwell's Equations, Boundary Conditions. Plane Electromagnetic Waves, Propagation in Free Space and in Matter. Reflection and Refraction of Waves at Conducting and Dielectric Boundary. Transmission Lines: TEM waves, Transmission Line Equations, Wave Propagation along Finite Transmission Lines, Transients on Lines, The Smith Chart. Waveguides, Waves in Guided Media, Parallel Plate Waveguide, Rectangular Waveguide, Cavity Resonators. Basic Theory of Antennas and Radiation Characteristics, Elementary Types of Antennas.
4	**Texts/References**	1. D K Cheng, "Fundamentals of Electromagnetics", Addison Wesley, MA 1993. 2. R K Shevgaonkar, "Electromagnetic Waves", McGraw- Hill Education (India) Pvt Limited, 2005 3. Hayt, William H., Jr., and John A. Buck, "Engineering Electromagnetics", 7th ed. McGraw-Hill, 2006.

1	**Title of the course** (L-T-P-C)	**Introductions to Power Systems** **(3-0-0-3)**
2	**Pre-requisite courses(s)**	Network Theory, Introduction to Electrical Machines
3	**Course content**	Introduction: Evolution of Power Systems, Energy Sources Structure of Bulk Power Systems, Power generation concepts, ac and dc transmission concepts, Basic three phase system concepts Transmission lines: Models and performance of transmission lines and cables Insulators: different types, Electric field distribution and insulators Power Flow: modelling of generators, transformers, lines and loads, per Unit Systems, Bus admittance matrix, Gauss Seidel and Newton-Raphson load flow methods Introduction to next course: introduction to faults, power system protection, stability, operation, blackout
4	**Texts/References**	1. Grainger and Stevenson , "Power System Analysis," 1st edition, McGraw Hill, 2017. 2. Bergen and Vittal, "Power System Analysis," 2nd Edison, Pearson 2002. 3. O E. Elgerd,"Electrical Energy Systems Theory," 2nd edition, McGraw Hill, 2017. 4. Stagg and el-abiad, "Computer methods in Power System Analysis," MedTech, 2019. 5. Glover, Sarma and Overbye, "Power System Analysis 6. and design," CLIPL, 5th edition, 2012. 7. Hadi Saadat, "Power System Analysis," PSA Publishing LLC, 2011. 8. B. F. Wollenberg, "Power Generation, operation and control," 2nd edition, Wiley, 2006. Nagrath and Kothari, "Power System

1	**Title of the course** (L-T-P-C)	**Introduction to Communication Systems** **(3-0-0-3)**
2	**Pre-requisite courses(s)**	Exposure to probability, signals and systems
3	**Course content**	Motivation towards designing Analog and Digital Communication Systems Baseband and passband signals Analog modulation techniques – Amplitude Modulation and Angle Modulation Overview of digital modulation – Signal Constellations, Hypothesis Testing, ML and MAP detection rules, performance analysis of selected digital modulation schemes.
4	**Texts/References**	1. Upamanyu Madhow, ``Introduction to Communication Systems,'' Cambridge university press, 2008 edition. 2. Simon Haykin, "An Introduction to Analog and Digital Communication," Wiley India Pvt. Ltd., 2006. 3. B. P. Lathi and Zhi Ding, ``Modern Digital and Analog Communication Systems,'' Oxford higher education, 2017.

1	**Title of the course** (L-T-P-C)	**Communications Lab** **(0-0-4-2)**
2	**Pre-requisite courses(s)**	Introduction to Communication Systems
3	**Course content**	Practical experiments in-line with the content of "Introduction to Communication Systems" course covering transmission and reception mechanisms corresponding to analog and digital communication. • Introduction to the usage of software defined radios and MATLAB • Analog modulation and demodulation • Digital modulation and demodulation – BPSK and QPSK only
4	**Texts/References**	1) Upamanyu Madhow, ``Introduction to Communication Systems,'' Cambridge university press, 2008 edition. 2) Simon Haykin, "An Introduction to Analog and Digital Communication," Wiley India Pvt. Ltd., 2006. 3) B. P. Lathi and Zhi Ding, ``Modern Digital and Analog Communication Systems,'' Oxford higher education, 2017.

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)	**Control Systems and Laboratory** **(2-0-2-6)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	● **Basic concepts:** Notion of feedback, open- and closed-loop systems. ● **Modeling and representations of control systems:** Transfer function models of for suitable mechanical, electrical, thermal and pneumatic systems, Ordinary differential equations, Transfer functions, Block diagrams, Signal flow graphs, State-space representations. ● **Performance and stability:** Time-domain analysis, Second-order systems, Characteristic-equation and roots, Routh-Hurwitz criteria. ● **Basic modes of feedback control:** Proportional, Integral, Derivative. ● **Root locus** method of design. ● **Frequency-domain techniques:** Root-locus methods, Frequency responses, Bode-plots, Gain-margin and phase-margin, Nyquist plots. ● **Compensator design:** Proportional, PI and PID controllers, Lead-lag compensators. ● **State-space concepts:** Controllability, Observability, pole placement result, Minimal representations. Laboratory involves set of experiments following the theory component covered in the class
4	**Texts/References**	1. Norman Nise, Control System Engineering, Wiley, 6th Edition, 2011 2. K. Ogata, Modern Control Engineering, Pearson, 5th edition, 2010. 3. Gene franklin et. al., "Feedback Control of Dynamic Systems", 7th Edition, Pearson 4. B. Kuo, Automatic Control System, Wiley, 9th Edition, 2014

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	EE 325	Microprocessors and Microcontrollers	3	0	0	6
2	EE 321	Digital Signal Processing (1st Half)	3	0	0	3
3	EE 315	Digital Signal Processing Lab (2nd Half)	0	0	4	2
4	EE 319	Microprocessors and Microcontrollers Lab	0	0	3	3
5	EE 311	Electrical Machines and Power Electronics Lab	0	0	3	3
6		HSS Elective	3	0	0	6
7		Electives				12
		Total Credits				**35**

1	**Title of the course** (L-T-P-C)	**Microprocessors and Microcontrollers** **(3-0-0-6)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	Block diagram view of a general purpose processor; elements of hardware and software architectures; introduction to concepts of data and control paths, registers and memory organization. Instruction set basics and assembly language programming: instruction structure and addressing modes, instruction encoding, and study of 8085A instruction set, hardware architecture and interrupts. Introduction to microcontrollers. 8051 hardware and instruction set architecture, timers/counters, interrupts and serial interface (including multi-processor communication). Interfacing basics using examples of I/O devices: parallel port, serial ports, keypad, display, etc. Introductory discussion on processor performance evaluation and design using a RISC ISA (including concepts of pipelining, pipelining hazards, cache, virtual memory and parallelism).
4	**Texts/References**	• R.S. Ganorkar, Microprocessor Architecture, Programming, and Applications with the 8085, Penram International Publishing, Fifth Edition, 2011. • J.H. Hennessy, and D.A. Patterson, Computer Architecture: A Quantitative Approch, Morgan Kaufmann Publishers, Fourth Edition, 2006. • Kenneth J. Ayala, The 8051 Microcontroller, Architecture, Programming and Applications, Penram International Publishing, 1996.

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)	**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.

1	**Title of the course** (L-T-P-C)	**Microprocessors and microcontrollers lab** **(0-0-3-3)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	1. Software experiments using an 8085 Kit to learn its instruction set. Hardware experiments for the use of peripherals like 8251 (USART). Experiments using a development board to learn the instruction set and assembly programming for 8051 family of microcontrollers. Experiments to learn Port IO, control of on chip peripherals such as timers, interfacing with off chip peripherals such as LCD displays, Key boards, Stepper motors and ADC chips. Experiments for the use of other microcontrollers such as PIC using development boards.
4	**Texts/References**	• R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996. • Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.

1	**Title of the course** (L-T-P-C)	**Electrical Machines and Power Electronics Laboratory** **(0-0-3-3)**
2	**Pre-requisite courses(s)**	Nil
3	**Course content**	Experiments reinforcing concepts learnt in EE206
4	**Texts/References**	

Semester VI						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	CE 301	Environmental Studies	3	0	0	6
2	EE 314	Electronics Design Lab	1	0	4	6
3		**Elective Courses**				24
		Total Credits				**36**

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)	**Electronic Design Laboratory** **(1-0-4-6)**
2	**Pre-requisite courses(s)**	All the core courses of Electrical Engineering Department taught till 5th semester
3	**Course content**	This is project-based course in which students will do embedded systems project applying the concepts of core EE courses.
4	**Texts/References**	--

Semester VII & VIII
1. The student has to earn 36 credits in the fourth year.
2. Students may choose to earn zero, 6, or 12 credits through the BTP/co-op project.
3. The BTP/co-op may be split into two semesters (6 credits per semester).
4. The remaining credits should be earned through institute electives.

Total Credits	**254**