Syllabus of B. Tech. Electronics and Communication Engineering (Design and Manufacturing) + M. Tech. VLSI & Electronic System Design (EVD) for 1st and 2nd Semesters

(According to 22nd and 23rd Senate meeting minutes)

Course Title	Calculus	Course No *(will be assigned)*				
Specialization	Mathematics	Structure (LTPC)	3	0	0	3
Offered for	UG& DD	Status	Core ■		Elective ☐	
Faculty		Type	New ☐		Modification ☐	
Pre-requisite		To take effect from				
Submission date	21/07/2014	Date of approval by Senate				
Objectives	The course will introduce the student to basic concepts in Calculus such as convergence, differentiation & integration and its applications.					
Contents of the course	Limit and Continuity of functions defined on intervals, Intermediate Value Theorem, Differentiability, Rolle's Theorem, Mean Value Theorem, Taylor's Formula (5) Sequences and series (7) Definite integral as the limit of sum – Mean value theorem – Fundamental theorem of integral calculus and its applications (9) Functions of several variables – Limit and Continuity, Geometric representation of partial and total increments Partial derivatives – Derivatives of composite functions (8) Directional derivatives – Gradient, Lagrangemultipliers – Optimization problems (7) Multiple integrals – Evaluation of line and surface integrals (6)					
Textbook	1. Thomas. G.B, and Finney R.L, Calculus, Pearson Education, 2007.					
References	1. Piskunov. N, Differential and Integral Calculus, Vol. I & II, Mir. Publishers, 1981. 2. Kreyszig. E, Advanced Engineering Mathematics, Wiley Eastern 2007. 3. J Hass, M D Weir, F R Giordano, Thomas Calculus, 11th Edition, Pearson.					

Course Title	Differential Equations	Course No *(will be assigned)*				
Specialization	Mathematics	Structure (LTPC)	3	0	0	3
Offered for	UG & DD	Status	Core ▬		Elective	
Faculty		Type	New		Modification ▬	
Pre-requisite		To take effect from				
Submission date	21/07/2014	Date of approval by Senate				
Objectives	To provide an exposure to the theory of ODEs & PDEs and the solution techniques.					
Contents of the course	Linear ordinary differential equations with constant coefficients, method of variation of parameters – Linear systems of ordinary differential equations (10) Power series solution of ordinary differential equations and Singular points Bessel and Legendre differential equations; properties of Bessel functions and Legendre Polynomials (12) Fourier series (6) Laplace transforms elementary properties of Laplace transforms, inversion by partial fractions, convolution theorem and its applications to ordinary differential equations (6) Introduction to partial differential equations, wave equation, heat equation, diffusion equation (8)					
Textbooks	1. Simmons. G.F, Differential Equations, Tata McGraw Hill, 2003. 2. Kreyszig. E, Advanced Engineering Mathematics, Wiley, 2007.					
References	1. William. E. Boyce and R. C. Diprima, Elementary Differential Equations and Boundary Value Problems, John Wiley, 8 Edn, 2004. 2. Sneddon. I, Elements of Partial Differential Equations, Tata McGraw Hill, 1972. 3. Ross. L.S, Differential Equations, Wiley, 2007. 4. Trench, W, Elementary Differential Equations, http://digitalcommons.trinity.edu/mono					

Course Title	Engineering Mechanics	Course No *(will be assigned)*				
Specialization	Physics	Structure (LTPC)	3	0	0	3
Offered for	UG & DD	Status	Core ■		Elective □	
Faculty		Type	New ■		Modification □	
Pre-requisite		To take effect from				
Submission date	March 2014	Date of approval by Senate				
Objectives	In this course, students will learn a basic knowledge of forces, moments on the components of a structure of engineering problems. They will also learn to analyze: forces and moments on a static rigid body, moments on/between multiple static rigid bodies and internal forces/moments in a static rigid body. This course will help the student to develop the ability visualize physical configurations in terms of real materials constraints which govern the behavior of machine and structures.					
Contents of the course	Equivalent force systems; free-body diagrams; degrees of freedom; equilibrium equations; analysis of determinate trusses and frames; properties of surfaces - friction; (10) Particle Dynamics: equations of motion; work-energy and impulse-momentum principles;. Generalized coordinates; Lagrangian mechanics. (12) Rigid body dynamics: plane kinematics and kinetics of rigid bodies including work-energy and impulse-momentum principles; single degree of freedom rigid body systems (10) Stresses and strains (including thermal starin); principal stresses and strains; generalized Hooke's Law; free vibration of single degree-of freedom systems. (10)					
Textbook	1. F. Beer. R. Johnston, Vector mechanics for engineers: statics and dynamics. Tata McGraw-Hill, 2010.					
References	1. Meriam. J. L and Kraige. L. G, Engineering Mechanics, Vol. I – Statics, Vol 2: Dynamics, 2007. 2. H. Goldstein , Classical Mechanics, Pearson Education, 2011. 3. Kittle. C, Mechanics – Berkley Physics Course, Vol. 1, Tata McGraw Hill, 2008.					

Course Title	Engineering Electromagnetics	Course No *(will be assigned)*				
Specialization	All Branches of UG	Structure (LTPC)	3	0	0	3
Offered for	UG	Status	Core ■		Elective □	
Faculty	Tapas Sil	Type	New ■		Modification □	
Pre-requisite	-----	To take effect from				
Submission date	21/07/2014	Date of approval by Senate				

Objectives

The objective of this course is to give an idea how the electromagnetic wave behaves. This also provides an understanding of theories of electrostatics, magnetism and electrodynamics with their applications. It will enhance the problem solving capacity of the student.

Contents of the course

Vectors - an introduction; Unit vectors in spherical and cylindrical polar co-ordinates; Concept of vector fields; Gradient of a scalar field; flux, divergence of a vector, Gauss's theorem, Continuity equation; Curl –rotational and irrotational vector fields, Stoke's theorem. (12)

Electrostatics:
Electrostatic potential and field due to discrete and continuous charge distributions, boundary condition, Energy for a charge distribution, Conductors and capacitors, Laplaces equation Image problem , Dielectric polarization, electric displacement vector, dielectric susceptibility , energy in dielectric systems. (10)

Magnetostatics:
Lorentz Force law Biot-Savart's law and Ampere's law in magnetostatics, Divergence and curl of B, Magnetic induction due to configurations of current-carrying conductors, Magnetization and bound currents, Energy density in a magnetic field Magnetic permeability and susceptibility. (10)

Electrodynamics:
Electromotive force, Time-varying fields, Faradays' law of electromagnetic induction,
Self and mutual inductance, displacement current, Maxwell's equations in free space. Boundary condition, propagation in linear medium. Plane electromagnetic waves—reflection and refraction, electromagnetic energy density, Poynting vector. (10)

Textbook

1. W. H. Hayt and J. A. Buck, Engineering Electromagnetics, Tata McFraw Hill Education Pvt. Ltd, 2006.

References

1. Grifiths. D. J, Introduction to Electrodynamics, Prentice Hall, 2007.
2. Purcell. E.M, Electricity and Magnetism Berkley Physics Course, V2, Tata McGraw Hill, 20 08.
3. Feynman. R.P, Leighton. R.B, Sands. M, The Feynman Lectures on Physics, Narosa Publish ing House, Vol. II, 2008. Hill, 2008.
4. G. B. Arfken, H. J. Weber and F. E. Harris, Mathematical Methods for Physicists, Academic Press, 2013.

Course Title	Computational Engineering	Course No *(will be assigned)*				
Specialization	Computer Engineering	Structure (LTPC)	3	0	0	3
Offered for	UG & DD	Status	Core ■		Elective ☐	
Faculty		Type	New ☐		Modification ■	
Pre-requisite		To take effect from				
Submission date	March 2014	Date of approval by Senate				
Objective	The course introduces students to computer systems and organization and a higher level language (C) to communicate with the system. The student would be equipped with basic skillset required to interact with the system / create applications supporting a command line interface.					
Contents of the course	Introduction to computers & breadth scope in engineering – Computer organization basics – Problem solving strategies – Higher level languages – Program design and development – Phases of program development - Basic programming constructs in C – Data types in C – Input output statements – Operators, control structures in C - Sequential, Selection, Repetition (12) Functions in C –Function declaration, definition – Built and user defined functions –Storage classes and scope –Recursive functions – Arrays in C – multidimensional arrays-String manipulations – Library support (14) Introduction to pointers – References – Pointer Arithmetic – Formatted input output – User defined data types – File processing in C - Sequential & Random - Dynamic Memory Allocation – Command Line Arguments – Usable CLI based applications - Non linear equations– Bisection, Newton raphson methods. (16)					
Textbook	1. Deitel P J and Deitel H M, C : How To Program, Prentice Hall, 7th Edn, 2012.					
References	1. Kernighan, Ritchie D, The C Programming Language, Prentice Hall, 2 Edn. 2. Chapra S.C and Canale R.P, Numerical Methods for Engineers, McGraw Hill, 2006.					

Course Title	Basic Electrical and Electronics Engineering	Course No *(will be assigned)*					
Specialization		Structure (LTPC)	3	0	0	3	
Offered for	UG/DD	Status	Core ■		Elective □		
Faculty		Type	New ■		Modification □		
Pre-requisite		To take effect from					
Submission date	21/07/2014	Date of approval by Senate					
Objectives	Learn how to develop and employ circuit models for elementary electronic components and circuit analysis, network theorems, role of power flow and energy storage in electronic circuits;step and sinusoidal-steady-state response, AC signal powers, three phase circuits and loads, and brief introduction to diodes and BJTs.						
Contents of the course	Electrical circuit elements: voltage and current sources, R,C,L,M,I,V, linear, non linear, active and passive elements, inductor current and capacitor voltage continuity, Kirchhoff's laws, Elements in series and parallel, superposition in linear circuits, controlled sources, energy and power in elements, energy in mutual inductor and constraint on mutual inductance (7) Network analysis: Nodal analysis with independent and dependent sources, modified nodal analysis, mesh analysis, notion of network graphs, nodes, trees, twigs, links, co-tree, independent sets of branch currents and voltages (6) Network theorems: voltage shift theorem, zero current theorem, Tellegen's theorem, reciprocity, substitution theorem, Thevenin's and Norton's theorems, pushing a voltage source through a node, splitting a current source, compensation theorem, maximum power transfer (8) RC and RL circuits: natural, step and sinusoidal steady state responses, series and parallel RLC circuits, natural, step and sinusoidal steady state responses (5) AC signal measures: complex, apparent, active and reactive power, power factor (2) Introduction to three phase supply: three phase circuits, star-delta transformations, balanced and unbalanced three phase load, power measurement, two wattmeter method (5) Semiconductor diodes and application: PN diodes, rectifiers and filters, clipping and clamping circuits, voltage multiplier circuits (5) Bipolar Junction Transistors: DC characteristics, CE, CB, CC configurations, biasing, load line (4)						
Textbook	1. Hayt. W. W, Kemmerly. J.E, and Durbin. S.M, Engineering Circuits Analysis, Tata McGraw Hill, 2008. 2. Boylestad R. &Nashelsky L., Electronic Devices & Circuit Theory, Pearson Education, 2009						
References	1. Hughes Edward, Electrical & Electronic Technology, Pearson Education, 2007. 2. Hambley. A, Electrical Engineering Principles and Applications: International Version, Pearson Education, 4 Edn, 2007. 3. Alexander.C. K. & Mathew. N. O. Sadiku, Fundamentals of Electrical circuits, Tata McGraw Hill, 2008.						

Course Title	Science and Engineering of Materials	Course No *(will be assigned)*				
Specialization		Structure (LTPC)	3	0	0	3
Offered for	UG & DD	Status	Core ■		Elective □	
Faculty		Type	New ■		Modification □	
Pre-requisite		To take effect from				
Submission date	March 2014	Date of approval by Senate				
Objectives	The objective of this course is to provide a basic conceptual understanding of crystal structure and its relevance in classification of different materials based on their properties. The engineering of structure of different materials and development of natural and man-made materials with their applications would also be discussed.					
Contents of the course	Crystal structure, defects, crystallographic planes, directions, slip, deformation mechanical behaviour, and strengthening mechanisms. (10) Electrical, electronic, magnetic properties of materials, property management and case studies alloys, steel, aluminum alloys. (6) Polymeric structures, polymerization, structure property relationships, processing property relationships,. (6) Natural and manmade composites, processing, properties, applications (6) Ceramics, manufacturing and properties, applications (4) Environmental degradation of engineering materials (4) Introduction to Nano, Bio, Smart and Functional materials. (4)					
Textbook	1. Callister's Materials Science and Engineering, 2nd ED, Adapted by R Balasubramaniam, 2010, ISBN-13: 978-8126521432, Wiley India Ltd. 2. V Raghavan, "Materials Science and Engineering: A First Course, 5th Ed, 2004, PHI India					
References	1. Donald R. Askeland K Balani, "The Science and Engineering of Materials," 2012, Cengage Learning					

Course Title	Concepts in Engineering Design	Course No *(will be assigned)*				
Specialization	Design	Structure (LTPC)	3	0	0	3
Offered for	UG & DD	Status	Core ■		Elective □	
Faculty		Type	New □		Modification ■	
Pre-requisite		To take effect from				
Submission date	March 2014	Date of approval by Senate				
Objectives	The purpose of this course is to introduce to the undergraduate student the fundamental principles of Engineering Design which is very important and relevant in the context of todays engineering professionals. The course will be generic to all engineering disciplines and will not require specialized preparation or prerequisites in any of the individual engineering disciplines. Case studies from field situations and real products will be used to illustrate these principles.					
Contents of the course	Design Conceptualization and Philosophy, Original, Adaptive, Variant and Re-Design, Evolution of Concept, Need for Systematic design Past methods of and design Product life cycle, Innovation, Types of innovation Needs and opportunities, Vision and Mission of a concept, Type of needs, Technology S - curve, Need analysis, market analysis and competitive analysis, Kano Diagrams, SWOT analysis Conceptualization techniques – Idea generation – ideation, brainstorming, Trigger session Brain writing, Mind maps, SCAMPER, TRIZ, Biommicry, Shape mimicry, Familiarity Matrix Concepts screening, Concept testing - exploratory tests, Assessment tests , Validation tests Comparison tests – Case studies Organization of design concept and design methods, Engineering Design - Descriptive and prescriptive model, Design decisions and development of design Group work and case studies					
Textbook	1. Otto. K and Wood, K, Product Design, Pearson Education, 2001. 2. Pahl. G and Beitz. G, Engineering Design, Springer, 1996					
References	1. Ullman. D. G, The Mechanical Design Process, McGraw- Hill, 1997.					

Course Title	English for Communication	Course No *(will be assigned)*				
Specialization	Humanities	Structure (LTPC)	2	0	0	2
Offered for	UG and DD	Status	Core ■		Elective □	
Faculty		Type	New ■		Modification □	
Pre-requisite		To take effect from				
Submission date	March 2014	Date of approval by Senate				
Objectives	Read a given text at a reasonable speed - Comprehend and critically read the text - Understand and use lexis accurately and appropriately - Listen to various types of spoken discourses understand, analyse and apply the same Listen and comprehend lectures and speeches - Speak coherently and fluently on a given topic Speak with confidence and present point of view - Write fluently and coherently on a given topic - Write various types of tasks short and long - Use lexis appropriate to the task while writing - Use accurate grammatical structures while speaking and writing - Give Power Point presentations. Use idioms appropriately.					
Contents of the course	Listening – Listening comprehension. Listen to various types of spoken discourses understand, analyse and apply the same. Listen and comprehend lectures and speeches. (3) Speaking – Organization, articulation and correctness. Speak with confidence and present a point of view. Speak coherently and fluently on a given topic. (8) Reading – Comprehend and critically read the text. Read a given text at a reasonable speed (5) Writing – Memos, letters, reports, reviews and writing fluently and coherently on a given topic. Write various types of tasks; short and long. (7) Presentation Skills – Oral presentation using Power Point. Study Skills – Dictionary, thesaurus & reference Structure of English – Remedial grammar/ Grammar for Communication (5)					
Textbook	1. Shreesh Choudhry, Devaki Reddy , Technical English, Macmillan Publishers,2009.					
References	1. Martin Hewings , Advanced English Grammar, Cambridge University Press,2007. 2. V. Saraswathi, Leena Anil, Manjula Rajan , Grammar for Communication,2012. 3. Thomson and Martinet , Practical English Grammar, Oxford University Press, 1986. 4. 4. Leech, Geoffrey & Jan Svartvik, A Communicative Grammar of English, Longman,2003					

Course Title	Design History	Course No *(will be assigned)*				
Specialization	Design	Structure (LTPC)	2	0	0	2
Offered for	UG & DD	Status	Core ■		Elective □	
Faculty		Type	New □		Modification ■	
Pre-requisite		To take effect from				
Submission date	March 2014	Date of approval by Senate				
Objectives	This course will help students to (a) understand the evolution and application of the concept of Design in everyday life of people (b) appreciate its role in national and international economic and social systems, and (c) analyze the emerging designs from a societal perspective.					
Contents of the course	Definition of Design; Origin of designers; Historical context of design and designers. Designers and designed products: Art, design and technology - Select International and Indian designers. Industrial Revolution: Mass production, Birth of Modern architecture, International Style, The modern home. Craft and Design: Type forms; William Morris and Arts and Craft Movement; Shantiniketan. Design movements: Art Nuoveau; Art Deco, Werkbund; Bauhaus; De Stijl. Changing values: Information Revolution: Impact of technology, industrialization and globalization on design: kitsch, pastiche, 'retro'; Shopping malls. Design Studies: Materials and techniques; Chinese ceramics; Typology; Content analysis : Anthropology / sociology; Nationalist and global trends in Design; Nationalist Design; Global trends and global identity; Nostalgia, Heritage and Design;					
Textbook	1. Conway Hazel, Design History – A Students' Handbook, Routledge: London, 1987.					
References	1. Raizman David, History of Modern Design, Graphics and Products since the Industrial Revolution. Laurence King Publishing :London, 2003 2. Walker John. A, Design History and History of Design. Pluto Press: London, 2003. 3. Woodham Jonathan M, Twentieth Century Design, Oxford University Press: Oxford, 2003.					

Course Title	Earth, Environment & Design	Course No *(will be assigned)*				
Specialization	Interdisciplinary	Structure (LTPC)	2	0	0	2
Offered for	UG	Status	Core ■		Elective □	
Faculty		Type	New ■		Modification □	
Pre-requisite		To take effect from				
Submission date	March 2014	Date of approval by Senate				
Objectives	The course aims to provide an understanding of systems and processes in aquatic and terrestrial environments, and to explore changes in the atmosphere, lithosphere, hydrosphere, biosphere, and the evolution of organisms, since the origin of life on earth.					
Contents of the course	Introduction to environment and ecology – Ecosystems – Principles concepts, components and function Atmospheric, aquatic and terrestrial ecosystems – Biogeochemical cycles and limiting factor concepts –Impacts of natural and human activities on ecosystems Environmental policies, acts and standards – Sustainable development and environmental impact assessment – Institutional frame work and procedures for EIA Methods for impact identification-matrices – Networks and Check lists – Environmental settings, indices and indicators Prediction and assessment of the impacts on air, water, land, noise and biological environments – Assessment of impacts of the cultural, socioeconomic and ecosensitive environments Mitigation measures, economic evaluation – Public participation and design making –Preparation of Environmental statement					
Textbook	1. Rubin. E. S, Introduction to Engineering and the Environment, McGraw Hill, 2000. 2. Masters. G. M., Introduction to Environmental Engineering & Science, Prentice Hall,1997.					
References	1. Henry. J. G, and Heike, G. W, Environmental Science & Engineering, Prentice Hall International, 1996. 2. Dhameja. S. K, Environmental Engineering and Management, S. K. Kataria and Sons, 1999. 3. Shyam Divan and Armin Rosancranz, Environmental Law and Policy in India, Cases, Materials and Statutes, Oxford University Press, 2001.					

Course Title	Professional Ethics for Engineers	Course No *(will be assigned)*				
Specialization	Management	Structure (LTPC)	2	0	0	2
Offered for	UG & DD	Status	Core ■		Elective □	
Faculty		Type	New □		Modification ■	
Pre-requisite		To take effect from				
Submission date	March 2014	Date of approval by Senate				
Objectives	In this course, students will be aware on Human Values and Ethics in Professional life. They will understand social responsibility of a professional person especially of an engineer. They will learn the techniques and logical steps to solve ethical issues and dilemmas.					
Contents of the course	Professionalism and Ethics: Profession and occupation, Qualities of a professional practitioner, Variety of ethics and moral issues, moral dilemmas; Kohlberg's theory - Gilligan's theory of moral development - consensus and controversy. Values- concept of intrinsic good, instrumental good and universal good. Kant's theory of good action and formula for universal law of action. Codes of ethics for engineers: need and scope of a code of ethics; Ethics and Law (10) Understanding Ethical Problems: ethical theories – utilitarianism, cost-benefit analysis, Duty ethics - Right ethics and virtue ethics. Applications for various case studies. Ethical Problem Solving Techniques: issues-factual, conceptual and moral; Bribery and acceptance of gifts; Line drawing and flow charting methods for solving conflict problem. (09) Risk, Safety and Accidents: Safety and risk, types of risk, types of accidents and how to avoid accidents. Rights and Responsibilities of an Engineer: Professional responsibility, professional right and whistle blowing. Ethical Issues in Engineering Practice: environmental ethics, computer ethics, ethics and research. (09)					
Textbook	1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004					
References	1. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000. 2. Velasquez. M. G, Business Ethics and Cases, 5 Edn, Prentice Hall, 2002. 3. Sekha. R.C, Ethical Choices in Business Response, Sage Publication, 2002. 4. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw Hill, 1996.					

<table>
<tr><td>Course Title</td><td>Engineering Skills Practice</td><td>Course No
(will be assigned)</td><td colspan="4"></td></tr>
<tr><td>Specialization</td><td>Interdisciplinary</td><td>Structure (LTPC)</td><td>0</td><td>0</td><td>3</td><td>2</td></tr>
<tr><td>Offered for</td><td>UG & DD</td><td>Status</td><td colspan="2">Core ■</td><td colspan="2">Elective □</td></tr>
<tr><td>Faculty</td><td></td><td>Type</td><td colspan="2">New □</td><td colspan="2">Modification ■</td></tr>
<tr><td>Pre-requisite</td><td>----</td><td>To take effect from</td><td colspan="4"></td></tr>
<tr><td>Submission date</td><td>March 2014</td><td>Date of approval by Senate</td><td colspan="4"></td></tr>
<tr><td>Objectives</td><td colspan="6">The objective of this course is to give an exposure on the basic practices followed in the domain of mechanical, electrical, electronics and communication engineering. The exercises will train the students to acquire skills which are very essential for the engineers through hands-on sessions.</td></tr>
<tr><td>Contents of the course</td><td colspan="6">Experiments will be framed to train the students in following common engineering practices: Basic manufacturing processes: Fitting – Drilling & tapping – Material joining processes – PCB making – Assembling and testing – Electrical wiring.

Familiarization of electronic components by Nomenclature, meters, power supplies, function generators and Oscilloscope – Bread board assembling of simple circuits: IR transmitter and receiver – LED emergency lamp – Communication study: amplitude modulation and demodulation – PCB: designing and making of simple circuits – Soldering and testing of electronic components and circuits –Various types of Domestic wiring practice: Fluorescent lamp connection, Staircase wiring – Estimation and costing of domestic and industrial wiring – power consumption by Incandescent, CFL and LED lamps.</td></tr>
<tr><td>Textbook</td><td colspan="6">1. Uppal S. L., “Electrical Wiring & Estimating”, 5Edn, Khanna Publishers, 2003.
2. Chapman. W. A. J., Workshop Technology, Part 1 & 2, Taylor & Francis.</td></tr>
<tr><td>References</td><td colspan="6">1. Clyde F. Coombs, “Printed circuits hand book”, 6Edn, McGraw Hill, 2007.
2. John H. Watt, Terrell Croft, “American Electricians’ Handbook: A Reference Book for the Practical Electrical Man”, Tata McGraw Hill, 2002.</td></tr>
</table>

Course Title	Engineering Electromagnetics Practice	Course No *(will be assigned)*				
Specialization	All Branches of UG	Structure (LTPC)	0	0	3	2
Offered for	UG	Status	Core ■		Elective ☐	
Faculty	Tapas Sil	Type	New ■		Modification ☐	
Pre-requisite	---	To take effect from				
Submission date	21/07/2014	Date of approval by Senate				
Objectives	The objective of this course is to give an hand on experience how the electromagnetic wave behaves in different situations. The students will be able to relate the knowledge they have got in the theory class with their experience. This course will enhance their skill of handling instruments and the presentation of the results obtained from the experiments.					
Contents of the course	Electrical and magnetic properties of materials based on the concept of electrical polarization, magnetization of materials will be studied in various experiments. Experiments based on theconcept ofphenomena such as interference, diffraction etc. related to electromagnetic waves will be done here and these methods will be applied to measure some unknown physical quantities such as wavelength of a light, diameter of a very thin wire, very small aperture for light etc.					
Textbook	1. IIITD&M Laboratory manual for Electromagnetic Wave Practice					
References	1. W. H. Hayt and J. A. Buck, Engineering Electromagnetics, Tata McFraw Hill Education Pvt. Ltd, 2006.					

Course Title	Computational Engineering Practice	Course No *(will be assigned)*				
Specialization	Computer Engineering	Structure (LTPC)	0	0	3	2
Offered for	UG & DD	Status	Core ■		Elective □	
Faculty		Type	New □		Modification ■	
Pre-requisite		To take effect from				
Submission date	March 2014	Date of approval by Senate				
Objective	The practice course would supplement the concepts presented in COM 102 course with assignments on application use and creation using the various programming constructs supported in C language. Programming assignments employing the various constructs are used to address real life situations such as a telephone directory creation / search, student grading, etc. A demo session to highlight the usability aspect relating to software / application development shall also be included.					
Contents of the course *(With approximate break up of hours)*	Learning operating system commands - editors – compilation - Assignments on using the operating system and open office suite - Programs involving output statements, input statements and expression evaluation - Assignments covering If-then-else statement iterative statements - Programs using arrays and functions based approach – Recursion sorting (bubble Sort) on a set of integers and a set of strings and linear search over a set of integers and a set of strings - structures and files in C - Implementation of a grading system computation of e^x, sin(x) and cos(x) - Bisection and Newton Raphson methods in C.					
Textbook	1. Deitel P J and Deitel H M, C : How To Program, Prentice Hall, 7th Edn, 2012.					
References	1. Kernighan, Ritchie D, The C Programming Language, Prentice Hall, 2 Edn 2. Chapra S.C and Canale R.P, Numerical Methods for Engineers, McGraw Hill, 2006.					

Course Title	Measurements and Data Analysis Practice	Course No *(will be assigned)*				
Specialization	Interdisciplinary	Structure (LTPC)	0	0	3	2
Offered for	UG & DD	Status	Core ■		Elective □	
Faculty		Type	New ■		Modification □	
Pre-requisite		To take effect from				
Submission date	March 2014	Date of approval by Senate				
Objectives	To introduce the students to different measurements techniques/instruments of data acquisition and statistical methods of data analysis. At the end of the course, the student should be able to plan/design, conduct, analyze and report the results of an experiment.					
Contents of the course	Role of Experiments and measurements: Evaluation of different measurement techniques in measurement of various physical/chemical/mechanical/electrical/thermal/environmental parameters Reporting Methodology: Collection, consolidation and reporting of the data Probability and Statistics: Presentation, analysis and interpretation of the data Uncertainty/Error Analysis: Performance evaluation and determination Signal Characterization, data acquisition and Analysis: Study of vivid waveforms and digitization process					
Textbook	1. Patrick F. Dunn, "Measurement and Data Analysis for Engineering and Science", First Edition, McGraw-Hill Book Company, 2005					
References	1. Julius S. Bendat, Allan G. Piersol, "Random Data: Analysis and Measurement Procedures", 4th Edition, Wiley, 2010 2. Anthony J. Wheeler, Ahmad Reza Ganji, "Introduction to Engineering Experimentation" 3rd Edition, Prentice Hall, 2010					

Course Title	Materials and Mechanics Practice	Course No *(will be assigned)*				
Specialization	Physics	Structure (LTPC)	0	0	3	2
Offered for	UG & DD	Status	Core ☑		Elective ☐	
Faculty		Type	New ☑		Modification ☐	
Pre-requisite		To take effect from				
Submission date	March 2014	Date of approval by Senate				
Objectives	The objective of this course is to give an hand on experience with mechanical properties of an object. The students will be able to relate the knowledge they have got in the theory class with their experience. This course will enhance their skill of handling instruments and how to present the result.					
Contents of the course	Experiments here will give hand on experience of concepts of small oscillations, friction, elasticity and strength of material. Experiments will be done to measure various properties of different mechanical objects such as object such rigidity modulus, Young's modulus, radius of gyration etc. Study of material properties such as microstructure, hardness, response to tensile load and long-term constant loading etc. will also be done in various experiments.					
Textbook	1. IIITD&M Laboratory manual for Mechanics and Materials Practice					
References	1. F. Beer. R. Johnston, Vector mechanics for engineers: statics and dynamics. Tata McGraw-Hill, 2010. 2. Callister's Materials Science and Engineering, 2nd ED, Adapted by R Balasubramaniam, 2010,Wiley India Ltd.					

Course Title	Industrial Design Sketching	Course No *(will be assigned)*				
Specialization	Interdisciplinary	Structure (LTPC)	0	0	3	2
Offered for	UG & DD	Status	Core ■		Elective □	
Faculty		Type	New □		Modification ■	
Pre-requisite		To take effect from				
Submission date	March 2014	Date of approval by Senate				
Objectives	Develop necessary artistic skills required for the engineer to make communications with the industrial designers. Train the students to make realistic sketches of concept design using the commercial concept sketching software and hardware. This course will cover the concepts in perspective projections, shading, texturing, and concepts of light, shadow, reflection and colors.					
Contents of the course	• Role and importance of sketching in industrial design (2) • Principles of perspective drawing (8) • Perspective drawing of planar and curved shapes (12) • Shading and texturing (8) • Representation of shadow and reflections (8) • Colors in Industrial design and coloring (4) • Introduction to 3D forms and form development (4)					
Textbooks	1. Thomas C Wang, Pencil Sketching, John Wiley, 2002. 2. Itten Johannes, Design and Form, John Wiley, 1975.					
References	1. Kasprin Ron, Design Media – Techniques for Water Colour, Pen and Ink Pastel and colored markers, John Wiley,1999.					

Course Title	Engineering Graphics	Course No (will be assigned)				
Specialization	Interdisciplinary	Structure (LTPC)	1	0	3	3
Offered for	UG & DD	Status	Core ☑		Elective ☐	
Faculty		Type	New ☐		Modification ☑	
Pre-requisite		To take effect from				
Submission date	March 2014	Date of approval by AAC				
Objectives	To impart the basic engineering problem solving skills and to teach the fundamentals in technical drawing. Train the students to make orthographic projections and isometric projects of objects using drawing instruments and commercial drafting software.					
Contents of the course *(With approximate break up of hours)*	• Introduction to IS code of drawing (1hr) • Construction of basic shapes (4 hrs) • Dimensioning principles (1hr) • Conventional representations (1 hr) • Orthographic projection of points, lines, planes, right regular solids and objects (17 hrs) • Section of solids and objects (4 hrs) • Isometric projection of objects (6 hrs) • Intersection of solids (4 hrs) • Development of surfaces (4 hrs)					
Textbook	1. Narayana. K.L, and Kannaiah. P, Engineering Drawing, Charaotar Publ House, 1998. 2. Bhatt. N.D, Engineering Drawing, New Age International, 2007.					
References	1. Gopalakrishnan. K.R, Engineering Drawing, Subash Stores, 2002. 2. Natarajan. K.V, A text book of Engineering Drawing, Classic Prints, 2000.					

Course Title	Design Realization	Course No *(will be assigned)*				
Specialization	Design	Structure (LTPC)	0	0	3	2
Offered for	UG & DD	Status	Core ▬		Elective ☐	
Faculty		Type	New ▬		Modification ☐	
Pre-requisite		To take effect from	August 2014			
Submission date	March 2014	Date of approval by Senate				
Objectives	In Product Realization Lab, students practice conceptualization, making of simple product and realize them.					
Contents of the Course	The students are exposed to tools and equipments to machine external appearance of products of simple shapes. Wood carving, Plastic welding and cutting, engraving, sheet metal works, wire cutting are some of the process that the students will learn and use for product realization. The students will also be exposed high end machines to realize the product during demo sessions. Few sessions will be allocated to re-design an existing simple products in terms of shape, size functionality etc.					

Syllabus of B. Tech. Electronics and Communication Engineering (Design and Manufacturing) + M. Tech. VLSI & Electronic System Design (EVD) for 3rd and 4th Semesters

(According to 26th Senate meeting held on 30th June 2015)

Course Title	Linear Algebra	Course No	To be filled by the office		
Specialization	Mathematics	Structure (IPC)	3	0	3
Offered for	UG and DD	Status	Core ■	Elective ☐	
Course Objectives	To impart knowledge of basic concepts and applications of Linear Algebra				
Course Outcomes	At the end of the course, a student will be able to show that they get clear understanding of methods of Linear Algebra.				
Contents of the course *(With approximate break up of hours)*	**Linear System of Equations**: Gaussian Elimination—echelon forms—existence, uniqueness and multiplicity of solutions of linear equations. (6) **Vector Spaces**: Definition—linear dependence and independence—spanning sets, basis, and dimension—definition of a subspace—intersection and sum of subspaces—direct sums. (8) **Linear Transformations**: Definition—matrix representation of a linear transformation—change of basis—similarity transformation—invertible transformation—system of linear equations revisited—the four fundamental subspaces associated with a linear transformation. (10) **Inner Products**: Definition—induced norm—orthogonality—Gram-Schmidt orthogonalization process—orthogonal projections—unitary transformations and isometry. (8) **Eigen Decomposition**: Eigenvalues and eigenvectors—characteristic polynomials and eigen spaces—diagonalizability conditions—invariant subspaces—spectral theorem. (10)				
Textbook	1. G. Strang, "Linear Algebra and its Applications," Cengage Learning, 4th Edition, 2005. 2. D. C. Lay, "Linear Algebra and its Applications," Pearson Education, 4th edition, 2011.				
References	1. C. D. Meyer, "Matrix Analysis and Applied Linear Algebra," SIAM, 2000. 2. S. H. Friedberg, A. J. Insel, and L. E. Spence, "Linear Algebra," Pearson Education, 4th Edition, 2002.				

Course Title	Systems Thinking for Design	Course No	To be filled by the office		
Specialization	Design	Structure (IPC)	2	0	2
Offered for	UG and DD	Status	Core ■	Elective ☐	
Pre-requisite	Matrix Methods	To take effect from			
Course Objectives	Design for effectiveness – Level 1				
Course Outcomes	This course will help students understand • The importance of modeling systems to realize effective designs • Abstraction of key elements from problem situations • Use of specific techniques to model problems in a holistic manner				
Contents of the course	• Real-world problems & the need for inter-disciplinary approaches [2] • Basic concepts of systems thinking (parts, relations, patterns) [6] • Technique #1: Rich Pictures • Technique #2: Mapping Stakeholder, Needs, Alterables, Constraints [6] • Technique #3: Structural Modeling (Hierarchical decomposition) [6] • Technique #4: Influence Diagrams (Self-regulating systems) [6]				
Textbook	1. Hitchins, Derek K. (2007) Systems Engineering: A 21st Century Systems Methodology, John Wiley, ISBN: 978-0-470-05856-5. 2. Wilson, Brian (1991) Systems: Concepts, Methodologies and Applications. 2nd Edition, Wiley. ISBN: 0471927163. 3. Hutchinson, William; Systems Thinking and Associated Methodologies, Praxis Education. ISBN: 0 646 34145 6.				
References	1. Gerald Wienberg (2001), An introduction to general systems thinking, Dorset House Publishing. 2. Sage, A.P. (1977); Methodology for Large Scale Systems, McGraw Hill, New York.				

Course Title	Engineering Economics	Course No	To be filled by the office		
Specialization	Management	Structure (LTPC)	2	0	2
Offered for		Status	Core ■	Elective ☐	
Pre-requisite	Basic Mathematics	To take effect from			
Course Objectives	Help students learn basics of economics and cost analysis to make economically sound design decisions				
Course Outcomes	This course will help students understand: • the basics of micro-economics and cost analysis • Techniques to make economically sound decisions				
Contents of the course *(With approximate break up of hours)*	• Engineering Economic Decisions • Time is Money • Understanding Financial Statements • Cost Concepts and Behaviors • Understanding Money and Its Management • Principles of Investing • Present Worth Analysis • Annual Equivalent Worth Analysis • Rate of Return Analysis • Depreciation • Capital Budgeting Decisions				
Textbook	1. John A. White, Kellie S. Grasman, Kenneth E. Case, Kim LaScola Needy, David B. Pratt, "Fundamentals of Engineering Economic Analysis (First Edition)," Wiley 2014. 2. Chan S.Park, "Contemporary Engineering Economics," Prentice Hall of India, 2002.				
References	1. Blank Tarquin (2005). Engineering Economy. 6th Edition. McGraw-Hill.				

Course Title	Digital Logic Design	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	3	0	3
Offered for	B Tech. EDM, DD (ESD, EVD)	Status	Core ■	Elective □	
Course Objectives	The goal of this course is to provide a good understanding on the design and implementation of digital circuits and systems.				
Course Outcomes	The course would equip students to 1. Learn digital circuits 2. Design Combinational circuits 3. Design sequential circuits 4. Formulate logic and design circuits for practical problems				
Contents of the course	**Representation of Data (5):** Introduction, Data representations, Number systems, conversions and codes **Switching Theory (5):** Laws and theorems of Boolean algebra, Switching functions, truth table and algebraic form, realization using logic gates **Digital Logic and Implementation(6):** K-Maps, QM method, SOP, POS; NAND and NOR implementation, Digital Circuit Characterization **Combinational Circuit Design (8):** Design Procedure, Multiplexer, Decoder, Encoder, Comparator, Seven-segment display, Parity generator, Design of large circuits, **Asynchronous and Synchronous Sequential Circuit Design (10hrs);** Design of sequential modules – SR, D, T and J-K Flip-flops, applications, Clock generation, Counters, Registers, **Design using State machines (8)** Moore and Mealy machines, Design Examples				
Textbook	1. C. H. Roth, Jr., "Fundamentals of Logic Design," 7th Edition, Cengage Learning, 2013. 2. S. Brown and Z. Vranesic, "Fundamentals of Digital Logic with VHDL Design," TMH, 3rd Edition.				
References	1. J. F. Wakerly, "Digital Design- Principles and Practices," 3rd Edition, Pearson 2. M. M. Mano, "Digital Design," PHI. 3. T. L. Floyd and R. P. Jain, "Digital Fundamentals," 8th Edition, Pearson. 4. Taub and Schilling, "Digital Principles and Applications," TMH. 5. V. A. Pedroni, "Digital Electronics and Design with VHDL," Elsevier. 6. R. J. Tocci, N. S.Widmer, and G. L.Moss "Digital Systems Principles and applications," 10th Edition, Pearson Prentice Hall Edition.				

<table>
<tr><td>Course Title</td><td>Signals and Systems</td><td>Course No</td><td colspan="3">To be filled by the office</td></tr>
<tr><td>Specialization</td><td>Electronics Engineering</td><td>Structure (IPC)</td><td>3</td><td>0</td><td>3</td></tr>
<tr><td>Offered for</td><td>B.Tech. EDM, DD (ESD, EVD)</td><td>Status</td><td colspan="3">Core ■ Elective □</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The primary goal of this course is to introduce the idea of signals and systems: their analysis and characterizations. This course is a foundation for various other courses such as Analog and Digital Communications, Control theory, Image processing, Power spectral estimations, etc.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">At the end of the course, the students are expected to
1. Understand various properties of continuous time signals
2. Analyze the frequency spectrum of continuous time signals
3. Describe a LTI system by impulse/frequency response
4. Analyze magnitude/phase response of various LTI systems
5. Analyze systems commonly used in Communications, Control, and Signal Processing</td></tr>
<tr><td>Contents of the course</td><td colspan="5">Introduction to Signals and Systems: The unit impulse and unit step functions, Continuous-time signals, Transformations of the independent variables, Exponential and Sinusoidal signals, Continuous-time systems and basic system properties. (8)
Linear Time-invariant Systems: Continuous-time Linear Time-invariant (LTI) system, Discrete-time LTI system, Properties of LTI systems, System representation through linear constant coefficient differential equations. (8)
Fourier Series Representation of Periodic Signals: Fourier series representation of continuous-time periodic signals, Convergence of the Fourier series, Properties of continuous-time Fourier series, Fourier series and LTI systems, Filtering, Examples of continuous-time filters described by differential equations. (8)
The Continuous-time Fourier Transform: Representation of aperiodic signals, The Fourier transform for periodic signals, Properties of the continuous-time Fourier transform, Convolution and multiplication properties and their effect in the frequency domain, magnitude and phase response. (8)
The Laplace Transform: The Laplace transform for continuous-time signals and systems, the notion of Eigen value and Eigen functions of LTI systems, Region of convergence, System functions, Poles and zeros of system functions and signals, Properties of the Laplace transform, Analysis and characterization of LTI systems using the Laplace transform, The unilateral Laplace transform. (8)
Applications of signals and systems theory. (2)</td></tr>
<tr><td>Textbook</td><td colspan="5">1. A. V. Oppenheim, A. S. Willsky, and S. H. Nawab, “Signals and Systems,” 2nd Edition, Prentice Hall, 2003.</td></tr>
<tr><td>References</td><td colspan="5">1. S. Haykin and B. V. Veen, “Signals and Systems” 2nd Edition, Wiley, 2007.
2. B.P. Lathi, “Principles of Linear Systems and Signals,” Oxford University Press, 2nd Edition, 2009.</td></tr>
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Course Title	Analog Circuits	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	3	0	3
Offered for	B.Tech. EDM, DD (ESD, EVD)	Status	Core ■	Elective □	
Course Objectives	The goal of this course is to provide a good understanding on the design and implementation of analog circuits for various applications such as amplification, filtering, frequency generation etc.				
Course Outcomes	The course would equip students to 1. Understand analog circuits 2. Analysis and design of amplifiers viz. VCVS, VCCS, CCVS, CCCS 3. Analysis and design of analog circuits with operational amplifiers				
Contents of the course	**Device Models (6):** (diode, BJT, MOSFET); Small signal analysis of nonlinear circuits, small signal equivalent of diode, BJT, MOSFET **Biasing (7):** Adding dc bias to ac signals-Concept of ac coupling, current mirrors **Basic transistor Amplifiers (8):** small signal and large signal (low frequency) characteristics, VCVS, VCCS, CCVS, CCCS, high frequency effects **Differential pair (5)-**Need of active load, differential amplifier **OpAmp internal circuitry (8):** 2-stage+ buffer example, Miller compensation of a 2-stage OpAmp, Stability, frequency compensation **OpAmp circuits (8):** Amplifier Circuits, Filters, oscillators				
Textbook	1. B. Razavi, "Fundamentals of Microelecronics," Wiley Student Edition, 2010. 2. S. Franco, "Design with Operational Amplifiers and Analog Integrated Circuits," McGraw-Hill Series in Electrical and Computer Engineering, 4th Edition, 2015.				
References	1. Sedra and Smith, "Microelectronic Circuits," 7th Edition, Oxford University Press. 2. D. A. Newman, "Electronic circuits," 4th Edition, TMH.				

Course Title	Analog Circuits Practice	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	0	3	2
Offered for	B.Tech. EDM, DD (ESD, EVD)	Status	Core ■	Elective □	
Course Objectives	The goal of this course is to provide a good understanding on the design and implementation of analog circuits for various applications such as amplification, filtering, frequency generation etc.				
Course Outcomes	The course would equip students to 1. Design and build analog circuits 2. Design and build analog circuits using op amp and other analog ICs				
Contents of the course	Amplifiers using BJTs and MOSFETs, Circuit using Op Amp, Filters, Oscillators and other analog signal processing circuits				
Textbook	1. B. Razavi, "Fundamentals of Microelecronics," Wiley Student Edition, 2010. 2. S. Franco, "Design with Operational Amplifiers and Analog Integrated Circuits," McGraw-Hill Series in Electrical and Computer Engineering, 4th Edition, 2015.				
References	1. Sedra and Smith, "Microelectronic Circuits," 7th Edition, Oxford University Press. 2. D. A. Newman, "Electronic circuits," 4th Edition, TMH.				

Course Title	Digital Logic Design Practice	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	0	3	2
Offered for	B.Tech. EDM, DD (ESD, EVD)	Status	Core ■	Elective □	
Course Objectives	The goal of this course is to provide a hands on experience in design and implementation of digital circuits and systems. This includes formulating the logic for a given problem, minimizing or optimizing the logic using different approaches and realizing it using gates and other digital ICs. This is done in three phases: Spice simulation of circuit, experimental verification and Verilog/VHDL implementation.				
Course Outcomes	The course would equip students to 1. Understand digital circuits 2. Design Combinational circuits 3. Design sequential circuits 4. Formulate logic and design circuits for practical problems				
Contents of the course	Formulating Boolean expressions and truth tables from practical statements, designing logic diagrams, simplifying using k-map, designing NAND-NAND & NOR-NOR diagrams & verifying the same by simulation and experiment. Combinational circuits: code converters, arithmetic circuits, mux/demux, encoder/decoder, comparators etc Sequential circuits including flip flops, shift registers, counters, sequence generators etc Simple design examples with Moore and Mealy machines				
Textbook	1. C. H. Roth, "Fundamentals of Logic Design," 5th Edition, Thomson Books/Cole. 2. S. Brown and Z. Vranesic, "Fundamentals of Digital Logic with VHDL Design," TMH, 3rd Edition.				

Course Title	Probability Theory	Course No	To be filled by the office		
Specialization	Mathematics	Structure (IPC)	3	0	3
Offered for	B.Tech. (COE, EDM), DD (CED, ESD, EVD)	Status	Core ■	Elective ☐	
Course Objectives	To impart knowledge of basic concepts and applications of Probability and Statistics				
Course Outcomes	At the end of the course, a student will be able to apply the knowledge in solving engineering problems				
Contents of the course *(With approximate break up of hours)*	Introduction to Probability: Sets, Events, Axioms of Probability, Conditional Probability and Independence, Bayes Theorem and MAP Decision Rule (8) Random Variables: Definitions, Cumulative Distribution Functions, mass and density functions, joint and conditional distributions, Functions of Random Variables (8) Expectations: Mean, Variance, Moments, Correlation, Chebychev and Schwarz Inequalities, Moment-generating and Characteristic Functions, Chernoff Bounds, Conditional Expectations (8) Random Vectors: Jointly Gaussian random variables, Covariance Matrices, Linear Transformations, Diagonalization of Covariance Matrices (6) Random Sequences: Sequences of independent random variables, correlation functions, wide-sense stationary sequences, LTI filtering of sequences (6) Law of Large Numbers, Central Limit Theorem (6)				
Textbook	1. Stark and Woods, "Probability and Random Processes with Applications to Signal Processing," 3rd Edition, Pearson Education 2002. 2. S. Ross, "A First Course in Probability," 6th Edition, Pearson.				
References	1. J. S. Milton and J. Arnold, Introduction to Probability and Statistics, Tata McGraw Hill Education Private Limited, 4th Edition, 2006. 2. S. Kay, Intuitive Probability and Random Processes Using MATLAB, Springer, 2008. 3. R. M. Gray and L. D. Davisson, "An Introduction to Statistical Signal Processing," Cambridge University Press, 2004.				

Course Title	Designing Intelligent Systems	Course No	To be filled by the office		
Specialization	Design	Structure (LTPC)	2	0	2
Offered for	UG and DD	Status	Core ■	Elective ☐	
Pre-requisite	Systems Thinking for Design	To take effect from			
Course Objectives	Design for effectiveness – Level-2				
Course Outcomes	This course will help students understand • Principles of complex and living systems • Concepts such as Information intensity & Knowledge • Introduction to emerging digital technologies • Apply these ideas in design				

Contents of the course *(With approximate break up of hours)*	• Design Metaphors & Patterns (incl biomimetic) **[10]**
	  • Metaphors such as living systems, complex networks, viable systems
	  • Key principles governing living / complex systems (Self-organization, self-production, recursion, fractal)
	• Increasing information-intensity in products **[8]**
	  • Concept of information intensity vs material/energy intensity
	  • Self-learning, usage patterns, early warning systems
	  • Using data, voice, collaborative technologies (semantic, big data, speech, Remote-help, Indic computing), Internet-of-things
	• Synthesizing the above ideas for creative design **[8]**				

Textbook and References	1. H. G. Hey, A. M. Agogino, "Metaphors in Conceptual Design," ASME Design Engineering Technical Conferences, Las Vegas, Nevada, in review, 2007. 2. H. Casakin, and G. Goldschmidt, "Expertise and the Use of Visual Analogy: Implications for Design Education," Design Studies, 20(2), 153-175, 1999. 3. Kryssanov, V. V., Tamaki, H. and Kitamura, S., "Understanding Design Fundamentals: How Synthesis and Analysis Drive Creativity, Resulting in Emergence," Artificial Intelligence in Engineering, 15, 329 – 342, 2001.				

Course Title	Sociology of Design	Course No	To be filled by the office		
Specialization	Management	Structure (LTPC)	2	0	2
Offered for	UG and DD	Status	Core ■	Elective ☐	
Pre-requisite	None	To take effect from			
Course Objectives	Design as a Social Activity – Level 1				
Course Outcomes	This course will help students understand • Design as a social activity involving people, their relationships & values - How designs can emerge out of or be constrained by social patterns of relating • How technology can influence interactions among people, cooperative work, ethical issues around technology interventions • Exposure to techniques like ethnomethodology				
Contents of the course *(With approximate break up of hours)*	Basics concepts of sociology (behavior, interaction, language) **[6]** Historical evolution of Societies (Agrarian, Industrial, Digital) and current human and organizational contexts in which engineers and other professionals work, Personal and corporate social responsibility & ethics **[10]** Relationship between people (age, gender, cultures) and technology - Social and psychological dimensions of technological change, Technology & Work, Co-operative Work & Coordinative Practices, Ethnomethodology, Critical Systems Heuristics **[10]**				
Textbook and References	1. Manuel Castells (1996); The Rise of Network Society. 2. Herbert Blumer (1986); Symbolic Interactionism: Perspective and Method. 3. Herkert, J. (ed.), Social, Ethical, and Policy Implications of Engineering: Selected Readings. New York, NY: IEEE Press, 2000. 4. Heath, C. and Luff, P. (2000); Technology in Action, Cambridge: Cambridge Univ Press. 5. Werner Ulrich (1983), Critical Systems Heuristics, John Wiley, London.				

Course Title	Control Systems	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	3	0	3
Offered for	B.Tech. EDM, DD (ESD, EVD)	Status	Core ■	Elective ☐	
Course Objectives	This course develops the fundamentals of feedback control using linear transfer function and state space system models. Topics covered include analysis in time and frequency domains; design in the s-plane and in the frequency domain. Students have to complete an extended design case study.				
Course Outcomes	This course will teach fundamentals of control design and analysis using state-space methods. By the end of the course, a student should be able to design controllers using classical and modern control methods and evaluate whether these controllers are robust to some types of modeling errors and nonlinearities. They will learn to: • Design controllers and analyze using classical tools. • Understand impact of implementation issues (nonlinearity, delay). • Indicate the robustness of control design. • Linearize a nonlinear system, and analyze stability.				
Contents of the course	Introduction :Scope of control, Parts of a control system, Multidisciplinary nature, Scope of present course (2) Mathematical modeling of physical systems :Differential equation, Transfer function, and State variable representations; Examples, Equivalence between the elements of different types of systems (6) Linear systems and their s-domain representations: Linearity and linearization, Transfer function and its interpretation in terms of impulse and frequency responses, Block-diagram and signal flow graph manipulations. (8) Characterization of systems: Stability -- concept and definition, poles, Routh array, internal stability of coupled systems, Time domain response and Frequency domain response; Link between time and frequency domain response features. (8) Closed loop operation - Advantages: Sensitivity, Disturbance and noise reduction, Structured and unstructured plant uncertainties. (3) Analysis of closed loop systems : Stability and relative stability using root-locus approach, Nyquist stability criterion, Steady state errors and system types (7) Compensation techniques: Performance goals, specifications, PID, lag-lead and algebraic approaches for controller design. (8) Case study of a closed loop system to design controller for any system. (could be a design (simulation/hardware) project done along with the course)				
Textbook	1. N. S. Nise, "Control Systems Engineering," Wiley, 2014. 2. B.C. Kuo, "Automatic Control Systems", 8th Edition, John Wiley.				
References	1. I. J. Nagrath and M. Gopal, "Control System Engineering," New Age International publishers, 2008. 2. J. J. Distefano, A. R. Stubberud, and I. J. Williams, "Control Systems," Shaum's outline Series, 3rd Edition, McGraw Hill.				

Course Title	Digital Signal Processing	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	3	0	3
Offered for	B.Tech. EDM, DD (ESD, EVD)	Status	Core ■	Elective □	
Course Objectives	The primary goal of this course is to introduce discrete-time signals and systems: their analysis and characterizations. This course is a foundation for various other courses such as Analog and Digital Filters, Digital Communications, Control theory, Image processing, Power spectral estimations, etc.				
Course Outcomes	At the end of the course, the students are expected to 1. Understand various properties of discrete-time signals 2. Analyze discrete time LTI systems, and their impulse responses 3. Synthesize discrete signals from analog signals 4. Reconstruct analog signals from discrete signals 5. Analyze systems commonly used in Communications, Control, and Signal Processing				
Contents of the course	**Review of Signals and Systems:** Discrete time complex exponentials and other basic signals—scaling of the independent axis and differences from its continuous-time counterpart—system properties (linearity, time-invariance, memory, causality, BIBO stability)—LTI systems described by linear constant coefficient difference equations (LCCDE)—autocorrelation. (4) **Discrete-time Signals and Systems:** Discrete-time signals: sequences, discrete-time systems, Linear time-invariant (LTI) systems, Properties of LTI systems, Linear constant-coefficient difference equations, Frequency domain representation of discrete-time signals and systems, Representation of sequences by Fourier transforms, Symmetry properties of Fourier transform, Fourier transform theorems, Discrete-time random signals. (8) **The Z-transform:** Introduction of z-transform, Properties of the region of convergence of the z-transform, The inverse z-transform, Properties of the z-transform. (5) **Sampling of Continuous-time Signals:** Periodic sampling, Frequency domain representation of sampling, Reconstruction of a bandlimited signals from its samples, Discrete-time processing of continuous-time signals, Continuous-time processing of discrete-time signals, Changing the sampling rate using discrete-time processing, Multirate signal processing. (7) **Transform Analysis of Linear Time Invariant Systems:** The frequency response of LTI systems, System functions for systems characterized by linear constant-coefficient difference equations, Frequency response of rational system functions, Relationship between magnitude and phase, All-pass systems, Minimum phase systems. (8) **The Discrete Fourier Transform:** Introduction of the Discrete Fourier Transform (DFT), The Fourier transform of periodic signals, Sampling of Fourier transform, Fourier representation of finite-duration sequences: the DFT, Properties of DFT, Linear convolution using the DFT. (5) **Computation of the DFT and the Fast Fourier Transform:** Efficient computation of the DFT, The Goertzel algorithms, Radix-2 decimation-in-time and decimation-in- frequency Fast Fourier Transform algorithms. (5)				
Textbook	1. A.V. Oppenheim, R.W. Schafer, and J. R. Buck, "Discrete-Time Signal Processing," Pearson Education, 3rd Edition, 2010.				
References	1. S. K. Mitra, "Digital Signal Processing: A Computer-Based Approach", 4th Edition, Tata Mcgraw Hill Publication, 2013. 2. J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", Fourth edition, Pearson, 2007.				

Course Title	Power Electronics	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	3	0	3
Offered for	B.Tech. EDM, DD (ESD, EVD)	Status	Core ■	Elective ☐	
Course Objectives	1. To introduce students to the basic theory of power semiconductor devices and passive components, their practical application in power electronics. 2. To familiarize the operation principle of AC-DC, DC-DC, DC-AC conversion circuits and their applications. 3. To provide the basis for further study of power electronics circuits and systems.				
Course Outcomes	At the end of the course, a student will be able to: 1. Understand basic operation of various power semiconductor devices and passive components. 2. Understand the basic principle of switching circuits. 3. Analyze and design AC/DC rectifier, DC/DC converter and DC/AC inverter circuits. 4. Understand the role power electronics play in the improvement of energy usage, efficiency and the development of renewable energy technologies.				
Contents of the course	Introduction to power electronics; applications and role of power electronics. (2) Introduction to power semiconductor devices, operating characteristics of Power Diode, SCR, Power BJT, Power MOSFET and IGBT; Driver circuits and Snubber circuits. (8) Introduction to AC/DC rectifiers, principle of operation of phase controlled rectifiers, single phase and three phaseAC-DC line commutated converters, dual converter, and introduction to unity power factor converters. Applications: DC motor drives and Battery chargers. (9) Introduction to DC/DC converters, Principle of operation of DC/DC (Buck, Boost, Buck-Boost, Cuk, Fly-back and Forward) converters. Applications: Power supply, DC motor drives and SMPS. (11) Introduction to DC/AC inverters, PWM techniques, Principle of operation of single phase and three phase DC-AC inverters, Applications: AC motor drives, UPS, active filters, CFL, renewable power generation, induction and dielectric heating. (12)				
Textbook	1. N. Mohan, T. Undeland, and W. Robbins, "Power Electronics: Converters, Applications, and Design," 3rd Edition, Wiley, 2003. 2. M. Rashid, "Power Electronics: Circuits, Devices & Applications," Prentice-Hall, 3rd Edition, 2003. 3. J. P. Agrawal, "Power Electronic Systems: Theory and Design," Pearson, 2013.				
References	1. I. Batarseh, "Power Electronic Circuits," John Wiley, 2004. 2. R. W. Erickson and D. Maksimovic , "Fundamentals of Power Electronics," 2nd Edition, Springer, 2001.				

Course Title	Data Structures and Algorithms Practice	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	1	3	3
Offered for	B.Tech. EDM, DD (ESD, EVD)	Status	Core ■	Elective ☐	
Course Objectives	Data Structure plays an important role in solving problems efficiently. Unless data are arranged in an efficient way, the algorithms which use the data cannot run efficiently. This course helps students to design and implement data structures to solve real world problems.				
Course Outcomes	At the end of the course, students will be able to design efficient data structure which will be used by efficient algorithms to solve real problems.				
Contents of the course	Encapsulation & Operator overloading - Inheritance & Polymorphism - applications Arrays: Linear and Binary search-Pointer based implementation of list, stack and queue - Application of linked lists – Polynomial manipulations - Representing sets using lists and implementation of set theoretic operations - Expression conversion and evaluation of postfix expressions - Binary trees - binary search trees, - HeapS, Graph Algorithms – Shortest path, minimum spanning tree				
Textbook	1. M. A. Weiss, "Data Structures and Algorithm Analysis in C++," 2nd Edition, Pearson Education, 2002.				
References	1. T. H. Cormen, C. E. Leiserson, and R. L. Rivest, "Introduction to Algorithms," 2nd Edition, Prentice Hall India, 2001. 2. Aho, Hopcroft, and Ullmann, "Data Structures and Algorithms," Addison Wesley, 1983.				

Course Title	Electrical Drives Practice	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	1	3	3
Offered for	B.Tech. EDM, DD (ESD, EVD)	Status	Core ■	Elective ☐	
Course Objectives	In this course fundamental electromechanical, power electronic, and control theory in the context of electric drive systems will be covered. The capabilities and limitations of different types of electric machines (e.g., permanent magnet, induction) in various drive applications will be covered.				
Course Outcomes	At the end of the course, a student will be able to, 1. Understand how power electronic converters and inverters operate. 2. Possess an understanding of feedback control theory. 3. Analyze and compare the performance of DC and AC machines. 4. Design control algorithms for electric drives which achieve the regulation of torque, speed, or position in the above machines. 5. Develop Simulink® models which dynamically simulate electric machine and drive systems and their controllers.				
Contents of the course	Experiments conducted in this course brings out the basic concepts of different types of electrical machines and their performance. Experiments are conducted to introduce the concept of control of conventional electric motors such as DC motor, AC Induction motor and also special machines such as Stepper motor, Permanent magnet brushless motors, Servo motor. Speed-Torque characteristics of various types of load and drive motors are also discussed. The working principle of various power electronic converters is also studied by conducting experiments.				
Textbook	1. IIITDM Kancheepuram - Electrical Drives Practice Manual.				
References	1. R. Krishnan, “Electric Motor Drives: Modeling, Analysis, and Control,” Prentice Hall, 2001. 2. N. Mohan, “Electric Drives: An Integrative Approach,” MNPERE, 2001.				

Course Title	Digital Signal Processing Practice	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	0	3	2
Offered for	B.Tech. EDM, DD (ESD, EVD)	Status	Core ■	Elective □	
Course Objectives	The primary goal of this lab is to have a hands on experience in digital signal processing. In this practice course, various signals and systems are analysed through Fourier transforms. This practice course is a precursor to other signal processing practice courses like Image Processing, Detection/Estimation Theory etc.				
Course Outcomes	The course will help students 1. Understand various properties of signals and systems 2. Apply various operations (filtering) on signals 3. Become aware of various applications of Signal Processing				
Contents of the course	Convolution, DFT and its properties, FFT and its properties, spectral analysis, Sampling, quantisation, reconstruction, companding, noise cancellation.				
References	1. TI TMS320C67XX DSP Starter Kit. 2. A.V. Oppenheim, R.W. Schafer, and J. R. Buck, "Discrete-Time Signal Processing," Pearson Education, 3rd Edition, 2010. 3. S. K. Mitra, "Digital Signal Processing: A Computer-Based Approach", Fourth edition, Tata Mcgraw Hill Publication, 2013. 4. E. Ifeachor, B. W. Jervis, "Digital Signal Processing: A Practical Approach" Second edition, Pearson, 2002. 5. S. W. Smith, "Digital Signal Processing: A Practical Guide for Engineers and Scientists", 3rd Edition, Newnes (an imprint of Butterworth-Heinemann Ltd.), 2002.				

Course Title	Sustainable Design	Course No	To be filled by the office		
Specialization	Design	Structure (IPC)	2	0	2
Offered for	UG and DD	Status (Core / Elective)	Core		
Prerequisite	Earth Environment and Design	To take effect from			
Course Objectives	The objective of this course is to prepare engineering students to address product design from a broader, holistic perspective, integrating environmental responsibility into the core of the design process.				
Course Outcomes	Upon completion of the course students are expected to demonstrate knowledge, skill and abilities in the following areas: • To equip the design student with specific environmentally-responsive tools, principles and methodologies in preparation for professional application. Management • To use a variety of techniques to communicate effectively (sketches, illustrations, photographs, persuasive writing, presentation skills, etc.).				
Contents of the course	Introduction, Definitions, History • the environmental origins of sustainability • theory of sustainability. (4) Environmentally-responsive design methodologies • industrial ecology • dematerialization • design for reuse / modularity • design for recycling • remanufacturing: issues/problems, current and future developments (10) Alternative resources • alternative energy • alternative materials • sustainable packaging. (10) Life-cycle assessment methods. (8)				
Textbooks	1. Victor Papanek, The Green Imperative, 1995, ISBN: 978-0500278468 2. William McDonough and Michael Braungart, Cradle to Cradle, 2009, ISBN: 978-0099535478 3. Stuart Walker, Sustainable by Design: Explorations in Theory and Practice, 2006, ISBN: 978-1844073535 4. Charter, Tischner, Sustainable Solutions, Green Leaf Publishing, 2001, ISBN: 978-1874719366.				
References	1. Cattanach, Holdreith, Reinke, Sibik, The Handbook of Environmentally Conscious Manufacturing, 1995, ISBN: 9780786301478 2. Sim van der Ryn, Stuart Cowan, Ecological Design, 1995, ISBN: 978-1559633895 3. Paul Hawken, The Ecology of Commerce, 2010, Collins Business Essentials, ISBN: 978-0061252792 4. Nattrass & Altomare, The Natural Step for Business, New Society Publishers, 1999, ISBN: 978-0865713840.				

Course Title	Entrepreneurship and Management Functions	Course No	To be filled by the office		
Specialization	HMC	Structure (IPC)	2	0	2
Offered for	UG and DD	Status (Core / Elective)	Core		
Prerequisite	Systems Thinking and Design	To take effect from			
Course Objectives	The objective of this course is to provide engineering students an exposure to the basic concepts of entrepreneurship and management, with a specific focus on the process of turning an idea into a commercially viable venture.				
Course Outcomes	At the end of the course, the students will learn how to • Understand the market & competition • Prepare a business case for the product/idea				
Contents of the course	Introduction • Division of labor and creation of value • Evolution of organizations, industries and sectors, for profit and non-profit • Role of Entrepreneurs and Managers in value creation • Principles of Management - Planning, Organizing, Resourcing, Directing (4) Strategy & Planning • Understanding industry dynamics & competition (Porter's Framework) • Understanding the industry value chain and firm positioning (6) Organizing • Typical organizational functions (R&D, Marketing & Sales, HR, Operations) • Cybernetics of organizational functions (Stafford Beer's viable systems model) • Types of organization structures (product, functional, matrix, global) (6) Resource Management • Financial management (Sources of funding, how to read a P&L, balance sheet) • Human resource management (Interviewing, compensation, motivation) • Global sourcing and supply chain management (8) Management Information & Decision Making (4) Legal and Regulatory environment (4)				
Textbooks	1. Peter F Drucker, The Practice of Management, Harper Collins, 2006, ISBN: 978-0060878979. 2. Hentry Mintzberg, Managing, Berret-Koehler Publishers, 2009, ISBN: 978-1605098746 3. Michael E. Porter, On competition, A Harvard Business School, 2008, ISBN: 978-1422126967. 4. Vasanta Desai, Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House, ISBN: 9788183184113.				
References	1. Walter Isaacson, Steve Jobs, 2011, ISBN:978-1451648539 2. Eric Ries, The Lean Startup, Portfolio Penguin, 2011, ISBN: 978-0307887894 3. Vineet Bajpai, Build from scratch, Jaico books, 2013, ISBN: 9788184952919.				

Course Title	Information Theory and Coding	Course No	To be filled by office		
Specialization	Electronics Engineering	Structure (IPC)	3	0	3
Offered for	UG and DD	Status (Core / Elective)	Core		
Pre-requisite	Probability Theory	To take effect from			
Objectives	This course aims at introducing the basic limits of a communication/signal-processing system. In particular, the course introduces the basic tools like entropy, mutual information, capacity, AEP etc, and uses the tools to introduce data compression and channel coding.				
Course Outcomes	At the end of this course, the students are expected to 1. Analyze different sources in terms of entropy 2. Analyze different channels in terms of mutual information 3. Design data compression for various sources 4. Compute the capacity of different channels 5. Analyze AWGN channels				
Contents of the course	Information - Fundamentals: Entropy, joint entropy and conditional entropy, relative entropy and mutual information, chain rules for entropy, relative entropy, and mutual information, Jensen's inequality, log sum inequality, sufficient statistics, Fano's inequality (10) Asymptotic Equipartition Property (AEP): AEP, consequence of AEP - data compression, typical set. (7) Data Compression: Kraft inequality, optimal codes and bounds on optimal codelength, Kraft inequality for uniquely decodable codes, Huffman codes, Shannon-Fano-Elias coding (10) Channel Capacity: (Binary) Symmetric Channels, Jointy typical sequences, the channel coding theorem, Fano's inequality and the converse to the coding theorem, Hamming codes, joint source-channel coding theorem. (10) Gaussian Channel: Differential entropy, coding theorem for Gaussian channels (5)				
Textbook	1. T. M. Cover and J. A. Thomas, Elements of Information Theory, 2nd edition, John-Wiley & Sons, 2006. ISBN: 978-0471241959				
References	1. I. Csiszar and J. Korner, Information Theory: Coding Theorems for Discrete Memoryless Systems, 1st edition, Akademiai Kiado, 1997. ISBN: 978-9630574402 2. R. G. Gallager, Information Theory and Reliable Communication, 1st edition, Wiley, 1968, ISBN: 978-0471290483				

Course Title	Microprocessors and Computer Architecture	Course No	To be filled by office		
Specialization	Electronics Engineering	Structure (IPC)	3	0	3
Offered for	UG and DD	Status (Core / Elective)	Core		
Pre-requisite	----	To take effect from			
Objectives	The goal of this course is to provide a good understanding of the components of a fast computing system, structure and functionalities of different architectures, and programming of microprocessors.				
Course Outcomes	The course would equip students to 1. Learn to develop suitable architectures for certain applications 2. Use microprocessors for building real time systems				
Contents of the course	Evolution and Performance of Processors (2) Computer System: Computer Components and Interconnections; Memory and I/O Organization: Cache, Internal, External, Input/Output, and Operating System (5) Processor Architecture and Functions: RISCs versus CISC, Register File, General Instruction Types, Addressing Modes (10) Memory Accesses, Pipelining, ALU and Arithmetic Instruction Format for Intel x86 and ARM processors (10) Control Unit: Hardwired Implementation and Microprogrammed Control (5) Instruction-Level Parallelism: Design Issues, Machine Parallelism, Branch prediction, Superscalar Execution (5) Parallel Processing: Use of Multiple Processors, Multithreading, Vector Computation (5)				
Textbook	1. W. Stallings, Computer Organization and Architecture, 8th Edition, Pearson Education, 2010				
References	1. D. A. Patterson and J. L. Hennessy, Computer Organization and Design - ARM, Morgan Kaufmann, 2010. 2. J. Stokes, Inside The Machine: An Illustrated Introduction to Microprocessors and Computer Architecture, No Starch Press, Inc 2007, ISBN-13: 978-1-59327-104-6. 3. B. B. Brey, Intel Microprocessors, 8th edition, Prentice Hall, 2008. 4. S. Furber, ARM System-on-chip Architecture, 13th impression, Pearson, 2012.				

Course Title	Analog and Digital Communication	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	3	0	3
Offered for	UG and DD	Status (Core / Elective)	Core		
Prerequisite	----	To take effect from			
Course Objectives	The primary goal of this course is to introduce the basic principles that are used in the analysis and design of communication systems. This course is fundamental to other advanced communication courses like Wireless Communications, Optical Fiber Communication, and many others.				
Course Outcomes	At the end of the course, the students are expected to 1 Analyse different analog modulation schemes 2 Evaluate the performance of various communication systems 3 Describe and Analyze transmission of digital data using baseband and carrier modulation techniques 4 Analyze/Understand BER of various digital communication systems 5 Analyse the power and bandwidth considerations, and analyze the spectral efficiency of various modulation schemes				
Contents of the course	Review of Probability Theory: Axioms of probability, independence, Bayes theorem, random variables, pdf, cdf, marginalization, functions of random variables, MGF, CLT, random processes, correlation, Gaussian processes through LTI system. (10) Analog Communication: Band pass signal and system representation, AM: generation and demodulation, FM and PM: generation and demodulation, Matched filter, and correlation receiver, Super heterodyne receiver, Phase recovery with PLLs, PAM, PCM, Delta modulation. (16) Digital Communication: ASK, BPSK, M-PSK, QAM, FSK, MSK, - transmitter and receiver structures, BER Analysis, Bandwidth/Power efficiency, Carrier recovery – squaring and Costas loop, DPSK. (16)				
Textbooks	1. B. P. Lathi and Z. Ding, Modern Digital and Analog Communication Systems, 4th Edition, Oxford University Press, 2011. 2. S. Haykin, Communication Systems, 4th Edition, Wiley, 2006.				
References	1. J. M. Wozencraft and I. M. Jacobs, Principles of Communication Engineering, Wiley, 1965. 2. J. R. Barry, E. A. Lee, and D. G. Messerschmitt, Digital Communication, 3rd Edition, Springer, 2004.				

Course Title	Sensing and Instrumentation Practice	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	0	3	2
Offered for	UG and DD	Status (Core / Elective)	Core		
Prerequisite	------	To take effect from			
Course Objectives	To familiarize the students with different sensors and their signal conditioning circuits required for different applications.				
Course Outcomes	By the end of the course, the students would be able to build systems which would sense the different physical signals and also process the signals in the required analog or digital formats.				
Contents of the course	Transducers, transducer sensing and functions, Passive and active – Resistance, inductance and capacitance, Strain Gauges, Hall Effect sensors, Optical sensors Measurement of non electrical quantities such as displacement/velocity/acceleration, pressure, force, flow and temperature, calibration of sensors, Data acquisition and detection techniques, Signal conversion, PC-based Instrumentation Systems Practice includes experiments from following topics: Signal generation, Instrumentation amplifiers, Signal conversion and processing, Characteristics of Transducers, Calibration of sensors, Measurement of physical quantities.				
Textbooks	1. Alan S. Morris, Measurement and Instrumentation Principles, Elsevier, 2001. 2. A. K. Sawhney, Course In Electrical & Electronics Measurement & Instrumentation, Dhanpat Rai, 2007.				
References	1. Bruce Mihura, LabVIEW for Data Acquisition (National Instruments Virtual Instrumentation Series), Prentice Hall, 2001. 2. Howard Austerlitz, Data acquisition techniques using PCs, 2nd edition, Academic Press, 2002.				

Course Title	Microprocessors and Microcontrollers Practice	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	0	3	2
Offered for	UG and DD	Status	Core		
Pre-requisite	----	To take effect from			
Objectives	The goal of this course is to help the students have thorough understanding with the programming and usage of microprocessor and microcontrollers so as to build simple systems.				
Course Outcomes	The course would equip students to 1. Programme and use microprocessor 8086 and ARM processors for real time applications				
Contents of the course	Programming with 8086 and ARM processors Interfacing examples with 8086 and ARM				
Textbooks	1. Kenneth J. Ayala, The 8086 Microprocessor: Programming and Interfacing The PC, Delmar Publishers, 2007.				
References	1. A. K. Ray, K. M. Bhurchandi, Advanced Microprocessors and Peripherals, Tata McGraw Hill, 2007. 2. A. N. Sloss, D. Symes, C. Wright, ARM System Developer's Guide, Morgan Kaufmann, 2004.				

Course Title	Analog and Digital Communication Practice	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	0	3	2
Offered for	UG and DD	Status (Core / Elective)	Core		
Prerequisite	----	To take effect from			
Course Objectives	The primary goal of this course is to have hands on experience with the analog and communication systems. This course is fundamental to other advanced communication courses like Coding Theory, Wireless Communications, and many others.				
Course Outcomes	At the end of the course, the students are expected to 1 Analyse different analog modulation schemes 2 Evaluate the performance of various communication systems 3 Describe and analyse transmission of digital data using baseband and carrier modulation techniques 4 Analyze/Understand BER of various digital communication systems 5 Analyse the power and bandwidth considerations, and analyze the spectral efficiency of various modulation schemes				
Contents of the course	Amplitude Modulation: AM, DSB, DSB-SC, SSB, Frequency Modulation, Phase Modulation, Carrier recovery, PCM. BPSK, QPSK, PAM, MPSK, MQAM, FSK, modulation and demodulation/detection. PSD computation.				
Textbooks	1. B. P. Lathi and Z. Ding, Modern Digital and Analog Communication Systems, 4th Edition, Oxford University Press, 2011. 2. S. Haykin, Communication Systems, 4th Edition, Wiley, 2006.				
References	1. J. M. Wozencraft and I. M. Jacobs, Principles of Communication Engineering, Wiley, 1965. 2. J. R. Barry, E. A. Lee, D. G. Messerschmitt, Digital Communication, 3rd Edition, Springer, 2004.				

Course Title	Electronic Manufacturing and Prototyping	Course No.	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	1	3	3
Offered for	UG and DD	Status (Core / Elective)	Core		
Prerequisite	----	To take effect from			
Objectives	To give an overview of Electronic manufacturing and packaging aspects. To familiarize with the electrical, mechanical and thermal design considerations required for electronic system development.				
Course Outcomes	Students would be able to design and develop PCB with MSI circuits for different applications.				
Contents of the course	Overview of electronic systems manufacturing and packaging , Introduction to IC manufacturing and realization of passive components in ICs and VLSI, Surface Mount Technology, Thermal budget and Current trends An overview on CAD based manufacturing process of PCB, Industry standards for design, Mechanical and Electrical aspects of PCB design, Design for manufacturability, Design consideration for special circuits, PCB design flow- Schematic -layout - PCB design using created library -PCB printing using PCB prototyping machine-Testing and debugging of PCB ***Experiments*** Design and development of PCBs using different simulator tools and prototyping.				
Textbooks	1. R. T. Rao, Fundamentals of Microsystems Packaging, McGraw Hill, 2001, ISBN-10: 0071371699, ISBN-13: 978-0071371698. 2. J. Axelson, Making Printed Circuit Boards, TAB/McGraw Hill, 1993, ISBN-10: 0070027994, ISBN-13: 978-0070027992.				
References	1. R. K. Ulrich, W. D. Brown, Advanced Electronic Packaging, : IEEE Press Series on Microelectronic Systems, 2nd edition, 2006, Wiley-IEEE Press; ISBN-10: 0471754501, ISBN-13: 978-0471754503 2. J. Varteresian, Fabricating Printed Circuit Boards (Demystifying Technology) 1st edition, Newnes, 2002. ISBN-10: 1878707507, ISBN-13: 978-1878707505 3. R. A. Reis, Electronic project design and fabrication, 6th edition, Prentice Hall, 2004, ISBN-10: 0131130544, ISBN-13: 978-0131130548 4. K. Mitzner Complete PCB Design Using OrCad Capture and Layout, Elsevier, 2009, ISBN :9780750689717. 5. J. H. Lau, C. P. Wong, J. L. Prince, Electronic Packaging: Design, Materials, Process, and Reliability Electronic Packaging and Interconnection Series, 1st edition, McGraw-Hill Professional, 1998. ISBN-10: 0070371350, ISBN-13: 978-0070371354				

Course Title	Design for Quality and Reliability	Course No	To be filled by the office		
Specialization	Design	Structure (IPC)	2	0	2
Offered for	UG and DD	Status (Core / Elective)	Core		
Prerequisite	Measurements and Data Analysis Lab (Probability and Statistics)	To take effect from			
Course Objectives	The objectives of the course are to help engineering students understand: 1. To understand concepts of quality & reliability 2. To evaluate the overall reliability of a system from component reliability.				
Course Outcomes	Attending the course would enable the student to: 1. Model repairable and non-repairable systems and calculate failure rate, repair rate, reliability and availability 2. Use various probability density distributions significant to reliability calculations 3. Fit a given failure data set of a product into a Weibull distribution and estimate the reliability parameters.				
Contents of the course	Concepts of Product Quality • Quality Function Deployment / House of Quality • Six Sigma (6) Concepts of Reliability • Basic concepts of repairable and non-repairable systems • Reliability, Availability and Maintainability (6) Failure data analysis • Fitting discrete and continuous distributions to failure data sets, Weibull analysis, estimation of important reliability parameters (8) Calculation of System Reliability from Component reliabilities • Markov modeling of repairable and non-repairable systems • Reliability Logic Diagrams • Fault-tree analysis (8) Preventive and Predictive maintenance • Failure Modes and Effects Analysis (4)				
Textbooks	1. Louis Cohen, Joseph P. Ficalora, Quality Function Deployment and Six Sigma: A QFD Handbook, Prentice Hall, 2nd Edition, 2009, ISBN: 9780137035441 2. VNA Naikan, Reliability Engineering and Life Testing, PHI Learning, 2010, ISBN: 978-8120335936 3. Singiresu S Rao, Reliability Engineering, Pearson Education, 2014, ISBN: 978-0136015727				
References	1. Patrick O Connor, Practical Reliability Engineering, John Wiley, 2009, ISBN: 9780470979815 2. B.L. Hansen & P.M. Ghare, Quality Control and Applications, Prentice-Hall, 1997, ISBN: 9780137452255				

Course Title	Product Management	Course No	To be filled by the office		
Specialization	HMC	Structure (IPC)	2	0	2
Offered for	UG and DD	Status (Core / Elective)	Core		
Prerequisite	Entrepreneurship and Management Functions	To take effect from			
Course Objectives	The course provides an introduction to product management with an emphasis on product strategy, product development, product life-cycle management, platform and portfolio management and branding.				
Course Outcomes	This course will equip engineering students with an understanding of 1. The role of product management in a new or established technology enterprise 2. Techniques to price, promote, position and track profitability of product				
Contents of the course	Introduction to Product Management • Core responsibilities of Product Management within an organization • Typical Product Development Process & Product Life Cycle • Key Product Management Concepts ('Value", "Market", "Minimum Viable Product") (4) Product Marketing • Market Research, Market segmentation, Entry strategy • Test marketing, and Tracking New Product Launch • Brand Management (10) Product Strategy, Roadmap and Organization • Corporate strategy & Product strategy • Product Platforms, Product Lines &Product Portfolio Management • Risk Management (market, technology, portfolio) • Organization structures for product management & new product development (8) Product Life Cycle Management Tools & Product Profitability Assessment (8)				
Textbooks	1. Jakki J Mohr and Sanjit Sengupta, Marketing of High-Technology Products and Innovations, 2nd Edition, Pearson Education, 2011, ISBN:978-0136049968 2. John Stark, Product Lifecycle Management: 21st Century Paradigm for Product Realisation, Springer, 2011, ISBN: 9781447126782 3. Karl T. Ulrich and Steven D. Eppinger, Product Design and Development, 6th Edition, McGraw-Hill, 2016, ISBN: 978-0070658110				
References	1. Steven Haines, Product managers desk reference, 2nd Edition, McGraw Hill, 2014, ISBN: 978-0071591348.				

Course Title	Digital IC Design	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	3	0	3
Offered for	DD	Status (Core / Elective)	Core		
Prerequisite	----	To take effect from			
Course Objectives	To impart in depth knowledge in CMOS digital circuits, performance metrics, design procedures for complex combinational and sequential circuits and subsystems.				
Course Outcomes	Students would be able to design and analyze complex digital integrated circuits using semicustom and full custom design procedures.				
Contents of the course	Issues in Digital Integrated Circuit Design. (1) Fabrication of CMOS IC and packaging. (4) MOS Device: Threshold Voltage, Secondary Effects, SPICE Models. (4) Interconnect: Parameters, Electrical Wire Models, SPICE Wire Models. (2) CMOS Inverter: Transfer Characteristics, Noise margin, Capacitances, Propagation Delay, Power. (5) Combinational Logic Circuits: Static CMOS, Pass-Transistors, Dynamic CMOS, Dynamic Logic, Cascading. (7) Sequential Logic Circuits: Timing Metrics, Static and Dynamic Latches, Registers, C^2MOS, NORA-CMOS. (7) Arithmetic Building Blocks: Datapaths in Digital Processor Architectures. (7) Memory and Array Structures: ROM, RAM, CAM, Peripheral Circuitry, PLA and Flash Memory. (5)				
Textbooks	1. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, Digital Integrated Circuits, 2nd edition, Pearson, 2003. ISBN-10: 0130909963, ISBN-13: 978-0130909961				
References	1. John E. Ayers, Digital Integrated Circuits: Analysis and Design, 2nd edition, CRC Press, 2009. ISBN-10: 142006987X, ISBN-13: 978-1420069877. 2. R. Jacob Baker, CMOS Circuit Design, Layout, and Simulation, 3rd edition, Wiley-Blackwell, 2010. ISBN-10: 0470881321, ISBN-13: 978-0470881323. 3. Sung-Mo (Steve) Kang, Yusuf Leblebici, Chilwoo Kim, CMOS Digital Integrated Circuits Analysis & Design, 4th edition, McGraw-Hill Higher Education, 2014. ISBN-10: 0073380628, ISBN-13: 978-0073380629.				

Course Title	Electromagnetic Interference and Compatibility	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	3	0	3
Offered for	DD	Status (Core / Elective)	Core		
Prerequisite	----	To take effect from			
Course Objectives	• To learn the various sources of Electromagnetic Interference. • To familiarize the fundamentals those are essential for product design with EMC compliance. • To understand the various EMC pre compliance measurement.				
Course Outcomes	• The students would gain knowledge to understand the concept of EMI / EMC related to product design. • The students will have broad knowledge of various aspect of EMC and its standards. • The students can diagnose and solve various electromagnetic compatibility problems.				
Contents of the course	Introduction to EMI and EMC- Various EMC requirements and standards-Need for EMC and its importance in electronic product design - sources of EMI - few case studies on EMC. (8) Conducted and radiated emission -power supply line filters-common mode and differential mode current-common mode choke- switched mode power supplies. (4) Shielding techniques- shielding effectiveness-shield behavior for electric and magnetic field - aperture-seams-conductive gaskets- conductive coatings (6) Grounding techniques- signal ground-single point and multi point grounding-system ground-common impedance coupling -common mode choke-Digital circuit power distribution and grounding. (8) Contact protection - arc and glow discharge-contact protection network for inductive loads-C, RC, RCD protection circuit- inductive kick back. (4) RF and transient immunity-transient protection network- RFI mitigation filter-power line disturbance- ESD- human body model- ESD protection in system design. (5) PCB design for EMC compliance-PCB layout and stack up- multi layer PCB objectives-Return path discontinuities-mixed signal PCB layout. (4) EMC pre compliance measurement-conducted and radiated emission test-LISN-Anechoic chamber. (3)				
Textbooks	1. H. W. Ott, Electromagnetic Compatibility Engineering, 2nd edition, John Wiley & Sons, 2011, ISBN: 9781118210659. 2. C. R. Paul, Introduction to Electromagnetic Compatibility, 2nd edition, Wiley India, 2010, ISBN: 9788126528752.				
References	1. K. L. Kaiser, Electromagnetic Compatibility Handbook, 1st edition, CRC Press, 2005. ISBN: 9780849320873.				

Course Title	Electromagnetic Interference and Compatibility Practice	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	0	3	2
Offered for	DD	Status (Core / Elective)	Core		
Prerequisite	Electromagnetic Interference and Compatibility	To take effect from			
Course Objectives	To teach and demonstrate the various fundamentals required for electronic product development with EMC compliance.				
Course Outcomes	• The students will able to understand the sources of EMI and various coupling methods. • The students can learn the various method of doing the pre compliance measurement techniques.				
Contents of the course	Familiarization of various EMC pre-compliance test, Study of induced voltages and Pick up, demonstration of cross talk in cables, Ground noise in digital logic, Measurement of conducted emission using LISN, Measurement of radiated emission, Susceptibility test of various electronic equipment.				
Textbooks	1. H. W. Ott, Electromagnetic Compatibility Engineering, 2nd edition, John Wiley & Sons, 2011, ISBN: 9781118210659. 2. C. R. Paul, Introduction to Electromagnetic Compatibility, 2nd edition, Wiley India, 2010, ISBN: 9788126528752.				
References	1. K. L. Kaiser, Electromagnetic Compatibility Handbook, 1st edition, CRC Press, 2005. ISBN: 9780849320873.				

Course Title	System on Programmable Chip Practice	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	1	3	3
Offered for	DD	Status (Core / Elective)	Core		
Prerequisite	VLSI Deign, Computer Organization, Data Structure and Algorithms	To take effect from			
Course Objectives	Design and development complete hardware/software system on FPGA.				
Course Outcomes	Student can able to design and develop the hardware/software system on FPGA, can able to effectively use commercially available building block (IP) to construct highly integrated systems, Can able to efficiently break down complex computational tasks into hardware and software components and build co-processor.				
Contents of the course	Introduction to System-on-Chip, Register Transfer Language, Folding, Re-timing and Re-coding, Protocol and Interface, SystemC Components, Basic SoC components, Electronic system level modeling, Transactional level modeling, Assertion based Design, Network on chip and Bus Structures, SoC Engineering and associated Tools, Architectural design exploration, High Level Design Capture and Synthesis.				
Textbooks	1. Louise H. Crockett, Ross A. Elliot, Martin A. Enderwitz, Robert W. Stewart, The Zynq Book: Embedded Processing with the ARM Cortex-A9 on the Xilinx Zynq-7000 All, 1st edition, Strathclyde Academic Media, 2014. ISBN: 099297870X.				
References	1. Wayne Wolf, FPGA based System Design, 1st edition, Prentice Hall, 2004. ISBN: 0131424610. 2. Steve Furber, ARM System on Chip Architecture, 2nd edition, Addison-Wesley, 2000. ISBN: 0201675196.				

Course Title	Product Design Practice	Course No	To be filled by the office		
Specialization	Design	Structure (IPC)	0	3	2
Offered for	UG and DD	Status (Core / Elective)	Core		
Prerequisite	Design Realization, Product Realization	To take effect from			
Course Objectives	Students will develop cross-discipline products and prototype them using product realization tools in a multi- disciplinary team setting.				
Course Outcomes	By the end of the course, the students would be able to • Develop cross disciplinary idea • conceive, design and prototype an innovative idea • work in cross-functional groups and to apply the concepts learnt in theory to a practical problem • manage group projects, maintain timeliness and follow method oriented approach to problem solving				
Contents of the course	This course is an inter-disciplinary team-based product design and prototyping course. The concept of the course is to provide hands-on learning experience in interdisciplinary fields of engineering and exposure to the context of a "real" product design problems. In this course students will design a product by following the systematic product design process. A team consist of students from different discipline will choose their own innovative product and while designing, students will consider many issues like market opportunities, formal requirements and constraints, the environment in which the product will be used, product look and feel; technical legitimacy, and manufacturing considerations for the products. During the course, students will learn and put in to practice team working, project management and product realization practices commonly found in product developers in industry. Throughout the semester, the student teams have several opportunities to present their progress to their fellow students and faculty.				
Textbooks	1. Carl Liu, Innovative Product Design Practice, Kindle Edition, ASIN: B00B29V9RQ 2. Bjarki Hallgrimsson, Prototyping and Modelmaking for Product Design, Laurance King Publishing Limited, 2012. ISBN-13: 978-1856698764.				

Course Title	Data Analytics	Course No	To be filled by the office		
Specialization	HMC	Structure (IPC)	2	0	2
Offered for	UG and DD	Status (Core / Elective)	Core		
Prerequisite	Measurement and Data Analysis Lab (Probability & Statistics) and Design for Quality and Reliability	To take effect from			
Course Objectives	Data Quality and Analytics plays a crucial role in the increasingly digital world and cyber-physical systems. This course will introduce engineering students to key techniques for deriving meaningful insights from structure & unstructured data, with specific examples derived from the world of design, manufacturing and management.				
Course Outcomes	At the end of the course, students will be familiar with applying known techniques for 1. Data enrichment and integration 2. Descriptive, Inferential, Predictive and Prescriptive analytics				
Contents of the course	Introduction • Introduction to Data and Analytics in a Digital Context (Internet of Things) • Product Data Management for Design and Manufacturing (PLM Tools) • Typical data challenges (data quality, enrichment, integration of ERP & PLM data) • Preparing data for analytics (techniques to improve data quality, integration - ETL) • Advances in data visualization & related tools (4) Statistical Techniques for Analytics • Descriptive Statistics • Inferential statistics • Regression and ANOVA (8) Machine Learning • Algorithmic and model based frameworks • Supervised Learning and Classification Techniques (Discriminant analysis, Neural Nets) • Unsupervised learning and challenges of big data (14) Semantic, contextual and real-time • Semantic enrichment, integration • Semantic reasoning with ontologies (6)				
Textbooks	1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The elements of statistical learning, 2nd Edition, Springer, 2009, ISBN: 9780387848570. 2. Douglas C Montgomery and George C Runger, Applied statistics and probability for engineers, 4th edition, John Wiley & Sons, 2010, ISBN: 9781118539712				
References	1. NPTEL Online course on Data Analytics by IITM (http://nptel.ac.in/courses/110106064/) 2. Batini, Carlo and Scannapieco, Monica, Data Quality Concepts, Methodologies and Techniques, Springer, 2009, ISBN:9783540331728 3. Christopher Tong and D. Sriram, Artificial Intelligence in Engineering Design: Knowledge acquisition, commercial systems, and integrated environments, 1992, ISBN:9780080926025				

Course Title	Analog IC Design	Course No	To be filled by the office		
Specialization	Computer Engineering	Structure (IPC)	3	0	3
Offered for	DD	Status (Core / Elective)	Core		
Prerequisite	Electromagnetic Theory	To take effect from			
Course Objectives	To impart in depth knowledge in CMOS based analog circuits, performance metrics, design and analysis of operational amplifiers and transconductor amplifiers.				
Course Outcomes	Students would be able to design and analyze complex analog integrated circuits using industry level analog IC Design tools				
Contents of the course	Components and mismatch in CMOS process, models and Layout techniques. (3) MOS Transistor: Layout, model, Body effect, transit frequency. (3) Noise: Noise in Resistor, capacitor, and MOSFET, spectral density; noise, offset, swing limits and slew rate in single stage opamp. (8) Cascode current mirror, and Negative feedback amplifiers. (5) Cascade, Folded cacscode multi stage and Miller compensated op amps. (8) Fully differential circuits and opamp, common mode feedback circuits. (6) Loop gain and stability, PLL. (5) Voltage reference and regulator circuits. (4)				
Textbooks	1. Behzad Razavi, Design of Analog CMOS Integrated Circuits, 2nd edition McGraw-Hill Education, 2016, ISBN: 978-0-07-252493-2.				
References	1. Tony Chan Carusone, David A. Johns, Kenneth W. Martin, Analog Integrated Circuit Design, John Wiley & Sons, Inc., 2012, ISBN: 978-0-470-77010-8. 2. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, Analysis And Design Of Analog Integrated Circuits, 5th edition, John Wiley & Sons, Inc., 2009. ISBN: 978-0-470-24599-6. 3. Tertulien Ndjountche, CMOS Analog Integrated Circuits High-Speed And Power-Efficient Design, CRC Press Taylor & Francis Group, 2011. ISBN: r-13: 978-1-4398-5500-3.				

Course Title	Mechanical Design of Electronic Systems	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	3	0	3
Offered for	UG and DD	Status (Core / Elective)	Core		
Prerequisite	----	To take effect from			
Course Objectives	In this course students will learn the fundamentals of Thermodynamics, fluid flow principles and heat transfer concepts and their applications to electronic equipment and digital devices.				
Course Outcomes	By the end of this course students are expected to perform the mechanical design of electronic systems including packaging, managing thermal stress and heat dissipation.				
Contents of the course	Thermodynamics in electronics: System & control volume, State & process, Forms of work, heat and interaction, Thermodynamic laws and equilibrium, Enthalpy and Entropy, Cyclic & non-cyclic process, Concept of total energy, Derivation of general energy equation for control volumes, Steady & unsteady flow process, Thermal efficiency and COP, Irreversible process. (10) Fluid Mechanics: The concept of a fluid, Themophysical properties of fluids, Properties of velocity field, Bernoulli's Equation, Laminar and Turbulent flows, Fluid friction and Boundary layers, Flow in plates, across bodies, inside channels, Effect of roughness. (8) Heat transfer: Conduction heat transfer, General conduction equation, One dimensional steady state conduction, Fins and extended surfaces, Contact resistance, Transient conduction of lumped and distributed systems, Convective heat transfer, Dimensionless group for convection, Forced convection, Elements of free convection, Elements of radiation heat transfer. (10) Importance of thermal and fluid management in electronics: Resistance heating in electronics, Heat generation in printed circuit boards, Estimation of Cooling loads in devices and power transmission mediums, Thermal resistance concepts, Estimation of Junction temperature, Heat frames, Thermal conduction modules, Air and liquid cooled heat sinks, Thermoelectric power generation and refrigeration, Dielectric heating, Heat pipes and vortex tubes and their applications in electronic cooling, cooling fans, thermal stresses in electronics. (14)				
Textbooks	1. P. K. Nag, Engineering Thermodynamics, Tata McGraw Hill, 2005. 2. J. B. Jones and H. N. Shapiro, Fundamentals of Engineering Thermodynamics, John Wiley, 1999.				
References	1. M. J. Moran and H. N. Shapiro, Fundamentals of Engineering Thermodynamics, John Wiley, 2003. 2. R. E. Sonnag, C. Borgnakke and G. J. Van Wyan, Fundamentals of Thermodynamics, 6^{th} edition, John Wiley, 2003. 3. D. B. Spalding and E. H. Cole, Engineering Thermodynamics, Edward Arnold, 1976.				

Course Title	Digital System Testing and Testable Design	Course No	To be filled by the office		
Specialization	Computer Engineering	Structure (IPC)	3	0	3
Offered for	UG and DD	Status (Core / Elective)	Core		
Prerequisite	VLSI Design, Data Structures and Algorithms	To take effect from			
Course Objectives	The course aims at imparting skills required for the design of an efficient testable circuit and optimal test vectors to detect all.				
Course Outcomes	The student can able to model the faults in the combination and sequential circuits, can able perform the fault analysis and test pattern generation using ATPG algorithms, can able to build the testable circuit with test vectors.				
Contents of the course	Basic of Test and Role of HDL - Design and Test, Test Concerns, HDLs in Digital System Test, ATE Architecture and Instrumentation. (3) verilog HDL for Design and Test: Using Verilog in Design, Using Verilog in Test, Basic Structures of Verilog, Combinational Circuits, Sequential Circuits, Testbench Techniques and PLI Basics. (3) Fault and Defect Modeling: Fault Modeling, Structural Gate Level Faults, Issues Related to Gate Level Faults, Fault Collapsing in Verilog. (5) Fault Simulation Application and Methods: Fault Simulation, Fault Simulation Applications, Fault Simulation Technologies. (5) Test pattern Generation Methods and Algorithm: Test Generation Basics, Controllability and Observability, Random Test Generation. (4) Deterministic Test Generation Algorithms: Deterministic Test Generation Methods, Sequential Circuit Test Generation, Test Data Compaction. (4) Design for Test by Means of Scan: Making circuits Testable, Testability Insertion, Full Scan DFT Technique, Scan Architectures and RT level Scan Design. (4) Standard IEEE Test Access Methods: Boundary Scan Basics, Boundary Scan Architecture, Boundary Scan Test Instructions, Board Level Scan Chain Structure, RT level Boundary Scan and Boundary Scan Description Language. (4) Logic Built-in Self-test: BIST Basics, Test Pattern Generation, Output Response Analysis, BIST Architectures, RT Level Bist Design. (4) Test Compression: Test Data Compression, Compression Methods and Decompression Methods. (3) Memory Testing by Means of Memory BIST: Memory Testing, Memory Structure, Memory Fault Model, Functional Test Procedures and MBIST Methods. (3)				
Textbook	1. Zainalabedin Navabi, Test and Testable Design using HDL Models and Architecture, 1st edition, Springer, 2010, ISBN: 978-1-4419-7547-8.				
References	1. M. Abramovici, M. A. Breuer and A. D. Figriieta, Digital Systems Testing and Testable Design, Wiley-IEEE Press, 1994, ISBN: 978-0-7803-1062-9. 2. Niraj K. Jha, Sandeep Gupta, Testing of Digital Systems, 1st edition, Cambridge University Press, 2003. ISBN: 0521-77356-3 3. Michael L. Bushnell, Vishwani D. Agrawal, Essentials of Electronic Testing for Digital, Memory, and Mixed-Signal VLSI Circuits, Springer, 2004. ISBN: 7923-7991-8.				

Course Title	Analog and Digital IC Design Practice	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	0	3	2
Offered for	DD	Status (Core / Elective)	Core		
Prerequisite	----	To take effect from			
Course Objectives	To impart in depth knowledge in the design, simulation and analyses of CMOS based analog integrated circuits especially operational amplifiers and transconductor amplifiers and Digital integrated circuits.				
Course Outcomes	Students would be able to design and analyze complex analog and digitalintegrated circuits using industry level analog and digital IC Design tools.				
Contents of the course	Design of various analog building blocks Schematic and layout simulation of analog ICs using Cadence and Synopsys tools Design of digital building blocks Schematic and layout simulation of digital blocks using Cadence and Synopsys tools				
Textbooks	1. Behzad Razavi, Design of Analog CMOS Integrated Circuits, 2nd edition McGraw-Hill Education, 2016, ISBN: 978-0-07-252493-2 2. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, Digital Integrated Circuits, 2nd edition, Pearson, 2003, ISBN-10: 0130909963, ISBN-13: 978-0130909961.				
References	1. Tony Chan Carusone, David A. Johns, Kenneth W. Martin, Analog Integrated Circuit Design, John Wiley & Sons, Inc., 2012, ISBN: 978-0-470-77010-8. 2. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, Analysis And Design Of Analog Integrated Circuits, 5th edition, John Wiley & Sons, Inc., 2009. ISBN: 978-0-470-24599-6 3. Sung-Mo (Steve) Kang, Yusuf Leblebici, Chilwoo Kim, CMOS Digital Integrated Circuits Analysis & Design, 4th edition, Mcgraw-Hill Higher Education, 2014. ISBN-10: 0073380628. 4. Ronald Mehler, Digital Integrated Circuit Design Using Verilog and System Verilog, 1st edition, Newnes, 2015. ISBN: 978-0-12-408059-1.				

Course Title	Digital System Testing and Testable Design Practice	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	0	3	2
Offered for	DD	Status (Core / Elective)	Core		
Prerequisite	VLSI Design, Data Structures and Algorithms	To take effect from			
Course Objectives	To introduce the design, Implementation, verification and testing of digital systems .To enable the student to do the fault modeling.				
Course Outcomes	The student can able to model the faults in the combination and sequential circuits, can able perform the fault analysis and test pattern geneation using ATPG algorithms, Can able to build the testable circuit with test vectors.				
Contents of the course	Fault Modeling; Faiult Simulation; Test Generation Algorithms; ATPG, Testability Measures; Design for Testability and Scan Design; Built-in Self-test, Delay Testing; Wafer-level burn-in and Test; Memory Tesing; System-on-a-chip Test; Test Compression.				
Textbooks	1. Zainalabedin Navabi, Test and Testable Design using HDL Models and Architecture, 1st edition, Springer, 2010, ISBN: 978-1-4419-7547-8.				
References	1. M. Abramovici, M. A. Breuer and A. D. Figriieta, Digital Systems Testing and Testable Design, Wiley-IEEE Press, 1994, ISBN: 978-0-7803-1062-9. 2. Niraj K. Jha, Sandeep Gupta, Testing of Digital Systems, 1st edition, Cambridge University Press, 2003. ISBN: 0521-77356-3 3. Michael L. Bushnell, Vishwani D. Agrawal, Essentials of Electronic Testing for Digital, Memory, and Mixed-Signal VLSI Circuits, Springer, 2004. ISBN: 7923-7991-8.				

Course Title	Innovation Management	Course No	To be filled by the office		
Specialization	HMC	Structure (IPC)	2	0	2
Offered for	UG and DD	Status (Core / Elective)	Core		
Prerequisite	Entrepreneurship and Management	To take effect from			
Course Objectives	The objective of this course is to help engineers understand the innovation challenge from the entrepreneur and manager's perspective, i.e., both at a strategic level and organizational level. In other words, how do entrepreneurs and managers build organizations and ecosystems that can continuously generate and commercialize innovations, and how can they protect and enhance competitive advantage				
Course Outcomes	At the end of the course, students will have a familiarity with: • Topics in strategic innovation management, such as innovation networks, idea brokering, open innovation; • Innovation processes and structures such as R&D team, the pros and cons of various R&D organizational structures, and challenges of innovation in large and small firms; • Skills to identify, evaluate, and resolve a variety of issues relating to poor innovative performance in large firms as well as entrepreneurial firms.				
Contents of the course	Exploring innovations • Processes used to explore innovations along the technology, market and strategy dimensions as the innovation moves from idea to market. • Introduction to concepts such as Blue Ocean Strategy, Value Network, Disruptive Innovation, Open Innovation (8) Executing innovations • Structures and incentives to effectively allow talented individuals from different functions to execute innovation processes • Roles such as Chief Innovation or Technology Officer or Technology Evangelist (8) Exploiting innovations • Strategies to effectively exploit the value of innovation, including innovation platforms that include multiple products, portfolios, standards and business models (8) Renewing innovations • Processes, structures and strategies for exploring, executing and exploiting innovations that established firms can use to renew their innovation foundations in the face of potentially disruptive innovations. (8)				
Textbooks	1. Paul Trott, Innovation Management and New Product Development, Pearson, 5th Edition, 2011, ISBN: 9781447916079 2. Joe Tidd and John Bessant, Managing Innovation: Integrating Technological, Market and organizational change, Wiley, 2009, ISBN: 978-1-118-53859-3. 3. Burgelman R. Christensen C., Maidique M., Wheelwright S., Strategic Management of Technology and Innovation. McGraw Hill, 2007, ISBN: 9780071232302.				
References	1. Christensen, Clayton M., The innovator's solution: creating and sustaining successful growth, Harvard Business Press, 2003, ISBN: 9781578518524. 2. Naushad Forbes, and Wield David, From Followers to Leaders - Managing technology and innovation, Routledge, 2002, ISBN: 9780415251754.				

Course Title	VLSI System Design	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	3	0	3
Offered for	DD	Status (Core / Elective)	Core		
Prerequisite	----	To take effect from			
Course Objectives	To impart in depth knowledge in the design, simulation and analyses of complex VLSI circuits including both digital and analog building blocks.				
Course Outcomes	Students would be able to design and analyze complex VLSI systems using industry level Design and verification tools				
Contents of the course	Design Methodologies and implementation options of VLSI systems. (2) Designing Fast CMOS Circuits: Logical Effort and optimization. (2) Low Power Design Techniques. (2) Layout Designs: Design considerations for signal integrity, manufacturability and reliability (2) VLSI system design with HDL: Module concepts and modeling styles: Behavioral, dataflow, structural and mixed style modeling, Synthesis and verification of designs. (5) Datapath subsystem design: Combinational and sequential circuits, arithmetic circuits and interconnects; implementation of such systems with HDL and design verification including post layout simulations. (13) Interconnect Design: Design issues with Resistive, Capacitive and Inductive Parasitics, Interconnect techniques. (4) Power distribution and clock design: power distribution networks, clock generation and distribution networks. (4) Input/Output modules and ESD protection networks: Input buffers, output drivers, and ESD protection circuits. (4) Overall System design examples with HDL. (4)				
Textbooks	1. Ming-Bo Lin, Introduction to VLSI Systems A logic, circuit and Systems Perspective, CRC Press, 2012, ISBN: 978-1-4398-6859.				
References	1. Neil H. E. Weste, David Money Harris, CMOS VLSI Design, A Circuits and Systems Perspective, 4th edition, Addison-Wesley, Pearson, 2013, ISBN: 978-0-321-54774-3. 2. Liming Xiu, VLSI Circuit Design, Methodology Demystified, A conceptual Taxonomy, IEEE Press, A John Wiley & Sons, Inc., 2008, ISBN: 978-0-470-12742-1. 3. Hubert Kaeslin, Morgan Kaufman, Top-Down Digital VLSI Design, Elsevier, 2015, ISBN: 978-0-12-800730-3.				

Course Title	Digital Systems Engineering	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	3	0	3
Offered for	DD	Status (Core / Elective)	Core		
Prerequisite	----	To take effect from			
Course Objectives	To familiarize with the system-level electrical design of a digital system which determine the speed, reliability, and power of the system.				
Course Outcomes	The course would fill the gap between circuit design and logic design and help to develop techniques so as to keep up with the speed and power for the correct and efficient operation of any type of modern digital system.				
Contents of the course	Introduction to digital systems engineering and Packaging of digital systems. (5) Modeling and analysis of wires. (3) Power distribution and power distribution networks. (4) Noise in digital systems. (5) Advanced signaling techniques: Signaling over RC and LC interconnects, bidirectional and balanced signaling. (6) Timing conventions: open loop timing, closed loop timing and clock distribution. (4) Synchronization: synchronization strategies, synchronizer design, asynchronous design. (5) Signaling circuits: terminators, transmitter driver circuits, receiver circuits, ESD protection circuits. (5) Timing circuits: delay laine circuits, phase comparators, loop filters, clock aligners. (5)				
Textbooks	1. William J. Dally and John W. Poulton, Digital Systems Engineering, Cambridge University Press, 2008, ISBN: 0-521-59292-5.				
References	1. Howard W. Johnson and Martin Graham, High-Speed Digital Design, A Handbook of Black Magic, Prentice Hall, 1993, ISBN: 0-13-395724-1. 2. Tom Granberg, Handbook of Digital Techniques for High-Speed Design, Prentice Hall, 2004. ISBN-10: 013142291X. 3. Howard W. Johnson and Martin Graham, High-Speed Signal Propagation, Advanced Black Magic, Prentice Hall, 2003. ISBN: 0-13-084408-X 4. Douglas Brooks, PCB Currents: How They Flow, How They React, Pearson Prentice Hall, 2013. ISBN-10: 0133415333, ISBN-13:978-0133415339 5. Douglas Brooks, Signal Integrity Issues and Printed Circuit Board, Prentice Hall, 2012. ISBN-10: 0133359476, ISBN-13: 978-0133359473				

Course Title	Embedded System Design Practice	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	0	3	2
Offered for	DD	Status (Core / Elective)	Core		
Prerequisite	----	To take effect from			
Course Objectives	To familiarize with the design and implementation of different embedded systems with real time applications.				
Course Outcomes	The course would equip the students to deign embedded systems using ARM SoC platforms. They would alos be familiarized with the usage of RTOS for system design and IoT systems design.				
Contents of the course	Implementation of embedded systems, Embedded systems design using ARM Cortex, Hardware-software co-design, Real-time operating systems in embedded systems, IoT systems design.				
Textbooks	1. A. S. Berger, Embedded Systems Design: An Introduction to Processes, Tools, and Techniques, CMP, 2002. ISBN: 1578200733. 2. J. W. Valavano, Embedded Microcomputer Systems: Real Time Interfacing, 2nd edition, Create Space, 2006. ISBN 0534551629. 3. F. Vahid and T. Givargis, Embedded System Design: A Unified Hardware/Software Introduction, John Wiley & Sons, 2002. ISBN: 0471386782.				
References	1. J. W. Valavano, Embedded Systems: Introduction to Arm® Cortex(TM)-M Microcontrollers, 5th edition, Create Space, 2012, ISBN-10: 1477508996, ISBN-13: 978-1477508992. 2. J. W. Valavano, Embedded Systems: Real-Time Interfacing to Arm® Cortex(TM)-M Microcontrollers, 2nd edition, Create Space, 2011. ISBN-10: 1463590156, ISBN-13: 978-1463590154. 3. J. W. Valavano, Embedded Systems: Real-Time Operating Systems for Arm Cortex M, 2nd edition, Create Space, 2012. ISBN-10: 1466468866, ISBN-13: 978-1466468863				

Course Title	VLSI System Design Practice	Course No	To be filled by the office		
Specialization	Electronics Engineering	Structure (IPC)	0	3	2
Offered for	DD	Status (Core / Elective)	Core		
Prerequisite	----	To take effect from			
Course Objectives	To impart in depth knowledge in the design, simulation and analyses of complex VLSI circuits including both digital and analog building blocks.				
Course Outcomes	Students would be able to design and analyze complex VLSI systems using industry level Design and verification tools.				
Contents of the course	VLSI system design including combinational and sequential circuits, required analog blocks, arithmetic circuits and interconnects Implementation of such systems with Verilog, Verilog AMS, System Verilog. Generation of test benches and verification and Design verification including post layout simulations. Using commercially available building block (IP) to construct highly integrated systems break down of complex computational tasks into hardware and software components and build co-processor components for an FPGA based processor. Introduction to System-on-Chip, Register Transfer Language, Folding, Re-timing and Re-coding, Protocol and Interface, Basic SoC components, Assertion based Design, Network on chip and Bus Structures, SoC Engineering and associated Tools, Architectural design exploration, High Level Design Capture and Synthesis.				
Textbooks	1. Ming-Bo Lin, Introduction to VLSI Systems A logic, circuit and Systems Perspective, CRC Press, 2012, ISBN: 978-1-4398-6859.				
References	1. Seetharaman Ramachandran, Digital VLSI Systems Design: A Design Manual for Implementation of Projects on FPGAs and ASICs Using Verilog, Springer, 2007. ISBN-10: 1402058284, ISBN-13: 978-1402058288. 2. Naveed A. Sherwani, Algorithms for VLSI Physical Design Automation, 3rd edition, Springer, 1998. ISBN-10: 0792383931, ISBN-13: 978-0792383932. 3. Franco Maloberti, Analog Design for CMOS VLSI Systems, Springer, 2001. ISBN-10: 3540301461, ISBN-13: 978-3540301462				