Indian Institute of Information Technology Guwahati
B.Tech Course Curricula and Syllabus

B.Tech I Sem

Sem	Number	Course Name	L	T	P	C
I	MA101	Mathematics I	3	1	0	8
I	CS101	Computer Programming	3	1	0	8
I	CS110	Computer Programming Lab	0	0	3	3
I	EC101	Digital Design	3	1	0	8
I	EC110	Digital Design Lab	0	0	3	3
I	EC102	Electrical Circuit Analysis	3	1	0	8
I	CS102	IT Workshop I	2	0	3	7
I	HS101	English (Pass / Not Pass)	2	0	0	4
		Total	16	4	9	49
		Contact Hours / Week	29			

MA101 **Mathematics I** **3-1-0-8**

Syllabus:

Linear Algebra: Systems of linear equations and their solutions; vector space R^n and its subspaces; spanning set and linear independence; matrices, inverse and determinant; range space and rank, null space and nullity, eigenvalues and eigenvectors; diagonalization of matrices; similarity; inner product, Gram-Schmidt process; vector spaces (over the field of real and complex numbers), linear transformations.

Single Variable Calculus: Convergence of sequences and series of real numbers; continuity of functions; differentiability, Rolle's theorem, mean value theorem, Taylor's theorem; power series; Riemann integration, fundamental theorem of calculus, improper integrals; application to length, area, volume and surface area of revolution.

Texts:

1. G. Strang, *Linear Algebra and Its Applications*, 4th Edition (South Asian Edition), Wellesley-Cambridge Press, 2009(ISBN: 9788175968110).
2. S. R. Ghorpade and B. V. Limaye, *An Introduction to Calculus and Real Analysis*, Springer India, 2006 (ISBN: 9788181284853).

References:

1. D. Poole, *Linear Algebra: A Modern Introduction*, 2nd Edition, Brooks/Cole, 2005.
2. K. Hoffman and R. Kunze, *Linear Algebra*, 2nd Edition, Prentice Hall India, 2009.
3. R. G. Bartle and D. R. Sherbert, *Introduction to Real Analysis*, 3rd Edition, Wiley India, 2007.

CS101 **Computer Programming** **3-1-0-8**

Syllabus:

Procedural programming through Language 'C': Basic Syntax and Semantics, Variables, Types, Expressions, Assignment statements, Conditional and Iterative Control Structures, Simple I/O, Functions and parameter passing, Strings and string processing, Pointers and References, Structures, Recursion.

Algorithm development: Techniques of problem solving, Stepwise Refinement, Simple numerical examples, algorithms for searching and sorting, merging order lists. Examples taken from real-world applications involving data manipulation.

Texts:

1. **Bryon Gottfried**, Programming with C, McGraw Hill, Third edition (ISBN: 9780070145900).

References:

1. **Horowitz, Sahni**, and **Anderson-Freed**, Fundamentals of Data Structures in C, Universities Press, Second edition (ISBN: 9788173716058).
2. **Kernighan** and **Ritchie**, The C Programming Language, PHI, Second edition, (ISBN:9788120305960).

CS 110	Computer Programming Lab	0-0-3

Programming assignments on:

Basic Assignment Statement, Conditional and Iterative Control Structures, Some Numerical Examples, Functions and parameter passing, Array and String, Pointer, Structure, Recursion, Dynamic Memory Allocation, File Handling, Linked List, Sorting, Command Line Arguments

CS102	IT Workshop I	2-0-3-7

Aim: This is intended to act as an introductory course which aims to provide theory and hands on experience on general Linux system. This would enable the students to use Linux systems for their day to day activities.

Also, the students will be able to create basic database backed web applications through simple tools like HTML, PHP, MySQL. The integrated development environment to be used is phpMyAdmin.

Syllabus:

Overview of Linux system and basic commands;

Basic Linux Administration---logging, authentication, network setup, mail system, backup and archiving etc;

Linux File system, vi editor, Open-office, Environment variables, Filters,

Basic Shell Programming using Bash.

Simple Database Driven Web Site: HTML, php, and MySQL (using phpMyAdmin)

Texts:

1. **S. Das**, *Unix System V.4 Concepts and Applications*, 4th Edition, Tata McGraw-Hill, 2006.
2. **Timothy Boronczyk**, **Elizabeth Naramore**, **Jason Gerner**,**Yann Le Scouarnec**, **Jeremy Stolz** and **Michael K. Glass**, *Beginning PHP6, Apache, MySQL Web Development*, Wiley India Pvt. Ltd., 2009.

References:

1. **Brian W. Kernighan** and **Rob Pike**, *The UNIX programming environment*, 1st Edition, PHI Learning, 1984, (Reprint 2011).
2. **Bruce Lawson** and **Remy Sharp**, *Introducing HTML5*, 2nd Edition, Pearson, 2012.

EC101	Digital Design	3-1-0-8

Syllabus:

Binary Arithmetic: Representation of integers, fractions and signed numbers in different codes; Addition and subtraction operations on binary-coded numbers; Algorithms for performing multiplication and division.

Combinational Circuits: Boolean expressions and their minimization using algebraic identities; Karnaugh map representation and minimization of Boolean functions using K-map; Two-level realizations using gates -- AND-OR, OR-AND, NAND-NAND and NOR-NOR structures.

Combinational Circuits using MSI Modules: Multifunction gates, Multi-bit adder, Multiplexers, Demultiplexers, Decoders, Programmable ALU; Multiplexer-based realization of K-maps; Combinational circuit design using multiplexers and gates.

Sequential Circuits: Latches and Flip-flops; Ripple counters using T flip-flops; Synchronous counters; Shift Registers; Ring and MLS counters; Sequence generator using J-K / D flip-flops.

Memories, Microprocessors and Microcomputer Organization: RAM, ROM, PAL, PLA, Introduction to microprocessor and microcomputer organization; Central processing unit (CPU), memory and input/output devices.

Texts:

1. M. Morris Mano, Digital Logic and Computer Design, 11th Edition, Pearson Education, 2009.

2. R. S. Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085

References:

3. Ronald J Tocci, Neal S Wisdmer and Gregory L. Moss, Digital Systems: Principle and Applications, 10th Edition, Pearson Education, 2011.
4. Albert Paul Malvino, Donald P Leach and Gautam Saha, Digital Principles and Applications 7th Edition, Tata McGraw - Hill Education, 2011.

EC110	**Digital Design Lab**	**0-0-3-3**

Familiarization with digital IC family 74LS00 and 74HS00. Familiarization with laboratory equipments – voltage generator, function generator, oscilloscope. Study of digital IC characteristics – input voltage, input current, output voltage, output current, fan out, noise margin and propagation delay.

Combinational logic circuits: Implementation of Boolean functions using logic gates; Arithmetic operations using logic gates; Implementation of Multiplexers, Demultiplexers, Encoders, Decoders; Implementation of Boolean functions using Multiplexers/Decoders

Study of sequential logic circuits: Implementation of flip flops, Implementation of counters, Implementation of sequence generators

Microprocessor: Programming in 8085 microprocessor

EC102	**Electrical Circuit Analysis**	**3-1-0-8**

Syllabus:

Basic components and electric circuits: charge, current, voltage and power, voltage and current sources, Ohm's law;
Voltage and current laws: nodes, paths, loops and branches, Kirchoff's current law, Kirchoff's voltage law, independent sources, voltage and current division;
Basic nodal and mesh analysis: nodal analysis, supernode, mesh analysis, supermesh;
Network theorems: linearity and superposition, source transformations, Thevenin and Norton equivalent circuits, maximum power transfer;
RL and RC circuits: source-free RL circuit, source-free RC circuit, unit-step function, driven RL circuits, natural and forced response, driven RC circuits;
RLC circuit: source-free parallel circuit, overdamped parallel RLC circuit, critical damping, underdamped parallel RLC circuit, source-free series RLC circuit, complete response of the RLC circuit;
Sinusoidal steady-state analysis: forced response to sinusoidal functions, complex forcing function, phasor, phasor relationship for R, L and C, impedance, admittance, phasor diagrams, instantaneous power, average power, apparent power and power factor, complex power;
Polyphase circuits: polyphase systems, single-phase three-wire systems, three-phase Y-Y connection, delta connection, power measurement in three-phase systems;
Magnetically coupled circuits: mutual inductance, energy considerations, linear transformer, ideal transformer;
Frequency response: parallel and series resonance, Bode plots, Filters;
Two-port networks: one-port networks, admittance parameters, impedance parameters, hybrid parameters, transmission parameters.

Texts:

1. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, Tata-McGraw-Hill Publishing Company Limited, 7th / 8th Edition, 2010/ 2012.

References:

1. Bruce Carlson, Circuits: Engineering Concepts and Analysis of Linear Electric Circuits, 2nd Reprint, Thomson Asia Pvt. Ltd., 2006.
2. R. A. De Carlo and P. M. Lin, Linear Circuit Analysis, 2nd Edition, Oxford University Press, 2001.

HS101	**English**	**2-0-0-4**

Pass / Not Pass

The course should enable the learners to

- Read and understand any type of text on her/his own
- Comprehend obvious and implied meanings of the text
- Speak with relative fluency with the target of achieving accuracy

- Write with clarity and coherence, and creatively when needed, to express assimilated ideas and complex thought patterns
- Communicate effectively in academic presentations and business communication, as a second language or a language for specific purposes

Syllabus/ Content:

The components of the course are: the four language skills – listening, reading, writing and speaking; integration of the four skills through grammar, vocabulary and literature; academic writing; skills of presentation

The following texts (and the select works) will act only as facilitators in the fulfilment of the aims and objectives mentioned above. The focus is on an 'emergent' syllabus that emerges from the ongoing process of the teaching-learning situation in the field of English Language Teaching (ELT), catering to the learners' needs and space for developing original and critical thinking. It will take into perspective the current know-how of the methods of ELT.

Prose:

- "Letter to my Daughter" by Jawaharlal Nehru
- "An Astrologer's Day" by R.K.Narayan
- "Money and the Englishman" by Nirad C. Chaudhuri

Poem:

- "Pied Beauty" by Gerard Manley Hopkins
- "The Villain" by William H. Davies
- "Magic of Love" by Helen Farries
- "Sonnet CXVI" by William Shakespeare
- "The Charge of the Light Brigade" by Alfred, Lord Tennyson

Texts:

1. **Menon, Madhavi**, ed. *Prose for Our Times*. 2004. Kolkata: Orient BlackSwan, 2004.
2. **Sriraman, T.,** and **N. Krishnaswami,** eds. *Verses for a Multiverse: Poems for the New Generation*. Hyderabad: The English and Foreign Languages University; Orient BlackSwan, 2011.
3. **Wood, F.T.** *A Remedial English Grammar for Foreign Students*. New Delhi: Macmillan, 1965.
4. **Arora, V.N.,** and **Lakshmi Chandra**. *Improve Your Writing.* New Delhi: OUP, 1981.
5. **Anderson, Marilyn, Pramod K. Nayar**, and **Madhucchanda Sen**. *Critical Reasoning, Academic Writing and Presentation Skills*. Rev. ed. New Delhi: Longman-Pearson, 2010.

References:

1. **Mukherjee, Meenakshi**. *Let's Go Home and Other Stories*. New ed. Hyderabad: Orient BlackSwan, 2009.
2. **Krishnaswami, N.,** and **T. Sriraman**. *Current English for Colleges*. Chennai: Macmillan, 1990.
3. **Krishnaswami, N.,** and **T. Sriraman**. *Creative English for Communication*. 2nd ed. New Delhi: Macmillan, 2009.
4. **Swan, Michael**. *Practical English Usage*. 3rd ed. Oxford: OUP, 2005.
5. **Swan, Michael**, and **Catherine Walter**. *Oxford English Grammar Course: Advanced*. Oxford: OUP, 2011.
6. *Oxford Collocations Dictionary: For Students of English*. 2nd ed. Oxford: OUP, 2009.

Methodology: The teacher will be a facilitator rather than a 'giver' of knowledge in the communicative language teaching process. This should help the development of independence in learners as active participants and innovators of practices of language use.

B.Tech II Sem

Sem	Number	Course Name	L	T	P	C
II	MA102	Mathematics II	3	1	0	8
II	CS103	Data Structures	3	1	0	8
II	CS111	Data Structures Lab	0	0	3	3
II	CS104	Computer Organization	3	1	0	8
II	EC103	Basic Electronic Circuits	3	1	0	8
II	EC111	Basic Electronics Lab	0	0	3	3
II	HS102	Economics	3	0	0	6
		Total	15	4	6	44
		Contact Hours / Week	25			

MA102 **Mathematics II** **3-1-0-8**

Syllabus:

Multivariable Calculus: Vector functions of one variable – continuity, differentiation and integration; functions of several variables - continuity, partial derivatives, directional derivatives, gradient, differentiability, chain rule; tangent planes and normals, maxima and minima, Lagrange multiplier method; repeated and multiple integrals with applications to volume, surface area, moments of inertia, change of variables; vector fields, line and surface integrals; Green's, Gauss' and Stokes' theorems and their applications. Ordinary Differential Equation: First order differential equations - exact differential equations, integrating factors, Bernoulli equations, existence and uniqueness theorem, applications; higher-order linear differential equations - solutions of homogeneous and non-homogeneous equations, method of variation of parameters, series solutions of linear differential equations, Legendre equation and Legendre polynomials, Bessel equation and Bessel functions of first and second kinds. Laplace and inverse Laplace transforms; properties, convolutions; solution of ODE by Laplace transform. Systems of first-order equations, two-dimensional linear autonomous system, phase plane, critical points, stability.

Texts:

1. G. B. Thomas, Jr. and R. L. Finney, *Calculus and Analytic Geometry*, 9th Edition, Pearson Education India, 1996.
2. S. L. Ross, *Differential Equations*, 3rd Edition, Wiley India, 1984.

References:

1. H. Anton, I. C. Bivens and S. Davis, *Calculus*, 10th Edition, Wiley, 2011.
2. T. M. Apostol, *Calculus*, Volume 2, 2nd Edition, Wiley India, 2003.
3. W. E. Boyce and R. C. Di Prima, *Elementary Differential Equations and Boundary Value Problems*, 9thEdition, Wiley India, 2009.
4. E. A. Coddington, *An Introduction to Ordinary Differential Equations*, Prentice Hall India, 1995.

CS103 **Data Structures** **3-1-0-8**

Syllabus: Performance of algorithms: space and time complexity, asymptotics; Fundamental Data structures: linked lists, arrays, matrices, stacks, queues, binary trees, tree traversals; Algorithms for sorting and searching: linear search, binary search, insertion-sort, selection sort, bubble-sort, quicksort, mergesort, heapsort, shellsort; Priority Queues: lists, heaps, binomial heaps, Fibonacci heaps; Graphs: representations, depth first search, breadth first search; Hashing: separate chaining, linear probing, quadratic probing; Search Trees: binary search trees, red-black trees, AVL trees, splay trees, B-trees; Strings: suffix arrays, tries; Randomized data structures: skip lists.

Text:

1. Seymour Lipschutz, Data Structures with C, SCHAUM SERIES, Tata McGraw-Hill, 1st edition, 2010

References:

1. M A Weiss, Data Structures and Problem Solving Using Java, Addison-Wesley, 1997.
2. A M Tannenbaum, Y Langsam and M J Augenstein, Data Structures Using C++, Prentice Hall India, 1996.
3. A H Aho, J E Hopcroft and J Ullman, Data Structures and Algorithms, Addison-Wesley, 1987.
4. Robert Sedgewick, Algorithms in C++ Parts 1-4, Pearson Education, Third Edition, 1998.
5. Robert Sedgewick, Algorithms in C++ Part 5, Pearson Education, Third Edition, 2002.

CS111 **Data Structure Lab** **0-0-3-3**

Programming assignments on:

Using C Programming Language, Implementation of linked lists, stacks, queues, binary trees, tree traversals:

Implementation of algorithms for sorting: Insertion-sort, selection sort, bubble-sort, quicksort, mergesort, heapsort, shellsort; Implementation of algorithms for searching: linear search, binary search.

Assignments on Priority Queues: lists, heaps, binomial heaps, Fibonacci heaps; Graphs: representations, depth first search, breadth first search; Hashing: separate chaining, linear probing, quadratic probing;

Assignments on search Trees: binary search trees, red-black trees, AVL trees, splay trees, B-trees; Strings: suffix arrays, tries; Randomized data structures: skip lists.

CS104	**Computer Organization**	**3-1-0-8**
Syllabus: Basic Computer Architecture; ARM Instruction Set and Assembly Language Programming; Computer Arithmetic: integer addition (carry look-ahead), multiply (booth's algorithm), division (restoring and non-restoring), floating point arithmetic; Processor Design – single cycle, multi-cycle; pipelined design; memory architecture (static and Dynamic RAM; row and column addressing; interleaving, banks), cache memory (direct, set-associative, multi-level); storage basics: disks, tapes, printers, displays, flash memory; Buses (daisy chaining; synchronous and asynchronous; point-to-point; PCI, PCIe); Intel Sandy Bridge Archtecture; Intel X86 instruction set introduction.		
Text: David A. Patterson and John L. Hennesy, Computer Organization and Design: The Hardware Software Interface, ARM Edition, 4th edition, Elesevier India, 2010.		

EC103	**Basic Electronic Circuits**	**3-1-0-8**

Objective - After pursuing this course the students shall be able to: 1. develop simple electronic circuits, 2. analyze the behavior of basic electronic circuits, 3. use operational amplifiers as basic building blocks of analog electronic circuits

Course Topics - Examples of Electronic Systems: Music System, Radio, Television,

D-C power supply: Diode characteristics, half-wave and full wave rectifiers, shunt capacitor filter, voltage regulator, regulated D-C power supply.

Amplifier: Amplifier parameters, controlled source models, classification, the operational amplifier (OP-AMP) as a linear active device, the VCVS model of an op-amp, different amplifier configurations using op-amp, frequency response of op-amp and op-amp based amplifiers.

Filter: Concepts of low-pass, high-pass and band-pass filters, ideal (brick-wall) filter response, frequency response of simple RC filters, active RC filters using Op-amp.

Oscillator: Effects of negative and positive feedback of an amplifier, condition of harmonic oscillation, RC and LC oscillator circuits.

Comparator: Op-amp as a comparator, digital inverters (TTL/CMOS) as comparators, comparator with hysteresis, Schmitt trigger using Op-amp, 555 timer as a two dimensional comparator.

Waveform generators: Concept of bistable, monostable and astable circuits, timer and relaxation oscillator based on comparator and RC timing circuit, square wave generator using 555 timer, crystal clock generator.

Analog-Digital conversion: Digital to Analog Converter (DAC) using binary resistor scheme, R-2R ladder DAC, DAC using switched current resources, Analog to Digital converter (ADC) using capacitor charge/discharge: single-slope and dual-slope ADCs, ADC using counter and DAC, ADC using successive approximation.

Outcome - As a result of this course students become acquainted with basics of electronic circuits at least at the system integration level.

Texts:

1. Adel S. Sedra, Kenneth C. Smith & Arun N. Chandorkar, Microelectronic Circuits, International Version 6th Edition, 2013, Oxford University Press India

EC111	**Basic Electronics Lab**	**0-0-3-3**
Experiments using diodes: diode characteristics, design and analysis of half-wave and full-wave rectifier circuits without and with filter, clipping circuits, clamper circuits, experiments using operational amplifier: inverting amplifier, non-inverting amplifier,		

voltage follower, integrator, differentiator, comparators, Multivibrators, Wien's Bridge Oscillator, first-order filters, D/A and A/D converters.

HS102	**Economics**	**3-0-0-6**

Syllabus:

Definition of economics, subject matter, scope and nature of economics; Basic concepts: goods, utility, wealth, value, consumption, human wants; Law of diminishing marginal utility; Demand: concept, law and elasticity; Supply: concept, law and elasticity; Theory of the firm - Production functions in the short and long run; Market Structure- Competitive market; Imperfect competition (Monopoly, Monopolistic and Oligopoly)- Pricing in different markets. Factors of production; National income: definition, concepts and measurement; Costs and revenue concepts; Economic system: basic ideas; Money: evolution, definition and its function; Banking: central bank and its function; Commercial bank: functions, balance sheet and essentials of sound banking; Public finance: public Vs private finance, taxes, Budget; Economic growth and development: definitions, measurement, obstacles and basic requirement.

Texts:

1. J. K. Mitra, Economics, World Press Pvt. Ltd., 1998.

References:

1. P .A. Samuelson and W. D. Nordhans, Economics, Mc Graw Hill Inc., 1995
2. S. B.Gupta, Monetary Economics, S. Chand & Co. Ltd., 2002.
3. B. P.Tyagi, Public Finance, Jai Prakash Nath & Co., 1998.
4. M. L. Jhingan, The Economics of Development and Planning, Vrinda Publ., 1997.

B.Tech III Sem

CSE:

Sem	Number	Course Name	L	T	P	C
III	MA203	Mathematics III	3	0	0	6
III	MA205	Discrete Mathematics	3	0	0	6
III	CS201	Algorithms	3	0	0	6
III	CS251	IT Workshop II	2	0	3	7
III	CS231	Operating Systems	3	0	0	6
III	CS232	Operating Systems Lab	0	0	4	4
III	SC201	Physics I	3	0	0	6
III	HS	HSS Course	3	0	0	6
		Total	20	0	7	47
		Contact Hours / Week	27			

MA205	**Discrete Mathematics**	**3-0-0-6**

Syllabus:
Set theory: sets, relations, functions, countability
Logic - formulae, interpretations, methods of proof, soundness and completeness in propositional and predicate logic
Number theory: division algorithm, Euclid's algorithm, fundamental theorem of arithmetic, Chinese remainder theorem, special numbers like Catalan, Fibonacci, harmonic and Stirling
Combinatorics: permutations, combinations, partitions, recurrences, generating functions
Graph Theory:- paths, connectivity, subgraphs, isomorphism, trees, complete graphs, bipartite graphs, matchings, colourability, planarity, digraphs
Algebraic Structures: semigroups, groups, subgroups, homomorphisms, rings, integral domains, fields, lattices and Boolean algebras

Texts:

1. C. L. Liu, *Elements of Discrete Mathematics*, 2nd Ed., Tata McGraw-Hill, 2000.
2. K. H. Rosen, *Discrete Mathematics and its Applications*, 7th Ed., Tata McGraw-Hill, 2009.

References:

1. J. P. Tremblay and R. P. Manohar, *Discrete Mathematical structures with Applications to Computer Science*, Tata McGraw-Hill, 2001.
2. R. C. Penner, *Discrete Mathematics: Proof Techniques and Mathematical Structures*, World Scientific, 1999.
3. R. L. Graham, D. E. Knuth, and O. Patashnik, *Concrete Mathematics*, 2nd Ed., Addison-Wesley, 1994.
4. J. L. Hein, *Discrete Structures, Logic, and Computability*, 3rd Ed., Jones and Bartlett, 2010.

CS201	**Algorithms**	**3-0-0-6**

Syllabus : Models of Computation: space and time complexity measures, lower and upper bounds; Design techniques: the greedy method, divide-and-conquer, dynamic programming, backtracking, branch and bound; Lower bound for sorting; Selection; Graph Algorithms: connectivity, topological sort, shortest paths, minimum spanning trees, network flow; The disjoint set union problem; String matching; NP-completeness; Introduction to approximate algorithms and Randomized algorithms.

Texts :

1. T H Cormen, C E Leiserson, R L Rivest and C Stein, Introduction to Algorithms, MIT Press, 2001.

References :

1. Jon Kleinberg and Eva Tardos, Algorithm Design, Addison Wesley, 2005

2. A Aho, J E Hopcroft and J D Ullman, The Design and Analysis of Computer Algorithms, Addison-Wesley, 1974.
3. S Sahni, Data Structures, Algorithms and Applications in C++, McGraw-Hill, 2001.
4. M T Goodrich and R Tamassia, Algorithm Design: Foundations, Analysis and Internet Examples, John Wiley & Sons, 2001.

CS 251	IT Workshop II	2-0-3-7

Syllabus: Programming in Java;

Java Basic: Why Java, Basic Syntax and Semantics, Variables, Types, Expressions, Assignment statements, Conditional and Iterative Control Structures;

Object Oriented Programming with Java:objects and classes, methods and messages, abstraction and encapsulation, inheritance, Interfaces, abstract classes, polymorphism, access specifiers, static members, constructors, finalize method

Java concept: Exception handling, Threads, packages, Array and String, Handling I/O, Files, Networking

Database Programming with Java: JDBC architecture, Establishing connectivity and working with connection interface, Working with statements, Creating and executing SQL statements, Working with Result Set

JSP: java server pages (JSP); SQL basics; Use of Mysql and a web server using JSP for assignments.

Texts:

1. **Harvey Deitel, Paul Deitel**: Java How to Program, 9/e, Prentice Hall India

References:

1. **The online Java tutorial** http://docs.oracle.com/javase/tutorial/
2. **Y. Daniel Liang**: Introduction to Java Programming, 9/e, Pearson Publishing
3. **Herb Schildt**: Java The Complete Reference 8/e Tata Mcgraw Hill Education

ECE:

Sem	Number	Course Name	L	T	P	C
III	MA203	Mathematics III	3	0	0	6
III	EC201	Analog Circuits	3	1	0	8
III	EC202	Analog Circuits Lab	0	0	3	3
III	EC241	Signals and Systems	3	0	0	6
III	EC242	Signals and Systems Lab	0	0	3	3
III	CS231	Operating Systems	3	0	0	6
III	CS232	Operating Systems lab	0	0	4	4
III	SC201	Physics I	3	0	0	6
III	HS	HSS Elective	3	0	0	6
		Total	18	1	10	48
		Contact Hours / Week	29			

EC201	Analog Circuits	3-1-0-8

Syllabus:

Review of working of BJT, JFET and MOSFET and their small signal equivalent circuits both for low and high frequencies; Different types of biasing for BJT and MOSFET, Bias Compensation, Thermal Stabilization; Single stage amplifiers CE-CB-CC and CS-CG-CD; Multistage amplifiers: RC Coupled, Transformer Coupled, Direct Coupled amplifier and their frequency responses; Differential amplifiers: DC and small signal analysis, CMRR, current mirrors, active load and cascade configurations, frequency response; case study: 741 op-amp – DC and small signal analysis, frequency response, frequency compensation, GBW, phase margin, slew rate, offsets; Feedback amplifiers: basic feedback topologies and their properties, analysis of practical feedback amplifiers, stability; Power Amplifiers: class A, B, AB, C, D, E stages, output stages, short circuit protection, power transistors and thermal design considerations, Tuned Amplifier; Filter: filter approximations: Butterworth, Chebyshev and elliptic, first order and second order passive/active filter realizations.

Text:

1. Adel S. Sedra, Kenneth C. Smith &Arun N. Chandorkar, Microelectronic Circuits, International Version 6th Edition, Oxford University Press India, 2013.

References:

1. P. Gray, P. Hurst, S. Lewis and R. Meyer, Analysis &Design of Analog Integrated Circuits, 5/e, Wiley, 2009.
2. Millman,Halkias, Parikh – Integrated Electronics, 2/e,Penguin Books Ltd, 2009.
3. Sergio Franco - Design with Operational Amplifiers and Analog Integrated Circuits, 3/e, McGraw Hill Book Company, 2001.

EC202	Analog Circuits Lab	0-0-3-3

Experiments using BJTs: BJT characteristics in different configurations, hybrid parameters, single-stage and multistage BJT amplifiers, effect of negative feedback; experiments using FETs: FET characteristics, FET amplifiers; current mirror, differential amplifier, filters, voltage regulators.

EC241	Signals and Systems	3-0-0-6

Signals: Signal Basics, Elementary signals, classification of signals; signal operations: scaling, shifting and inversion; signal properties: symmetry, periodicity and absolute integrability; Sampling and Reconstruction, Sampling and Nyquist theorem, aliasing, signal reconstruction: ideal interpolator, zero-order hold, first-order hold; Sinc function, Practical reconstruction.
Systems: classification of systems; Time-Domain Analysis of Continuous-Time Systems; system properties: linearity, time/shift-invariance, causality, stability; continuous-time linear time invariant (LTI) and discrete-time linear shift invariant (LSI) systems: impulse response and step response; response to an arbitrary input: convolution; circular convolution; system representation using differential equations; Eigen functions of LTI/ LSI systems, frequency response and its relation to the impulse response.
Signal representation: signal space and orthogonal basis; continuous-time Fourier series and its properties; continuous-time Fourier transform and its properties; Parseval's relation, time-bandwidth product; discrete time fourier series; discrete-time Fourier transform and its properties; relations among various Fourier representations. Linear Convolution using DFT. Fast Fourier Transform (FFT); Laplace transform and properties, Inverse Laplace Transform by Partial Fraction and Z-transform: definition, region of convergence, properties; transform-domain analysis of LTI/LSI systems, system function: poles and zeros; stability, inverse Z-Transform by Partial Fraction.

Text:

1. M. J. Roberts, "Fundamentals of Signals and Systems", 1st Edition, Tata McGraw Hill, 2007.

References::

1. A.V. Oppenheim, A.S. Willsky and H.S. Nawab, "Signals and Systems", 2nd Edition Prentice Hall of India,2006.
2. B. P. Lathi,"Signal Processing and Linear Systems", 1st Edition , Oxford University Press, 1998.
3. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th Edition, Prentice Hall, 1998.
4. Simon Haykin, Barry van Veen, "Signals and Systems", 2nd Edition, John Wiley and Sons, 1998.

EC242	Signals and Systems Lab	0-0-3-3

Matlab code generation and execution for the following modules: Generation of the basic continuous and discrete time signals, Basic Mathematical Operations on Signals, Convolution-All types, Continuous and Discrete time fourier series, Continuous and Discrete time fourier Transform, Sampling, Laplace transform and applications, Z transform and applications, Application of Matlab in Image Processing.

Common courses:

MA203	Mathematics III	3-0-0-6

Syllabus:

Introduction to probability: mathematical background - sets, set operations, sigma and Borel fields; classical, relative-frequency and axiomatic definitions of probability; conditional probability, independence, total probability, Bayes rule; repeated trials;
Random variables: cumulative distribution function, continuous, discrete and mixed random variables, probability mass function, probability density functions; functions of a random variable; expectation - mean, variance and moments; characteristic and moment-generating functions; Chebyshev, Markov and Chernoff bounds; special random variables-Bernoulli, binomial, Poisson, uniform, Gaussian and Rayleigh; joint distribution and density functions; Bayes rule for continuous and mixed random variables; joint moments, conditional expectation; covariance and correlation- independent, uncorrelated and orthogonal random variables; function of two random variables; sum of two independent random variables; random vector- mean vector and covariance matrix, multivariate Gaussian distribution; Vector-space representation of Random variables, laws of large numbers, central limit theorem;

Random process: discrete and continuous time processes; probabilistic structure of a random process; mean, autocorrelation and autocovariance functions; stationarity- strict-sense stationary and wide-sense stationary (WSS) processes: autocorrelation and cross-correlation functions; time averages and ergodicity; spectral representation of a real WSS process-power spectral density, cross-power spectral density, Wiener Khinchin theorem, linear time-invariant systems with WSS process as an input-time and frequency domain analyses; spectral factorization theorem;
Examples of random processes: white noise, Gaussian, Poisson and Markov processes, Basics of Queuing Theory, Characteristics of queuing systems.

Texts:

1. Papoulis and S.U. Pillai, Probability Random Variables and Stochastic Processes, 4/e, McGraw-Hill, 2002.
2. A. Leon Garcia, Probability and Random Processes for Electrical Engineering, 2/e, Addison-Wesley, 1993.

References:

1. H. Stark and J.W. Woods, Probability and Random Processes with Applications to Signal Processing, 3/e, Prentice Hall, 2002.
2. John J. Shynk, Probability, Random Variables, and Random Processes: Theory and Signal Processing Applications, 1/e, Wiley publications, 2012.

CS 231	**Operating Systems**	**3-0-0-6**

Syllabus: Process Management: process, thread, scheduling; Concurrency: mutual exclusion, synchronization, semaphores, deadlocks; Memory Management: allocation, protection, hardware support, paging, segmentation; Virtual Memory: demand paging, allocation, replacement, swapping, segmentation, TLBs; File Management: naming, file operations and their implementation; File Systems: allocation, free space management, directory management, mounting; I/O Management: device drivers, disk scheduling, Basics of Security

Text:

1. Silberschatz, A. and Galvin, P. B. Operating System Concepts. 8/e. Wiley, 2008.

References:

1. Stalling, W. Operating Systems: Internals and Design Principles. 6/e. Pearson, 2008.
2. Tanenbaum, A. S. Modern Operating System. 3/e. Pearson, 2007.
3. Dhamdhere, D. M. Operating SystemsA Concept Based Approach, McGrawHill, 2008

CS 232	**Operating Systems Lab**	**0-0-4-4**

Programming assignments on:

1. Linux Programming with System Calls
2. Critical Section Problems
3. Scheduling
4. Memory Management
5. File Systems

Alternative, to build parts of an OS kernel. Use of a teaching package such as Nachos, Pintos.

SC201	**Physics I**	**3-0-0-6**

Classical Mechanics: Motion in plane polar coordinates; Dynamics of system of particles and conservation principles; Rotation about fixed axis; Rigid body dynamics; Non-inertial frames and pseudo forces. [14 Lectures]

Modern Physics: Special Theory of Relativity - Michelson-Morley experiment, Einstein postulates, Lorentz transformations, length contraction and time dilation, twin paradox, relativistic momentum and energy; Quantum Mechanics - De Broglie's hypothesis, uncertainty principle, Schrodinger equations, probability and normalizaiton, expectation values, Eigenvalues and eigenfunctions, particle in a box, potential barrier, harmonic oscillator. [16 Lectures]

Optics: Review of wavefront and Huygen's principle; Interference by the division of wavefront – Yount's double slit, Fresnel biprism, Lloyd's mirror arrangement; interference by division of amplitude – plane parallel film illuminated by plane wave, non-reflecting films, plane film illuminated by a point source, colour of thin films, Newton's Rings, Michelson interferometer; Single slit and two slits Fraunhoffer diffraction; diffraction grating. [12 Lectures]

Texts:

1. D. Kleppner and R. J. Kolenkow, *An Introduction to Mechanics*, Tata McGraw-Hill, 2000.
2. Kenneth S. Krane, Mondern Physics, John Wiley &Sons, Inc, 3rd Edition, 2012
3. F. A. Jenkins and H. E. White, *Fundamentals of Optics*, McGraw-Hill, 1981.

References:

1. J.M. Knudsen and P.G. Hjorth, *Elements of Newtonian Mechanics*, Springer, 1995
2. A. Beiser, *Concepts of Modern Physics*, Tata McGraw-Hill, New Delhi, 1995.
3. Ajoy Ghatak, Optics, Tata McGraw-Hill, New Delhi, 1992

HSS Course:

HS201	**Introduction to Linguistics**	**3-0-0-6**

Aim:

1. To introduce the major branches of Linguistics
2. To enable students to appreciate the scientific nature of the study of language
3. To provide students with an understanding of the basic features and core concepts within each sub-field of Linguistics
4. To provide an academic base to students with which they can take a multi-pronged approach to the study of language

Syllabus:

Historical Linguistics, Linguistic Typology: Language universals; the major language families; types of languages in the world (isolating, agglutinating, polysynthetic etc.); languages of India

Phonetics, Phonology, Morphology: The production of speech; the organs of speech; a phonetic description of speech sounds (vowels and consonants and their place and manner of articulation); combination of speech sounds; minimal pairs; free and bound morphemes; word building strategies; inflectional and derivational morphology

Syntax, Semantics: The structure of sentences and their constituents; basic sentence patterns; the subject, verb and object/ complement; IC Analysis; word meaning and sentence relations; sense relations (synonymy, homonymy etc)

Sociolinguistics, Applied Linguistics, Neurolinguistics: What is language/ mother-other tongue?; language, society and variation; basic concepts: language/ dialect/ sociolect/ idiolect/ style/ context/ register; methods of teaching language; language and the brain

Texts:

1. **Murray, T. 1995.** *The Structure of English: Introduction to Phonetics, Phonology and Morphology.* Boston: Allyn & Bacon
2. **Mathews, P.H. 2003** *Linguistics: A Very Short Introduction*. Oxford University Press

References:

1. **Fromkin, V., Rodman R. and Hyams, N. 2003.** *An Introduction to Language*. Heinle and Thompson.
2. **Radford, A., Atkinson, M., Britain, D., Clahsen, H. and Spenser, A. 2009** *Linguistics: An Introduction*. Cambridge University Press.
3. **Additional reference material to be provided by Instructor**

B.Tech IV Sem

CSE:

Sem	Number	Course Name	L	T	P	C
IV	CS210	Formal Languages and Automata	3	0	0	6
IV	CS240	Database Management Systems	3	0	0	6
IV	CS241	DBMS Lab	0	0	4	4
IV	CS252	Computer Networks	3	0	0	6
IV	CS253	Computer Networks Lab	0	0	4	4
IV	CS200	Project-I	0	0	6	6
IV	SC202	Chemistry	3	0	0	6
IV	HS	HSS Elective	3	0	0	6
		Total	15	0	14	44
		Contact Hours / Week	29			

CS 210	**Formal Languages and Automata Theory**	**3-0-0-6**

Prerequisites: MA 204 or equivalent: Elementary discrete mathematics including the notion of set, function, relation, product, equivalence relation etc.

Syllabus:

Alphabets, language, grammars; Finite Automata, regular language, regular expression; Context free grammars, Push Down Automata; Context Sensitive grammars, Linear Bounded Automata; Turing Machines, design of Turing Machine, Universal Turing Machine, Halting Problem; Operations on formal language and their properties; Chomsky hierarchy.

Texts:

1. J. E. Hopcroft, R. Motwani, and J. D. Ullman, Introduction to Automata Theory, Languages and computation, 3rd Edition, Pearson / Addison Wesley, 2011.

References:

1. H. R. Lewis and C. H. Papadimitriou, Elements of the Theory of Computation, 2nd Edition, PHI Learning, 2009.
2. M. Sipser, Theory of Computation, 3rd Edition, Cengage Learning India Private Limited, 2014.

CS240	**Database Management Systems**	**3-0-0-6**

Syllabus:

Databases: Introduction, Introduction to the Relational Model, Introduction to SQL, Intermediate SQL, Advanced SQL, Formal Relational Query Languages.

Database Design: ER Model, Functional Dependencies, Schema Design, Normal Forms.

Data Storage and Querying: Storage and File Structure, Indexing and Hashing, Query Processing, Query Optimization.

Transaction Management: Transactions, Concurrency Control, Recovery System.

System Architecture: Database System Architecture, Parallel Databases, Distributed Databases.

Advanced Topics: Data Warehousing and Mining, Information Retrieval, XML.

Texts:

1. Database System Concepts - Silberschatz, Korth & Sudarshan (6th Edition) 2011.

References:

1. An Introduction to Database Systems - CJ Date (8th Edition) 2003.
2. Database Systems: The Complete Book - Gracia-Molina, Ullman, Widom. (2nd Edition) 2008.

CS241	**Database Management Systems Lab**	**0-0-3-3**

Familiarization with databases packages like Microsoft Access and MySql. The database language SQL, constraints and triggers in SQL, system aspects of SQL. Creation of views and stored procedures using PL/SQL. Client-server and 3 tier web enabled database programming. Design and implementation of a Database application using a multi-user DBMS.

CS 252	Computer Networks	3-0-0-6

Network Basics: Evolution of computer networks; Network Models, Network Media, LAN, MAN and WAN, needs and goals of networking topology, network architecture, need for protocols, OSI Reference Model, layer services, primitives and service access points
Data link layer: Framing, HDLC, PPP, sliding window protocols, medium access control, Token Ring, Wireless LAN; Virtual circuit switching: Frame relay, ATM;
Network Layer: Internet addressing, IP, ARP, ICMP, CIDR, routing algorithms (RIP, OSPF, BGP);
Transport Layer: UDP, TCP, flow control, congestion control; Introduction to quality of service;
Application Layer: DNS, Web, email, authentication, encryption.

Texts:

Andrew S. Tanenbaum, "Computer Networks", 4th ed., Prentice Hall, 2003.

References:

Forouzan, *Data Communications and Networking,* 4th Ed., Tata Mcgraw Hill, 2006.

CS 253	Computer Networks Lab	0-0-4-4

Linux network configuration, measurement and analysis tools, Wireshark,

Socket programming using C++ - TCP and UDP, peer-to-peer applications; reliable communications using unreliable datagrams; client-server using RPC;concurrent servers using threads or processes.

Assignment on simulation of LAN, Wi-Fi etc using NS3 simulator

References:

http://tldp.org/
http://www.nsnam.org/documentation/

ECE:

Sem	Number	Course Name	L	T	P	C
IV	MA204	Mathematics IV	3	0	0	6
IV	EC251	Principles of Communication	3	1	0	8
IV	EC252	Communications Lab	0	0	3	3
IV	EC243	Digital Signal Processing	3	0	0	6
IV	EC244	Digital Signal Processing Lab	0	0	3	3
IV	EC260	Semiconductor Devices	3	0	0	6
IV	SC202	Chemistry	3	0	0	6
IV	HS	HSS Elective	3	0	0	6
		Total	18	1	6	44
		Contact Hours / Week	25			

MA204	Mathematics IV	3-0-0-6

Syllabus:
Complex Analysis**:** Complex numbers and elementary properties. Complex functions - limits, continuity and differentiation. Cauchy-Riemann equations. Analytic and harmonic functions. Elementary functions. Anti-derivatives and path (contour) integrals. Cauchy-Goursat Theorem. Cauchy's integral formula, Morera's Theorem. Liouville's Theorem, Fundamental Theorem of Algebra and Maximum Modulus Principle. Taylor series. Power series. Singularities and Laurent series. Cauchy's Residue Theorem and applications. Mobius transformations.
Partial Differential Equations**:** First order partial differential equations; solutions of linear and nonlinear first order PDEs; classification of second-order PDEs; method of characteristics; boundary and initial value problems (Dirichlet and Neumann

type) involving wave equation, heat conduction equation, Laplace's equations and solutions by method of separation of variables (Cartesian coordinates); initial boundary value problems in non-rectangular coordinates.
Solving PDEs by Transforms Methods**:** Solution of PDE by Fourier Transform method and Laplace Transform method.

Texts:

1. J. W. Brown and R. V. Churchill, *Complex Variables and Applications*, 7th Edition, Mc-Graw Hill, 2003. (or 8th Edition-2008).
2. K. Sankar Rao, *Introduction to Partial Differential Equations*, 3rd Edition, 2011.

References:

1. J. H. Mathews and R. W. Howell, *Complex Analysis for Mathematics and Engineering,* 3rd Edition, Narosa, 1998.
2. I. N. Sneddon, *Elements of Partial Differential Equations*, McGraw Hill, 1957.

EC251	**Principles of Communication**	**3-1-0-8**

Basic blocks in a communication system: transmitter, channel and receiver; baseband and pass band signals and their representations; concept of modulation and demodulation. Continuous wave (CW) modulation: amplitude modulation (AM) - double sideband (DSB), double sideband suppressed carrier (DSBSC), single sideband suppressed carrier (SSBSC) and vestigial sideband (VSB) modulation; angle modulation -- phase modulation (PM) & frequency modulation (FM); narrow and wideband FM. AM transmitter – Broadcast transmitters – SSB transmitter – Radio telegraphy transmitter – FM transmitter – Tuned radio frequency and super heterodyne receivers – AM broadcast receiver – SSB receivers – Diversity reception – FM receivers. Pulse Modulation: sampling process; pulse amplitude modulation (PAM); pulse width modulation (PWM); pulse position modulation (PPM) ; pulse code modulation (PCM); line coding; differential pulse code modulation; delta modulation; adaptive delta modulation. Noise in CW and pulse modulation systems: Receiver model; signal to noise ratio (SNR); noise figure; noise temperature; noise in DSB-SC, SSB, AM & FM receivers; pre-emphasis and de-emphasis, noise consideration in PAM and PCM systems. Basic digital modulation schemes: Phase shift keying (PSK), amplitude shift keying (ASK), frequency shift keying (FSK) and Quadrature amplitude modulation (QAM); coherent demodulation and detection; probability of error in PSK, ASK, FSK & QAM schemes. Multiplexing schemes: frequency division multiplexing; time division multiplexing.

Text:

1. J. G. Proakis and M. Salehi, Communication system engineering, 2nd Edition, Pearson Education Asia, 2002.
2. R. E. Ziemer, W. H. Tranter, Principles of Communications: Systems, Modulation, and Noise, 5th Edition, John Wiley & Sons, 2001.

References :

1. Simon Haykin, Communication Systems, 4th Edition, John Wiley & Sons, 2001.
2. K. Sam Shanmugam, Digital and Analog Communication Systems, 1st Edition, John Wiley and Sons, 1979.
3. A. B. Carlson, Communication Systems,3rd Edition, McGraw Hill, 1986.
4. B. P. Lathi, Modern Analog and Digital Communication systems, 3rd Edition, Oxford University Press, 1998.
5. H. Taub and D. L. Schilling, Principles of Communication Systems, 2nd Edition, McGraw Hill, 1986.

EC252	**Communications Lab**	**0-0-3-3**

Amplitude Modulation -- Implementing the switching function using with the help of diode based ring modulator: AM generation, Demodulation of AM signal using envelope detector, To generate a conventional AM signal using multiplier chip AD633, To design and implement an envelope detector for appropriate demodulation of AM signal. Frequency Modulation -- FM generation using IC555, Demodulation using slope detector. Pulse Amplitude Modulation -- Generation of PAM signal, Reconstruction of PAM signal, Pulse Width Modulation -- Generation of PWM and PPM signals, Demodulation of PWM signals.
Matlab Experiments: Generation of AM signal, Demodulation of AM signal, Understanding Signal correlation, Autocorrelation, Cross correlation of signals, Power spectral density of signals, Modulation and demodulation of FM signals, Modulation and Demodulation of DSB-SC, Modulation and Demodulation of SSB-SC, Modulation and demodulation of PAM, PPM, PWM waveforms, QAM modulation, Communication receiver and BER performance, RZ, NRZ, Manchester codes.

EC243	**Digital Signal Processing**	**3-0-0-6**

Syllabus :
Review of discrete time signals, systems and transforms: Discrete time signals, systems and their classification, analysis of discrete time LTI systems: impulse response, difference equation, frequency response, transfer function, DTFT, DTFS and Z-transform.
Frequency selective filters: Ideal filter characteristics, lowpass, highpass, bandpass and bandstop filters, Paley-Wiener criterion, digital resonators, notch filters, comb filters, all-pass filters, inverse systems, minimum phase, maximum phase and mixed phase systems.
Structures for discrete-time systems: Signal flow graph representation, basic structures for FIR and IIR systems (direct, parallel, cascade and polyphase forms), transposition theorem, ladder and lattice structures.

Design of FIR and IIR filters: Design of FIR filters using windows, frequency sampling, Remez algorithm and least mean square error methods; Design of IIR filters using impulse invariance, bilinear transformation and frequency transformations.
Discrete Fourier Transform (DFT): Computational problem, DFT relations, DFT properties, fast Fourier transform (FFT) algorithms (radix-2, decimation-in-time, decimation-in-frequency), Goertzel algorithm, linear convolution using DFT. Multi-dimensional DFT (M-D DFT) and its computation.
Finite wordlength effects in digital filters: Fixed and floating point representation of numbers, quantization noise in signal representations, finite word-length effects in coefficient representation, roundoff noise, SQNR computation and limit cycle.
Introduction to multirate signal processing: Decimation, interpolation, polyphase decomposition; digital filter banks: Nyquist filters, two channel quadrature mirror filter bank and perfect reconstruction filter banks, subband coding. Applications of multi-rate filters in signal processing and communication. Adaptive digital filters and their applications. Introduction to wavelet transform and its applications. Case studies of applications of DSP: Applications in audio, medical and communication.

Text:

1. A. V. Oppenheim and R. W. Shafer, Discrete-Time Signal Processing, 2nd Edition, Prentice Hall India, 2004.
2. J. G. Proakis and D. G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, 4th Edition, Pearson Education, 2007.
3. E. C. Ifeachor and B. W. Jervis, Digital Signal Processing: A Practical Approach, 2nd Edition, Pearson, 2006.

References :

1. V.K. Ingle and J.G. Proakis, Digital Signal Processing using MATLAB, Cengage, 2008.
2. S. K. Mitra, Digital Signal Processing: A Computer-Based Approach, 4th Edition, McGraw Hill, 2006.
3. T. Bose, Digital Signal and Image Processing, John Wiley and Sons, Inc., Singapore, 2004.
4. L. R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall India, 2005.
5. A. Antoniou, Digital Filters: Analysis, Design and Applications, 2nd Edition, Tata McGraw-Hill, New Delhi, 2009.
6. T. J. Cavicchi, Digital Signal Processing, John Wiley and Sons, Inc., Singapore, 2002.

EC244	**Digital Signal Processing Lab**	**0-0-3-3**

List of Experiments:

1. Generation of signals – (i) ramp signals at different sampling frequencies, (ii) sinusoid signals, (iii) multi-toned sinusoid signals, (iv) pseudo random noise sequence.
2. Echo generation using three different delay.
3. Generation of AM and FM signals.
4. Application of mean filtering on a noisy sinusoid.
5. Application of autocorrelation function to generate sinusoid from a noisy signal.
6. Design of filters, IIR filter and FIR filter.

EC260	**Semiconductor Devices**	**3-0-0-6**

Syllabus:

Brief discussion of quantum theory of solids: energy bands, electrical conduction in solids, formation of Fermi-Dirac probability function using the concepts of statistical mechanics and k-space diagram.
Semiconductors in equilibrium: charge carrier profile in intrinsic and extrinsic semiconductor, behavior of Fermi energy level with varying temperature and doping concentration.
Carrier transport in semiconductors: drift current and diffusion current, Hall Effect. Semiconductors in non-equilibrium condition: carrier generation and recombination, continuity equation, ambipolar transport.
P-N junction: under zero applied bias and reverse bias, comparative study of abrupt junction and linearly graded junction, qualitative and quantitative discussion of p-n junction current, small signal model of p-n junction, junction breakdown and Tunnel diode.
Behavior of metal semiconductor junction: Schottky barrier diode, metal-semiconductor ohmic contact.
Bipolar transistor: basic principles of operation, carrier distribution under different modes of operation, non-ideal effects, frequency limitations. Fundamentals of MOSFET, capacitance-voltage characteristics, current voltage relationship, frequency limitations.

Text:

1. Donald A. Neamen, Semiconductor Physics and Devices, Tata McGraw Hill, 3rd Edition, 2007

References :

1. Ben G. Streetman, Solid State Electronic Devices, PHI, 5/e, 2001.
2. J. Singh, Semiconductor Devices - Basic Principles; John Wiley & Sons Inc., 2001.
3. Simon M. Sze, Kwok K. Ng, Physics of Semiconductor Devices, Wiley, 3/e, 2006/7.

Common courses:

SC202	**Chemistry**	**3-0-0-6**

Chemical Thermodynamics: The zeroth and first law, Work, heat, energy and enthalpies; The relation between C_v and C_p; Second law: entropy, free energy (the Helmholtz and Gibbs) and chemical potential; Third law; Chemical equilibrium; Equilibrium electrochemistry; Chemical kinetics: The rate of reaction, elementary reaction and chain reaction; Surface: The properties of liquid surface, surfactants, colloidal systems, solid surfaces, physisorption and chemisorption;
Periodic properties of elements; Shapes of inorganic compounds; Ionic solids and their structure, Coordination compounds: ligand, isomerism, colour, magnetism; Bioinorganic chemistry; Chemistry of materials and organometallic chemistry;
Stereo and regio-chemistry of organic compounds, conformers; Pericyclic reactions; Bioorganic chemistry: Amino acids, peptides, proteins, enzymes, carbohydrates, nucleic acids and lipids; Macromolecules (polymers); Green chemical processes. Basic spectroscopic techniques (Uv-Vis, IR, ^{1}H NMR).

Texts:

1. P. W. Atkins, J. De Paula *Physical Chemistry*, 9th Ed., OXFORD UNIVERSITY PRESS, 2011.
2. Peter Atkins, Tina Overton, Jonathan Rourke, Mark Weller, Fraser Armstrong, Mike Hagerman; *Shriver & Atkins' Inorganic Chemistry*, 5th Ed. 2012, OXFORD UNIVERSITY PRESS-NEW DELHI.
3. Jonathan Clayden, Nick Geeves, Stuart Warren, *Organic Chemistry*, 2nd Edition, 2012, OXFORD UNIVERSITY PRESS.

References:

1. I. A. Levine, *Physical Chemistry*, 6th Ed., Tata-McGraw-Hill, 2011.
2. J. E. Huheey, E. A. Keiter and R. L. Keiter, O. K. Medhi, *Inorganic Chemistry: Principle of structure and reactivity*, 4th Ed., Pearson Education, 2006..
3. F. A. Cotton, and G. Wilkinson, *Advanced Inorganic Chemistry*, 3rd Ed., Wiley Eastern Ltd., New Delhi, 1972, reprint in 1988.
4. L. G. Wade (Jr.), Maya S. Gingh, *Organic Chemistry*, 6th Edition, Pearson Education, 2008.
5. Paula Y. Bruce, *Organic Chemistry*, 3rd Ed. (13th Impression), Pearson Ed. Inc. New Delhi, 2013.
6. R. T. Morrison, R. N. Boyd, S. K. Bhattacharjee. *Organic Chemistry*, 7th Edition, Pearson Education, 2011.

HSS Elective:

(List of Courses)

HS202 — Language and Society — 3-0-0-6

Syllabus:

Language and Society:

Theoretical perspectives:
Language as evolutionary biology (Chomsky, Pinker etc); Linguistic Relativity (Sapir-Whorf Hypothesis/ Bernstein's Deficit Hypothesis (restricted and elaborated code); Behaviorism (Bloomfield , Skinner); Austin's Speech Act Theory; Gricean Maxims Cooperation etc.

Key concepts in Sociolinguistics: Language/ mother-other tongue/ society/ speech community/ variation/ dialect/ accent/ sociolect/ idiolect/ style/ context/ register/ pidgins/ creoles/ codes/ diglossia/ Lingua Franca/ vernacular/ standard language

Social aspects of language:

Languages and Communities: Varieties; Case Studies (New York City, Martha's Vineyard etc); Speech Communities; Identities (dialect, sex, age, social class, ethnic group, nation, geography etc); Bilingualism and Multilingualism

Language variation and change: The linguistic variable; Language change in progress; Regularity; Social motivation of language change, Spoken and Written Language; Code mixing/ switching; Diglossia

Linguistic aspects of society:

Language Contact, Conflict and Degeneration: Language maintenance and shift; Displacement, Migrations, Language death

Language and culture: Kinship/ Taboo/ Euphemisms

Sociolinguistics of Communication: Prestige, Media, Communicative Competence; Conversation/ Discourse Analysis;

Multiple perspectives:

Ethnographies, Solidarity, Politeness, Gender; Language Planning and Education, Power

Texts:

1. **Wardaugh, R. 2006**. *An Introduction to Sociolinguistics* Blackwell Publishing, UK.

References:

1. **Trudgill, P. 1974**. *Sociolinguistics: An Introduction to Language and Society*. Penguin Books, London
2. **Florian, C.** *The Handbook of Sociolinguistics*. Blackwell Reference Online.
3. **Additional reference material to be provided by Instructor**

HS203	**Science Fiction**	**3-0-0-6**

This course explores the long-established literary genre of science fiction through certain representative texts. The topics for discussion range from alien invasion, cyborgs, global catastrophe, and space travel to utopian and dystopian future societies. In our examination of these texts, we will consider questions regarding the impact of science and technology on "global culture"; the intimate relationship between technological development and the history of warfare in the 20th century, the use of alien narratives to explore issues about race; the ways gender and sexuality have been transformed by scientific advances; and the complexities of human government and power.

Texts:

1. Raymond William,"Science Fiction", Science Fiction Studies, 15.3 (1988).
2. Select chapters from Tom Shippey (ed), *The Oxford Book of Science Fiction Stories*, Oxford: OUP, 1992.

References:

1. Camille Bacon-Smith, *Science Fiction Culture*, Philadelphia: University of Pennsylvania, 2000.
2. Adam Roberts, *Science Fiction*, London: Routledge, 2000.

B.Tech V Sem

CSE:

Sem	Number	Course Name	L	T	P	C
V	CS301	Theory of Computation	3	0	0	6
V	CS320	Compilers	3	1	0	8
V	CS321	Compilers Lab	0	0	3	3
V	CS302	Data Communication	3	0	0	6
V	CS303	Distributed Systems	3	0	0	6
V	CS351	IT Workshop III: Cloud Computing	1	0	3	5
V	SC301	Biology	3	0	0	6
V	HS	HSS Elective	3	0	0	6
		Total	19	1	6	46
		Contact Hours / Week	26			

CS 301	**Theory of Computation**	**3-0-0-6**
Prerequisites: MA 204 or equivalent: Elementary discrete mathematics including the notion of set, function, relation, product, equivalence relation etc.; CS 210 or equivalent: Formal languages and Automata theory. *Syllabus:* The Church – Turing Thesis: Turing Machines, Variants of Turing Machines, The Definition of Algorithm. Decidability: Decidable Languages, Undecidability. Reducibility: Undecidable Problems from Language Theory, A Simple Undecidable Problem, Mapping Reducibility. Advanced Topics from Computability: The Recursion Theorem, Decidability of Logical Theories, Turing Reducibility, A Definition of Information. Time Complexity : Measuring Complexity, The Class P, The Class NP, NP – completeness, Additional NP-complete Problems. Space Complexity: Savitch's Theorem, The Class PSPACE, PSPACE-completeness, Class L and NL, NL-completeness, NL equals coNL. Intractability: Hierarchy Theorems, Relativization, Circuit Complexity. Advanced Topics of Complexity Theory: Approximation Algorithms, Probabilistic Algorithms, Alternation, Interactive Proof Systems, Parallel Computation, Cryptography.		
Texts: 1. Michael Sipser, Introduction to the Theory of Computation, 3rd Edition, Cengage Learning India Private Limited, 2014.		
References: 1 J. E. Hopcroft, R. Motwani, and J. D. Ullman, Introduction to Automata Theory, Languages and computation, 3rd Edition, Pearson / Addison Wesley, 2011. 2. H. R. Lewis and C. H. Papadimitriou, Elements of the Theory of Computation, 2nd Edition, PHI Learning, 2009.		

CS 320	**Compilers**	**3-1-0-8**
Syllabus: Compilers and translators, different phases of a compiler; Lexical analysis: specification of tokens, recognition of tokens, input buffering, automatic tools; Syntax analysis: context free grammars, top down and bottom up parsing techniques, construction of efficient parsers, syntax-directed translation, automatic tools; Semantic analysis: declaration processing, type checking, symbol tables, error recovery; Intermediate code generation: run-time environments, translation of language constructs; Code generation: flow-graphs, register allocation, code-generation algorithms; Introduction to code optimization techniques.		
Texts: 1. A. V. Aho, L.S. Monica R. Sethi and J. D. Ullman, Compilers: Principles, Techniques, and Tools, 2nd Ed., Prentice Hall, 2009.		
References: 1. V. Raghavan, Principles of Compiler Design, McGrawHill, 2010. 2. C.N. Fischer and R.J. Le Blanc, Crafting a Compiler with C, Pearson Education, 2009.		

3. J. Levine, T. Mason and D. Brown, Lex & Yacc, 2nd Edition, O'Reilly Media, Inc, 1992.

CS 321	Compilers Lab	0-0-3-3

Programming assignments to build a compiler for a subset of a C-like programming language, using tools such as Lex / Flex / JLex and Yacc / Bison / CUP etc.

Texts:

1. D. Brown, J. Levine and T. Mason, *Lex and Yacc,* 2nd Ed., O'Reilly Publications.

CS 302	Data Communication	3-0-0-6

Basics of Digital communications: Signals, noise, Nyquist rate, Shannon capacity; Analog

Transmission: Modulation techniques, Fundamentals of modems, FDM; Digital transmission: PCM,

Transmission media: Guided (twisted pair, coaxial, fiber optic) and Unguided media; Balanced and

Local area networks: Ethernet, Fast Ethernet, Introduction to Gigabit Ethernet and WLANs, Hubs,

Wireless Technologies: 3G LTE, RFID

Texts:

1.W. Stallings, *Data and Computer Communications,* 8th Ed., Pearson India, 2007.

References:

1. A. S. Tanenbaum, *Computer Networks,* 4th Ed., Pearson India, 2003.
2. B. Forouzan, *Data Communications and Networking,* 4th Ed., Tata Mcgraw Hill, 2006.
3. J. Quinn, *Digital Data Communications,* 1st Ed., Prentice Hall Career and Technology, 1995.
4. P. C. Gupta, *Data Communications and Computer Networks,* 2nd Ed., Prentice Hall of India, 2009.
5. F. Halsall, Data Communications, Computer Networks and Open Systems, 4th Ed., Addison Wesley, 1996.

CS303	Distributed Systems	3-0-0-6

Syllabus:

Introduction, design issues; Naming, resolution; Process and threads in distributed system, code migration; Clock synchronization; Global state, election; Distributed mutual exclusion, token- and non-token based algorithms; Distributed deadlock prevention, avoidance, detection, resolution; Distributed shared memory, memory coherence; Distributed file system, sharing semantics, caching, replication, fault-tolerance, atomicity; Distributed scheduling, load distribution, balancing, sharing; Consistency and replication, data- and client-centric models; Failure and recovery, synchronous and asynchronous checkpointing, message logging; Fault tolerance, commit protocols, failure resilient processes, group membership; Security, secure channels, access control matrix.

Texts:

1. George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair, Distributed Systems: Concepts and Design, 5th Edition, Addison-Wesley/Pearson Education, 2011.

References:

1. Andrew S. Tanenbaum and Maarten Van Steen, Distributed Systems: Principles and Paradigms, 2nd Edition, Prentice-Hall/Pearson Education, 2006.
2. Ajay D. Kshemkalyani and Mukesh Singhal, Distributed Computing: Principles, Algorithms, and Systems, Cambridge University Press, 2011.
3. Joel M. Crichlow, Distributed Systems: Computing over Networks, 2nd Edition, Prentice-Hall/Pearson Education, 2014.

CS 351	IT Workshop III (Cloud Computing)	1-0-3-5

Introduction to Cloud Computing, Cloud Concepts & Technologies, Cloud Services & Platforms, Hadoop & MapReduce - Concepts, Cloud Application Design, Python for Cloud, Cloud Application Development in Python, Big Data Analytics,

Multimedia Cloud, Cloud Security, Cloud Application Benchmarking & Tuning
Texts: 1) Cloud Computing: A Hands-On Approach by Arshdeep Bahga, Vijay Madisetti, 2013, Universities Press
References: 1) Cloud Computing Bible by Barrie Sosinsky, 2011, Willey India Pvt Ltd

ECE:

Sem	Number	Course Name	L	T	P	C
V	EC351	Digital Communication	3	1	0	8
V	EC352	Digital Communication Lab	0	0	3	3
V	EC301	Analog Integrated Circuits	3	0	0	6
V	EC302	Analog Integrated Circuit Lab	0	0	3	3
V	EC370	Electromagnetics	3	1	0	8
V	EC380	Control Systems	3	1	0	8
V	SC301	Biology	3	0	0	6
V	HS	HSS Elective	3	0	0	6
		Total	18	3	6	48
		Contact Hours / Week	27			

EC351	**Digital Communication**	**3-1-0-8**

Syllabus:

Review of the basics of Digital Communication System: message symbols, signaling waveforms, constellation diagram, distance metric; Performance metrics – Error rates, Data rates, Transmit power, Receiver sensitivity, Range of communication. Communication channels – Additive-White-Gaussian Noise (AWGN) channel, Band-limited channel (Inter-Symbol-Interference: ISI channel), Fading Multipath channel.

Transmission of message symbols by carrier modulation (bandpass signaling): Carrier Amplitude modulation – ASK, MASK; Carrier Phase modulation – BPSK, QPSK, Offset QPSK, MPSK; Quadrature-amplitude modulation (QAM) – MQAM; Constellation diagram for MPSK and MQAM signaling, minimum distance in a signal constellation, Gray-coded symbols, BER in terms of minimum distance; Comparison of various modulation schemes.

Frequency Modulation: BFSK, MFSK; Phase-coherent demodulation, Non-coherent demodulation; Probability of error; Continuous-phase FSK (CPFSK), Minimum-shift keying, Probability of error; Continuous-phase modulation (CPM).

Differential modulation schemes – DBPSK (DPSK), DQPSK, π/4-QPSK; Probability of error; Non-coherent receiver.

Synchronization: Carrier frequency and phase synchronization (coherent receiver); Symbol time synchronization (clock recovery).

Digital Communication through band-limited AWGN channel: Inter-symbol interference (ISI), Eye-diagram; signal design for band-limited channel for zero ISI – Nyquist criterion, raised-cosine and square-root raised cosine signals for transmit and receive pulse shaping; Partial-response signaling.

Selected topics in Digital Communication:

(a) Communication through fading multi-path channel
(b) Multi-carrier modulation and OFDM
(c) Spread-spectrum communication

Texts:

1. J. G Proakis and M. Salehi, “Fundamentals of Communication Systems”, Pearson Education, 2005.
2. S. Haykin, “Communication Systems”, Wiley- Student Edition, 5/e, 2010.

References:

1. B. Sklar, “Digital Communication: Fundamentals and Applications”, Pearson India, 2/e, 2009.
2. I. Clover, “Digital Communication”, Pearson India, 2/e, 2007.
3. J. B. Anderson, “Digital Transmission Engineering”, IEEE Press, Wiley-Interscience, 2/e, 2005.
4. S. Haykin, “Digital Communication Systems”, Wiley Student Edition, 2014.

EC352	**Digital Communication Lab**	**0-0-3-3**

Pulse shaping, Carrier modulations: ASK, PSK, FSK, QAM, MSK, Inter symbol interference, Measurement of Receiver Sensitivity, Nyquist criterion, Receiver performance with noise, Matched filter receiver, correlation receiver, BER performance of digital modulation techniques, Differential modulation schemes – DBPSK (DPSK), DQPSK, π/4-QPSK; M-ary signals, M-ary pulse-amplitude modulation, M-ary orthogonal signals. Performance evaluation under fading. Implementation of AWGN channel, Band-Limited Channel.

EC301	**Analog Integrated Circuit**	**3-0-0-6**

Syllabus:

Frequency response of different configurations of BJT, MOS amplifiers, Bipolar differential amplifier, and MOS differential amplifier. Feedback, different feedback configurations and frequency response of different feedback amplifiers and their stability analysis. Two stage MOS operational amplifier, MOS telescopic cascode amplifier, Folded cascode amplifier and their frequency response. Different output stages and their characterization. Voltage and current references. Low current, supply insensitive and temperature insensitive biasing. Non-linear analog circuits: precision rectification, analog multipliers, phase locked loop. Different types of filters, filter transfer functions, implementation and realization of active filters.

Texts:

1. P. Gray, P. Hurst, S. Lewis and R. Meyer, Analysis & Design of Analog Integrated Circuits, 5/e, Wiley, 2009.

References:

1. Adel S Sedra, Kenneth C Smith, Microelectronics Circuits, Theory and Applications, Oxford International Students Edition.
2. BehzadRazavi, Design of Analog CMOS Integrated Circuits, McGraw hill Education.

EC302	**Analog Integrated Circuit Lab**	**0-0-3-3**

Implementation and characterization of different feedback amplifiers, current mirror load differential amplifier. Behavioural study of different current biasing scheme. Implementation and characterization of oscillators. Study of VCO, PLL. Design and implementation of active LPF, HPF, BPF filters.

EC370	**Electromagnetics**	**3-1-0-8**

Syllabus:

Electrostatic field: Coulomb's and Gauss's law and its applications, Electric dipole; Electrostatic Boundary-Value Problems: Poisson's and Laplace equations, Uniqueness theorem, Resistance and capacitance, Method of image; Electric fields in material space: Conductor in field, Polarization in dielectrics, Continuity equation, Kirchoff's Voltage and Current laws, Boundary conditions at different interface; Magnetostatic Fields: Biot-Savart's and Ampere's Circuital law and its application; Magnetic vector potentials; Magnetic dipoles; Magnetization and behavior of magnetic materials; Electromagnetic waves: Maxwell's equations: Faraday's law of electromagnetic induction, Maxwell's discovery, Maxwell's equations and boundary conditions, Time-harmonic fields. Wave equation and plane waves: Helmholtz wave equation, Solution to wave equations and plane waves, Wave polarization, Poynting vector and power flow in em fields; Plane wave reflection from a media interface: Plane wave in different media, Plane wave reflection from a media interface, Plane wave reflection from a complex media interface.

Numerical Methods: FDM, MoM, FEM

Basics of Antenna: Radiation fundamentals, parameters, some basic radiators

Texts:

1. M. N. O. Sadiku, Principles of Electromagnetics, 4th Edition, Oxford University Press, 2007.
2. D. K. Cheng, Field and Wave Electromagnetics, 2nd Edition, Pearson, 2001.

References:

1. M.N.O. Sadiku, *Numerical Techniques in Electromagnetic, 2nd Edition,* CRC Press, 2000.
2. R. F. Harrington, Time-Harmonic Electromagnetic Fields, 2nd Edition Wiley-IEEE, 2001.
3. N. Ida, Engineering Electromagnetics, 1st Edition, Springer, 2000.
4. W.H.Hayt & J.A.Buck, Engineering Electromagnetics, 7thEdition Tata-McGraw-Hill, 2006.
5. C. A. Balanis, Advanced Engineering Electromagnetics, 2nd Edition, John Wiley, 2012.
6. C. A. Balanis, Antenna Theory: Analysis and Design, 3rd Edition, John Wiley, 2005.

EC380	Control Systems	3-1-0-8

A control system consisting of interconnected components is designed to achieve a desired response of a system. At the end of this course, the student shall be able to analyse stability of a system and design controller for linear time invariant systems.

Syllabus:

Mathematical models of physical systems: differential equations of physical systems, state-space models, transfer functions, block diagram algebra, signal flow graphs. Time-domain techniques: response of second-order systems, characteristic-equation and roots, Routh-Hurwitz criteria, Root-Locus. Frequency-domain techniques: frequency responses, Bode-plots, gain-margin and phase-margin, Nyquist plots. Compensator design: proportional, PI and PID controllers, lead-lag compensator. Modern control system techniques: state-space representations of transfer functions, controllability, observability, pole placement by state feedback, observer and observer based state feedback control, Linear Quadratic Regulator (LQR).

Texts:

1. R. C. Dorf and R. H. Bishop, Modern Control Systems, Prentice Hall, 2010.

References:

1. K. Ogata, Modern Control Engineering, Prentice Hall India, 2010.
2. B. C. Kuo, Automatic Control Systems, Wiley, 2002.
3. I. J. Nagrath and M. Gopal, Control Systems Engineering, New Age Publishers, 2010.
4. G. C. Goodwin, S. F. Graebe, and M. E. Salgado, Control System Design, Prentice Hall, 2000.

Common courses:

SC301	Biology	3-0-0-6

1. Chemical Foundation of Cells : Carbon compounds in cells (carbohydrates, proteins, lipids and nucleic acids) , their types, structure and function .
2. Cell Structure and Function: Components of typical animal and plant cells, concept of cell organelles and their functions.
3. Cell division : mechanism of mitosis and meiosis and their significances.
4. Animal tissues : preliminary idea of different types of animal tissues and their functions.
5. Flow of information : Principles of inheritance, Chromosome and DNA, DNA as genetic material;structure of DNA; DNA replication; transcription; translation; genes to proteins ; gene expression and regulation; recombinant DNA technology. Control of genes, recombinant DNA and genetic engineering.
6. Human physiology: Nutrition and digestion, respiration, circulation, movement, neural coordination and sensory receptors; chemical coordination and preliminary idea of immunity and immune system.
7. Mode of nutrition in plants: Photosynthesis and its mechanism

Texts:

1. P.S. Verma and V.K. Agarwal, Cell Biology, Genetics, Molecular biology, Evolution and Ecology, 2015 Edition, S.Chand and company Ltd., Ramnagar, New Delhi-55

References:

1. J. L. Tymoczko, J. M. Berg and L. Stryer, Biochemistry, 5th Ed, W. H. Freeman & Co, 2002.
2. D. L. Nelson and M. M. Cox, Lehninger, Principles of Biochemistry, Macmillan Worth, 2000.
3. R. Phillips, J. Kondev and J. Theriot, Physical Biology of the Cell,Garland Science, 2008. 1st edition.
4. J.B.Reece, L.A.Urry, M.L.Cain, S.A.Wasserman, P.V.Minorsky, R.B.Jackson, Biology, Benjamin Cummings, 2010. 9th edition.

HSS Elective:

(List of Courses)

HS301	Macroeconomic Problems and Policies	3-0-0-6

Introduction to macroeconomics, objectives of macroeconomic policies, Balance of Payment; Business cycle: Recovery, Prosperity, Recession, and Depression, Inflation: demand pull inflation and cost push inflation, causes of inflation, Inflation as a development promotion strategy; Deflation; Stagflation; Money and prices: Fisher's transactions approach to the quantity theory of money; The general theory of Employment, Interest and Money; Monetary policy: Objective of monetary policy, Instruments of monetary policy: Bank rate, Cash reserve ratio, Open market operations, The statutory liquidity ratio, repo rate, reverse repo rate, Selective credit control, limitation of monetary policy, Credit creation mechanism of commercial bank; Fiscal/Budgetary

Policy: objective of fiscal policies, importance of fiscal policy, Instruments of fiscal policies: Taxation, Public Expenditure, Public borrowings, Deficit financing, Budget deficit and public debt; Role of monetary and fiscal policies in tackling business cycle.

Texts:

1. Paul, R.R.Money Banking and International Trade, Kalyani Publisher, 2008.

References:

1. Misra S.K. and Puri V.K, Economics of Development and Planning, Himalaya Publishing House (2005).
2. Dornbusch, R. and Fischer, S., Macroeconomics, McGraw-Hill Publishing Company, 5th Edition.
3. Gupta, S.B., Monetary Economics: Institutions, Theory and Policy, S. Chand & Company Pvt. Ltd., 2013.

HS402	**Understanding Democracy and Governance in India**	**3-0-0-6**

Syllabus:

Introduction to Politics; The case for Indian Model of democracy, Structures and Process of Governance- Parliament-Lok Sabha and Rajya Sabha, Party System, Party Politics and Electoral behaviour, Theories of Federalism and Indian Experience, The Supreme Court and Judicial Activism, Local Governance-Panchayati Raj Institution special reference to 73rd and 74th Amendment, Women and SC, ST in Panchayati Raj Institution; Theories of development- Emergence of Classical Political Economy; Political Economy and Theories of Free Trade; the Great Depression and the crisis of neo-classical theories; the Keynesian revolution, Debates over Models of Development in India, Liberalisation of Indian Economy, E-governance.

Texts:

1. Gopal Jayal, Niraja and Pratap Bhanu Metha, eds., (2010), *The Oxford Companion to Politics in India* (Delhi: Oxford University Press)

References:

1. Frankel, Francine (2005). *India's Political Economy (1947-2004): The Gradual Revolution.* (Delhi: Oxford University Press).
2. Chari, Sharad and Stuart Corbridge (2008). (eds.). *The Development Reader*. (Delhi: Routledge

B.Tech VI Sem

CSE:

Sem	Number	Course Name	L	T	P	C
VI	MA305	Optimization Techniques	3	0	0	6
VI	CS330	Software Engineering	3	0	0	6
VI	CS331	Software Engineering Lab	0	0	3	3
VI	CS340	Computer Graphics	3	0	0	6
VI	CS341	Computer Graphics Lab	0	0	3	3
VI	CS306	Machine Learning	3	0	0	6
VI	CS36X	Elective I	3	0	0	6
VI	CS300	Project II(Optional)	0	0	6	6
VI	HS	HSS Elective	3	0	0	6
		Total	18	0	12/6	48/42
		Contact Hours / Week	30/24			

CS 330	**Software Engineering**	**3-0-0-6**
Software Engineering Principles: Overview of the software engineering discipline, Software lifecycle models, Agile development, The Unified Process (UP)Organising development projects Requirements Engineering: Documenting requirements, user stories, use cases and scenarios Introduction to UML: Review of object-oriented principles, UML use case, class, sequence, activity, state, component and deployment diagrams. UML models The Analysis and Design Process: User story realisation, Object-oriented modelling, Incremental refinement, Design Principles: Software architecture, Separation of concerns, Design patterns, Object-Oriented design practices, Refactoring, Testing: Unit Testing, Test-Driven Development, Functional Testing.		
Texts: 1) R. S Pressman, Software Engineering: A Practioner's Approach, 5th Ed, McGraw-Hill, 2001.		
References: 1) I. Sommerville, Software Engineering, 8th Ed, Addison-Wesley, 2007. 2) Jim Arlow, Ila Neustadt. UML and the Unified Process Addison Wesley. 2nd Edition, 2005. 3) Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide (2nd Edition), Addison Wesley, 2005.		

CS 331	**Software Engineering Lab**	**0-0-0-3**
Software Engineering Principles: Overview of the software engineering discipline, Software lifecycle models, Agile development, The Unified Process (UP)Organising development projects Requirements Engineering: Documenting requirements, user stories, use cases and scenarios Introduction to UML: Review of object-oriented principles, UML use case, class, sequence, activity, state, component and deployment diagrams. UML models The Analysis and Design Process: User story realisation, Object-oriented modelling, Incremental refinement, Design Principles: Software architecture, Separation of concerns, Design patterns, Object-Oriented design practices, Refactoring, Testing: Unit Testing, Test-Driven Development, Functional Testing.		
Texts: 1) Jim Arlow, Ila Neustadt. UML and the Unified Process Addison Wesley. 2nd Edition, 2005. 2) R. S Pressman, Software Engineering: A Practioner's Approach, 5th Ed, McGraw-Hill, 2001.		
References: 1) I. Sommerville, Software Engineering, 8th Ed, Addison-Wesley, 2007. 2) Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide (2nd Edition), Addison Wesley, 2005.		

CS340	Computer Graphics	3-0-0-6

Syllabus:

Introduction: Graphics input and output devices; Raster scan and random scan devices.
Output primitives: Points, lines; Line/circle/ellipse-drawing algorithms.
Filled area primitives: Scan line polygon fill algorithm; Boundary-fill and flood-fill algorithms.
2D geometrical transformation: Translation, rotation, scaling, reflection, shear; Matrix representations.
2D viewing: Viewing pipeline; Viewing coordinate reference frame; Window-viewport coordinate transformation; Line/polygon clipping algorithms.
3D object representation: Polygon surfaces and quadric surfaces: Spline representation; Hermite, Bezier and B-Spline curve representations; Bezier and B-Spline surfaces; Polygon rendering methods.
3D geometrical transformation & viewing.
Visible surface determination: Visible line and surface determination methods; Depth cueing.
Graphics Architecture: GPU; Graphics pipeline; DirectX, OpenGL.

Text:

1. Donald D. Hearn, M. Pauline Baker and Warren Carithers, Computer Graphics with OpenGL, 4th Edition, Pearson Education, 2014.

References:

1. Peter Shirley, Michael Ashikhmin and Steve Marschner, Fundamentals of Computer Graphics, 3rd Edition, CRC Press, 2009.
2. Sumanta Guha, Computer Graphics through OpenGL®: From Theory to Experiments, 2nd Edition, CRC Press, 2014.
3. John L. Hennesy and David A. Patterson, Computer Architecture: A Quantitative Approach, 5th Edition, Chapter 4 (Data-Level Parallelism in Vector, SIMD, and GPU Architectures), Elsevier India, 2012.

CS341	Computer Graphics Lab	0-0-3-3

- Programming assignments to learn and practice topics in Computer Graphics using C/C++ and OpenGL.

References:

1. Dave Shreiner, Graham Sellers, John M. Kessenich and Bill M. Licea-Kane, OpenGL® Programming Guide. The Official Guide to Learning OpenGL® Version 4.3, 8th Edition, Addison-Wesley Professional, 2013.
2. Graham Sellers, Richard S Wright Jr. and Nicholas Haemel, OpenGL® SuperBible: Comprehensive Tutorial and Reference, 6th Edition, Addison-Wesley Professional, 2014.

CS 306	Machine Learning	3-0-0-6

Supervised learning algorithms: linear and logistic Regression, gradient descent, support vector machines, kernels, artificial neural networks, decision trees, ML and MAP Estimates, K-nearest neighbor, Naive Bayes, Bayesian networks; Unsupervised learning algorithms: K-means clustering, Gaussian mixture models, learning with partially observable data (EM); Dimensionality reduction and principal component analysis; Model selection and feature selection; Introduction to Markov decision processes; Application to information Retrieval, natural language processing, and image processing etc.

Texts:

1. T. M. Mitchell, Machine Learning, McGraw-Hill, 2013.
2. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2013.

References:

1. S. Theodoridis and K. Koutroumbas. Pattern Recognition. Academic Press, 2009.
2. S. Haykin. Neural Networks: A Comprehensive Foundation. Prentice-Hall of India, New Delhi, 2007.

MA305	Optimization Techniques	3-0-0-6

Syllabus:

Linear programming problem: formulation and geometric ideas, simplex algorithm, duality, transportation and assignment problem, Integer programming problems; Nonlinear optimization: method of Lagrange multipliers, Karush-Kuhn-Tucker theory, numerical methods for nonlinear optimization; Convex optimization and quadratic programming; Applications of linear, integer and quadratic programming to various areas of science and engineering.

Texts:

1. S. Chandra, Jayadeva, A. Mehra, Numerical Optimization with Applications, 1st Edition, Narosa Publishing House, 2009.

References:

1. John J. Jarvis, Mokhtar S. Bazaraa, Hanif D. Sherali, Linear Programming and Network Flows, 4th Edition, John Wiley & Sons, 2010.
2. Hamdy A. Taha. Operation Research: An Introduction, 9th Edition, Prentice Hall, 2011.
3. D. G. Luenberger and Y. Ye, Linear and Nonlinear Programming, 3rd Edition, Springer, 2008.

List of Subjects for Elective I

CS 361	**Computer and Network Security**	**3-0-0-6**

Objectives of cryptography, Basic cryptographic primitives, Cryptanalysis, Symmetric and Asymmetric key cryptography, stream cipher (Based on LFSR) and block cipher (AES), Public key encryption (RSA, Rabin and ElGamal), Digital signature, Entity authentication, Key Exchange (Diffie Hellman), Key distribution, Lightweight cryptography and its application

Attacks and countermeasures: Buffer overflow attacks, Internet worms, viruses, spyware, Spam, phishing, botnets, denial of service, Web security, OWASP top ten, Wireless security.

Security and Privacy: Physical Media security, LAN security, TCP/IP and DNS security, routing protocol security, Firewalls and intrusion detection systems, Signature and Anomaly Detection, Traffic Analysis, Operational Network Security, Intrusion prevention system

Text Books:

1) Behrouz A. Forouzan, Introduction to Cryptography and Network Security, McGraw-Hill 1st edition, 2008.
2) W. Stallings, Cryptography and Network Security: Principles and Practice, 5th Ed, Prentice Hall, 2011.

*References***:**

1) Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, Handbook of Applied Cryptography CRC Press, October 1996, Fourth Printing (July 1999).
2) Kaufman, Perlman, and Speciner, Network Security (2nd edition), Prentice Hall (2002).

CS362	**Topics in Algorithms**	**3-0-0-6**

Syllabus:

Advanced Data Structures: Hashing, Heap, Red Black trees, B-trees, Interval Trees, Binomial Heap, Fibonacci Heap, van Emde Boas Trees;

Parallel Algorithms: Introduction to Parallel Algorithm, Parallel Computational Models, Performance Measures of Parallel Algorithms, Parallel Sorting Network, Parallel Searching Algorithms, Root Findings of Linear and Non-Linear Equations, Graph Searching Algorithm, Combinatorial Algorithm for Permutation, Combinations and Derangements

Graph Algorithms: Introduction to graphs: definition and basic concepts, efficient representations of graphs; Graph Searching: BFS and DFS; Applications of graph searching: finding connected components, bi-connected components, testing for bipartite graphs, finding cycles in graphs; Different MST algorithms; Shortest path algorithms; Hamiltonian graphs: sufficient conditions for Hamiltonian Graphs; Eulerian graphs: characterization of Eulerian graphs, construction of Eulerian tour; Network Flows and Matching; Planarity Testing Algorithms.

Texts:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Cifford Stein. Introduction to Algorithms, 3rd Edition, MIT Press, 2010.
2. Pankaj Sharma. Parallel Algorithms, 2nd Edition, S.K. Kataria & Sons, 2012.

References:

1. Douglas B. West. Introduction to Graph Theory, 2nd Edition, Prentice Hall, 2001.
2. Alferd.V. Aho, John E. Hopcroft, Jeffrey D. Ullman. Data Structures and Algorithms, Pearson Education, 2009.

ECE:

Sem	Number	Course Name	L	T	P	C
VI	EC353	Information Theory and Coding	3	0	0	6
VI	EC361	VLSI Design	3	0	0	6
VI	EC362	VLSI Design Lab	0	0	3	3
VI	EC371	Microwave Engineering	3	0	0	6
VI	EC372	Microwave Engineering Lab	0	0	3	3
VI	EC381	Embedded Systems	3	0	0	6
VI	EC382	Embedded Systems Lab	0	0	3	3
VI	EC354	Communication Networks	3	0	0	6
VI	HS	HSS (Elective)	3	0	0	6
VI	EC300	Project (optional)	0	0	6	6
		Total	18	0	15/9	51/45
		Contact Hours / Week	33/27			

EC353	**Information Theory and Coding**	**3-0-0-6**

Syllabus:

Information Theory**:** Entropy, mutual information, source coding, channel capacity, Shannon's noisy coding theorem, differential entropy, Gaussian channel, rate distortion function.

Coding Theory**:** Linear block codes: generator and parity check matrices, standard Array and syndrome Decoding. Convolutional codes: Convolutional encoder representation, decoding of convolutional codes: maximum likelihood detection, the Viterbi Algorithm.

Texts:

1. T. M. Cover and J. A. Thomas, Elements of Information Theory, 1/e, John Wiley, 1991.
2. S. Lin and D.J. Costello, Error Control Coding, 2/e, Prentice-Hall, 2004.

References:

1. R. B. Ash, Information Theory, 1/e, Dover Publisher, 1990.
2. Todd K. Moon, Error Control Coding: Mathematical Methods and Algorithms, 1/e, Wiley, 2005.

EC361	**VLSI Design**	**3-0-0-6**

Syllabus:

Overview of VLSI design methodology, overview of VLSI design flow, fabrication process flow, layout design rules, full custom mask layout design, MOSFET scaling and small geometry effects. Brief ideas of MOS modeling. MOS inverters as VLSI design building blocks. Inverter static characteristics and dynamic characteristics; switching and interconnect issues. Combinational and sequential MOS logic circuits. Dynamic logic circuits using MOS. Construction and characterization of semiconductor memories.

Text:

1. Jan M. Rabaey, Anantha ChandraKasan, Borivoje Nikolic, Digital Integrated Circuits, A Design Perspective, Prentice Hall, second edition, 2003.

Reference:

1. David Hodges, Analysis and Design of Digital Integrated Circuits, In Deep Submicron Technology (special indian edition)

EC362	**VLSI Design Lab**	**0-0-3-3**

Familiarization with analog and digital CAD tools. Implementation of MOS inverter circuits using CAD tools and verification of different characteristics of an inverter. Implementation MOS current mirrors and current sources. Implementation of NAND and NOR gates using CMOS logic and observation of their static and dynamic behaviors. Design of flip-flop circuits and study of its transient behavior. Mask layout of an inverter, application of design verification rules, RC extraction, pre and post layout comparison of characteristics.

EC371	**Microwave Engineering**	**3-0-0-6**

Syllabus:

Transmission lines and waveguides, modes, Smith chart; Narrowband and broadband impedance matching: L-section impedance matching, stub matching, Quarter wave transformer, Theory of small reflections, Multi section matching transformer,

Tapered lines; Microwave networks: N-port microwave networks, Impedance, admittance, transmission and scattering matrix representations, Reciprocal and lossless networks, Network matrices transformations, Equivalent circuit extraction.
Microwave passive circuits: RLC, micro strip and waveguide cavity resonators; Periodic structure and microwave filter, Hybrid junctions, directional couplers and power dividers; Ferrite devices and circulators; Microwave tubes: Limitations of conventional tubes, Klystron amplifier, Reflex klystron oscillator, Magnetrons, Traveling wave tubes, Microwave solid-state devices: Characteristics of microwave bipolar transistors and FET, Transferred electron devices, avalanche diode oscillators.
Microwave integrated circuits: Planar transmission lines, characteristics of microwave integrated circuits; design of single stage amplifier and oscillator using transistor; PIN diode based control circuits, Microwave antennas.

Texts:

1. D. M. Pozar, Microwave Engineering, 4th edition, John Wiley & Sons Inc, 2012.
2. A. Das and S. K. Das, Microwave Engineering, 18th Reprint, Tata McGraw-Hill, 2007.

References:

1. R. E. Collin, Foundations for Microwave Engineering, 2nd Edition, Wiley-IEEE Press, 2000.
2. R. C. Booton, Computational methods for Electromagnetics and Microwaves, 1st Edition, Wiley, 1992.
3. G. Gonzalez, Microwave Transistor Amplifiers: Analysis and Design, 2nd Edition, Prentice Hall of India, 2007.
4. S. M. Liao, Microwave devices and Circuits, 3rd Edition, Prentice Hall of India, 2004.
5. P. A. Rizzi, Microwave Engineering Passive Circuits, 1st Edition, Pearson, 1998.
6. K. C. Gupta, Microwaves, New Age Publishers, 1st Edition 1983, Reprint 2005.
7. C. A. Balanis, Antenna Theory: Analysis and Design, 3rd Edition John Wiley, 2005.

EC372 Microwave Engineering Lab 0-0-3-3

Frequency and wavelength measurements; determination of standing wave ratio and reflection coefficient; study of characteristics of Klystron tube and Gunn diodes; study of s-parameters; measurement of unknown impedance; simulation and measurement of antenna parameters.

EC381 Embedded Systems 3-0-0-6

Syllabus:

Introduction: Introduction to embedded systems with examples, Concept of real-time system, Challenges in embedded system design.
Embedded System Architecture: Basic Embedded processor/Microcontroller architecture, CISC (8051), RISC (ARM) Architecture, and Harvard Architecture (PIC).
Designing Embedded computing platform: The CPU Bus, memory devices, I/O devices, component interfacing, Design with microprocessor.
Embedded system design with FPGs: Introduction to FPGA and Verilog HDL, Hardware Design with Verilog HDL.
Processes and Operating Systems: Multiple Tasks and Multiple Processes; Preemptive Real-Time Operating Systems, Priority-Based Scheduling, Interprocess Communication Mechanisms, Evaluating Operating System Performance, Power Management and Optimization for Processes.
Networks: Distributed embedded architectures; Networks for embedded systems.
Case studies: Washing machine, Inkjet printer, telephone exchange, etc

Texts:

1. W. Wolf, "Computers as components: Principles of embedded computing system design", 2/e, Elsevier, 2008.
2. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Prentice Hall, 2003.

References:

1. D. Symes, and C. Wright, "ARM system developer's guide: Designing and optimizing system software",Elsevier,2008.
2. Muhammad Ali Mazidi, Janice G.Mazidi, Rolin D.McKinlay, "Jack Ganssle, The 8051 Microcontroller and Embedded Systems ".
3. Jack Ganssle, "The art of designing embedded systems", 2/e, Elsevier, 2008.
4. M. D. Ciletti , "Advanced Digital Design with the Verilog HDL", Prentice Hall, 2010.

EC382 Embedded system Lab 0-0-3-3

Familiarization with ARM microcontroller development environment, assembler, compiler, simulator, debugger and JTAG; Interfacing: LED Blinking, seven segment display, ADC and DAC interfacing, LCD interfacing, Applications: LCD desk clock, pressure and temperature monitoring, different controller implementation in ARM (P, PI, PID etc.), speed control of DC motor, speed and direction control of stepper motor; project

EC354 Communication Networks 3-0-0-6

Syllabus:

Introduction: Basics of Data Communications for networking; Packet switching, Store-&-Forward operation; Layered network architecture, Overview of TCP/IP operation. Data Link Layer: Framing; error control, error detection, parity checks, Internet Checksum and Cyclic Redundancy Codes for error detection; Flow control and ARQ strategies; HDLC protocol. Media Access Control (MAC): MAC for wired and wireless Local Area Networks (LAN), Pure and Slotted ALOHA, CSMA, CSMA/CD, IEEE

802.3; ETHERNET, Fast ETHERNET, Gigabit ETHERNET; IEEE 802.11 WiFi MAC protocol, CSMA/CA; IEEE 802.16 WiMAX. Network Layer: Routing algorithms, Link State and Distance Vector routing; Internet routing, RIP, OSPF, BGP; IPv4 protocol, packet format, addressing, subnetting, CIDR, ARP, RARP, fragmentation and reassembly, ICMP; DHCP, NAT and Mobile IP; IPv6 summary. Fundamentals of Queueing Theory: Simple queueing models, M/M/- Queues, M/G/1/ Queues, queues with blocking, priority queues, vacation systems, discrete time queues. Transport Layer: UDP, segment structure and operation; TCP, segment structure and operation. Reliable stream service, congestion control and connection management. Selected Application Layer Protocols: Web and HTTP, electronic mail (SMTP), file transfer protocol (FTP), Domain Name Service (DNS). Network Security: Basics of cryptographic systems, symmetric and public key cryptography, certificates, authentication and use of trusted intermediaries; Security for Wi-Fi systems.

Texts:

1. A. Leon-Garcia and I. Widjaja: Communication Networks; 2/e, McGraw Hill, 2004.
2. J.F. Kurose and K. W. Ross: Computer Networking, A Top-Down Approach, 4/e, Pearson/Addison Wesley, 2008.

References:

1. D. Bertsekas and R. Gallagar, Data Networks, 2/e, PHI, 1992.
2. A. S. Tanenbaum, Computer Networks, 3/e, PHI, 1997.
3. W. Stallings, Data and Computer Communication, 7/e, Prentice-Hall, 2004.

EC300	**Project (Optional)**	**0-0-6-6**

A project work, with primary emphasize on research output. A mentor will be allotted to each student.

HSS Elective:

(List of Courses)

HS 302	**Language, Cognition and Culture**	**3-0-0-6**

Syllabus:

Language evolution: Form and content; ways of thinking; role of meaning in comprehension

Cognitive and semantic issues: Structural and linguistic issues; categorization, metaphor and mental imagery; sense relations; spatial and temporal language

Socio-cultural issues: Embodiment, universalism / relativism, schemas; kinship relations

Theoretical perspectives: Various approaches and views; Separate Worlds Hypothesis; Gender Theory; Speech Act Theory; Gricean Maxims; Performative Theory etc.

Texts:

1. A. Akmajian, R. A. Demers, A. K. Farmer, R. M. Harnish. 2001. *Linguistics: An Introduction to Language and Communication*. (PART II: 'Communication and Cognitive Science'). MIT Press, London.
2. Croft, W. and D.A. Cruse. 2004. *Cognitive Linguistics*, Cambridge University Press.
3. Select papers (Langacker, Harris, van Djik etc) to be provided by Instructor.

References:

1. Friedenberg, J. and Silverman, G. 2006. *Cognitive Science: An Introduction to the Study of Mind*. Sage Publications, Thousand Oaks, California.
2. Albertazzi, L. 2000. *Meaning and Cognition: A Multidisciplinary Approach*. John Benjamins Publishing Company.
3. Gumperz, J. and Levinson, S. C. 1996. *Rethinking Linguistic Relativity*. Cambridge University Press.
4. Sunderland, J. 2006. *Language and Gender: An Advanced Resource Book.* Routledge, New York.

HS303	**Indian Writing in English**	**3-0-0-6**

This course introduces the learner to the large and diverse body of Indian Writing in English. Representative texts are employed to consider cultural issues like hybridity, nationalism, diaspora, post-colonialism, etc. The aim of the course is to make the students aware of literary genres, themes and styles used by various Indian authors in order to express themselves in English. The texts chosen for the course further make the students aware of the many socio-political issues that govern cultural relations in India.

Texts:

1. Select chapters from Salman Rushdie and Elizabeth West (eds), *The Vintage book of Indian writing, 1947-1997*, London: Vintage Books, 1997.

References:

1. M.K. Naik, A History of Indian English Literature, New Delhi: Sahitya Akademi, 2009.

2. Arvind Krishna Mehrotra (ed), *An Illustrated History of Indian Literature in English*, Orient Blackswan, 2003.

3. Meenakshi Mukherjee, "The anxiety of Indianness: Our novels in English,"*Economic and Political Weekly* (1993): 2607-2611.

B.Tech VII Sem

CSE:

Sem	Number	Course Name	L	T	P	C
VII	CS450	Internet Protocols	3	0	0	6
VII	XXxxx	Open Elective	3	0	0	6
VII	CS4xx	Elective II	3	0	0	6
VII	CS4xx	Elective III	3	0	0	6
VII	CS400	Project III	0	0	12	12
VII	HS	HSS Elective	3	0	0	6
		Total	15	0	12	42
		Contact Hours / Week	27			

Open Elective					
Number	Course Name	L	T	P	C
CS401	Number Theory in Cryptography	3	0	0	6

Departmental Electives					
Number	Course Name	L	T	P	C
CS402	Advanced graph algorithms	3	0	0	6
CS430	Parallel Programming	3	0	0	6
CS440	Image and Video Processing	3	0	0	6

CS450	**Internet Protocols**	**3-0-0-6**
Syllabus: Internetworking Protocols: IP, ICMP, IGMP, ARP, RARP, DHCP:Routing Protocols: RIP-2, RIPng for IPV6, OSPF, EIGRP, EGP, BGP:IP Multicast: Mobile IP, IPV6:Quality of Service: Queuing techniques (WFQ, RED, etc.):Multi-Protocol Label Switching (MPLS) and GMPLS:Virtual Private Network (VPN) Protocols: L2TP, PPTP:IP security; VOIP, IPTV, IP service management:Integrated services, differentiated services, RSVP:Transport over IP: TCP, UDP, SCTP, RTP, SNMP.		
Texts: 1. Lydia Parziale et. al. TCP/IP Tutorial and Technical Overview, 2006. (Available online at www.ibm.com/redbooks).		
References: 1. Adrian Farrel, The Internet and Its Protocols: A Comparative Approach(The Morgan Kaufmann Series in Networking), 2004.		

Open Elective

CS401	**Number Theory in Cryptography**	**3-0-0-6**
Syllabus: **Elementary Number Theory:** Euclid's Algorithm, Congruence, Chinese Remainder Theorem, Primitive Roots, Finite fields, Quadratic residue and reciprocity, Arithmetic Functions. **Primality Testing and Factorization:** Primality Testing, Pseudo-primes, Fermat's pseudo-primes, Pollard's rho method for factorization, Continued fractions, Continued fraction method for factorization. **Public Key Cryptosystems:** Public Key cryptography, Diffie-Hellmann key exchange, Discrete logarithm-based crypto-systems, RSA crypto-system, Signature Schemes, Digital signature standard, RSA Signature schemes, Knapsack problem, Attack on RSA, Forging of Digital Signature. **Elliptic Curve Cryptography:** Introduction to elliptic curves, Group structure, Rational points on elliptic curves, Discrete Log problem for Elliptic curves, Factorization using Elliptic Curves and other applications.		
Texts: *1.* Neal Koblitz *, A course in Number Theory and Cryptography, 2nd Edition, Springer, 1994.* *2.* D. R. Stinson, *Cryptography: Theory and Practice*, 3rd Edition, Chapchan & Hall/ *CRC Press, 2006*.		
Reference Books:		

1. T. H. Cormen, C. E. Leiserson, R. Rivest and C. Stein, *Introduction to Algorithms* , Second Edition, *PHI,* 2001.
2. William Stallings, *Cryptography and Network Security,* Sixth Edition, Pearson Publication, 2014.
3. Lawrence C. Washington, *Elliptic Curves: Number Theory and Cryptography*, 2nd Edition, CHAPMAN & HALL/CRC, 2003.
4. Tom M. Apostol, *Introduction to Analytic Number Theory*, 1st Edition, Springer, 1976.

Department Electives

CS402	**Advanced graph algorithms**	**3-0-0-6**

Syllabus:
Basic graph algorithms (BFS, DFS, Shortest path, Max Flow), Matching, Perfect graph and its sub-classes (chordal and interval graphs), Planar graphs, NP-complete graph problems (clique, independent set, dominating set), Approximation algorithms for NP-hard graph problems, Basic randomized algorithms and probabilistic methods (alternation technique, Second moment methods), Basic concept of parameterized complexity

Texts:
1. Neal Koblitz *, A course in Number Theory and Cryptography, 2nd Edition, Springer, 1994.*
2. D. R. Stinson, *Cryptography: Theory and Practice*, 3rd Edition, Chapchan & Hall/ *CRC Press, 2006*.

Reference Books:

1. D. B. West, Introduction to Graph Theory, 2nd Edition, Prentice Hall, 2001
2. R. Diestel, Graph Theory, 4th Edition, Springer, 2010
3. M.C. Golumbic, Algorithmic graph theory and perfect graphs, 2nd Edition, Elsevier, 2004
4. D. P. Williamson and D. B. Shmoys, The design of approximation algorithms, Cambridge University Press, 2010
5. M. Mitzenmacher and E. Ufpal, Probability and Computing_Randomized algorithms and probabilistic analysis, Cambridge University Press, 2005
6. M. Cygan, F. V. Fomin, L. Kowalik, D. Lokshtanov, D. Marx, M. Pilipczuk, M. Pilipczuk and S. Saurabh, Parameterized Algorithms, Springer, 2015

CS430	**Parallel Programming**	**3-0-0-6**

Syllabus:
Introduction to course; Introduction to parallel computing; Single Processor Machines; Principles of parallel algorithm design; Parallel Models; Parallel Machines and programming models; Basic techniques in parallel computing; Analytical models of parallel programming; Programming shared address space platforms; PThreads; Dense Linear Algebra; OpenMP; Graphics Processing Units (GPU); Compute Unified Device Architecture (CUDA); Distributed Memory Machines; Introduction to Message Passing; MPI Basics; Implementation of MPI primitives; Parallel graph computations; Benchmarking; Overview of parallel programming models; Partitioned Global Address Space (PGAS); Hybrid programming models; MPI + X; Cloud computing and virtualization; Map-reduce

Texts:

1. Introduction to Parallel Computing by Ananth Grama et. al.
2. Parallel Programming in C with MPI and OpenMP by Michael J. Quinn

Reference *Books:*

1. An Introduction to Parallel Algorithms by Joseph Jaja.
2. Various publications and reading materials that will be posted along with lecture slides.

CS440	**Image and Video Processing**	**3-0-0-6**

Syllabus:
Image Representations: Image acquisition, Sampling, Quantization **Visual Perception and Color Spaces:** Physiological characteristics of the eye and image formation
Human color vision: Color models: CIE, RGB, CMYK, HSI, HSV, L*a*b*
Spatial Domain Image Enhancement and Filtering: Point processing (contrast enhancement, histogram equalization),

Spatial domain 2-D LSI filtering, Median filtering

Frequency Domain Image Filtering and Enhancement: 2-D Discrete Fourier Transform, Frequency domain LSI filtering, Enhancement in the frequency domain **,** DCT

Image Compression: JPEG **Multi-resolution and Wavelet Transform**

Video representation and compression: MPEG2, H.264/AVC

Texts:

1. Digital Image Processing, 3rd edition by Gonzalez, Woods, Pearson Education India

Reference Books:

1. Handbook of Image and Video Processing, 2nd edition, Editor A L Bovik, Academic Press;
2. Fundamentals of Digital Image Processing, 1st edition by Anil K. Jain, Prentice Hall India Learning Private Limited; (2015)
3. Digital video Processing, 2nd Edition, by M. Tekalp, Prentice Hall International

ECE:

Sem	Number	Course Name	L	T	P	C
VII	EC451	Mobile Communication	3	0	0	6
VII	EC481	Measurement and Instrumentation	3	0	0	6
VII	ECxxx	Elective I	3	0	0	6
VII	EC400	Project I	0	0	12	12
VII	XXxxx	Open Elective	3	0	0	6
VII		HSS Course	3	0	0	6
		Total	15	0	12	42
		Contact Hours / Week	27			

Open Elective					
Number	Course Name	L	T	P	C
EC455	Wireless Sensor Networks	3	0	0	6

Departmental Electives					
Number	Course Name	L	T	P	C
EC461	VLSI Technology	3	0	0	6
EC454	Communication Systems	3	0	0	6
EC441	Image Processing	3	0	0	6

EC451 **Mobile Communication** **3-0-0-6**

Syllabus:

Evolution of mobile radio communication; Different generations of wireless communication and their technical specifications; Overview of current wireless systems and standards, Cellular concept: frequency reuse, channel assignment, handoff, interference, improving system capacity and cell coverage, radio trunking; Mobile radio propagation: free space propagation, reflection, diffraction, scattering, link budget design; Fading: multipath propagation, Doppler shift, impulse response model,multipath parameters, statistical models for multipath propagation; Mitigation of fading effects: equalization, diversity, channel coding; Transmitter and receiver techniques: modulation up to GMSK, line coding, pulse shaping, OFDM; Multiple access: FDMA, TDMA, SSMA, SDMA. MIMO channels. Diversity in wireless communications - Non-coherent and coherent reception; error probability for uncoded transmission; realization of diversity: time diversity; frequency diversity: DSSS and OFDM; receiver diversity: SC, EGC and MRC; transmit diversity.

Texts:

1. T. S. Rappaport, Wireless Communications: Principles and Practice, 2nd Edition, Pearson Education, 2004.
2. S. Haykin and M. Moher, Modern Wireless Communications, 1st Edition, Pearson Education, 2005.

References:

1. A. J. Goldsmith, Wireless Communications, Cambridge University Press, 2005
2. G. L. Stuber, Principles of Mobile Communications, Kluwer, 1996.
3. D. Tse and P. Viswanath, Fundamentals of Wireless Communications, Cambridge University Press, 2005.

EC481	Measurement and Instrumentation	3-0-0-6

Syllabus:

Introduction to instrumentation, Static and dynamic characteristics of measurement Systems, Error and uncertainty analysis, standards and calibration, Bridges and potentiometers, measurement of R,L and C. Measurements of voltage, current, power, power factor and energy. A.C & D.C current probes, ohmmeter, loading effect, Transducers classification, Measurement of displacement, velocity, acceleration, strain, force, temperature, pressure, flow, level, conductivity, viscosity and humidity, Signal conditioning; Instrumentation amplifier, isolation amplifier, and other special purpose amplifiers, Time, phase and frequency measurements, Cathode ray oscilloscope, Q meter, DMM, frequency counter, spectrum analyzers, logic probe and logic analyzer; programmable logic controller; Virtual instrumentation, Serial and parallel communication. Shielding and grounding.

Texts:

1. E. O. Deobelin, Measurement Systems: Application and Design, 5th Edition, Tata McGraw-Hill, 2003.
2. A. D. Helfrick and W. D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, 2nd Edition, Phi Learning, 2008.

Reference:

1. B. G. Liptak, Instrument Engineers Handbook: Process Measurement and Analysis, 4th Edition, CRC, 2003.
2. A. K. Sawhney, A course of Electrical and Electronic Measurement and Instrumentation, 9th Edition, Dhanpat Rai Publication, 2014.

Open Elective

EC455	Wireless Sensor Networks	3-0-0-6

Syllabus:

Characteristics of WSN: Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations. Medium Access Control Protocols: Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts - Contentionbased protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol. Routing And Data Gathering Protocols Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing - Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB. Embedded Operating Systems: Operating Systems for Wireless Sensor Networks – Introduction - Operating System Design Issues - Examples of Operating Systems, Interfaces and Modules- Configurations and Wiring - Generic Components -Programming in Tiny OS using NesC, Emulator TOSSIM. Applications Of WSN: Few WSN Applications.

Texts:

1. KazemSohraby, Daniel Minoli and TaiebZnati, Wireless Sensor Networks Technology, Protocols, and Applications, John Wiley & Sons, 2007.
2. Holger Karl and Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, John Wiley & Sons, Ltd., 2005.

References:

1. Feng Zhao & Leonidas J. Guibas, Wireless Sensor Networks- An Information Processing Approach, Elsevier, 2007.

Department Electives

EC461	VLSI Technology	3-0-0-6

Syllabus:

Introduction on VLSI Design, Crystal Structure of Si, Defects in Crystal, Crystal growth, Epitaxy; Vapour phase Epitaxy, Doping during Epitaxy, Molecular beam Epitaxy, Oxidation; Kinetics of Oxidation, Oxidation rate constants, Dopant Redistribution, Oxide Charges, Diffusion; Theory of Diffusion, Infinite Source, Actual Doping Profiles, Diffusion Systems, Ion - Implantation Process, Annealing, Masking, Lithography, Wet Chemical Etching, Dry Etching, Plasma Etching Systems, Etching of Si,Sio2,SiN and other materials, Plasma Deposition Process, Metallization, MOSFET Fabrication for IC; Metal gate vs. Self-aligned Poly-gate, Tailoring of Device Parameters, CMOS Technology

Texts:

1. S.K. Ghandhi, VLSI Fabrication Principles – Silicon and Gallium Arsenide, 2nd edition, John Wiley and Sons, 2009.

References:

1. J.D. Plummer, M.D. Deal, P.G. Griffin, Silicon VLSI Technology, 2nd edition, Pearson Education, 2008.
2. S.M. Sze, VLSI Technology, 2nd edition, McGraw Hill, 1988.

EC454	Communication Systems	3-0-0-6

Optical Communication:

Basic Introduction**:** Ray theory transmission- Total internal reflection-Acceptance angle – Numerical aperture – Skew rays

Components: Optical Transmitter, Optical amplifier, Photoreceiver, Transmission media - free-space, twisted pair and coaxial cable, Optical Fiber

Transmission System: Baseband and modulated transmission, bandwidth filtering, demodulation and signal recovery, multimode and single-mode; attenuation and dispersion; Optical MUX and DEMUX - Operating principle of multiplexers and de-multiplexors, optical telecoms

Communication networks: LAN, MAN, WAN; multiplexing (TDM, WDM, SDM); packet- and circuit-switched networks; network protocols, SONET/SDH, All optical networks; Access networks

Noise and Detection: Noise in optical transmitters, amplifiers and detectors, Crosstalk in WDM system: Component, Stimulated Raman Scattering, Four-Wave mixing, etc., Bit error rate, Power Penalty

Recent Developments: Solitons; Optical Time Division Multiplexing; All optical components; Photonic Band Gap Device

Satellite Communication:

Basic Principles: General features, frequency allocation for satellite services, properties of satellite communication systems. Satellite Orbits: Introduction, Kepler's laws, orbital dynamics, orbital characteristics, satellite spacing and orbital capacity, angle of elevation, eclipses, launching and positioning, satellite drift and station keeping. Satellite Links: Introduction, general link design equation, system noise temperature, uplink design, downlink design, complete link design, effects of rain. Earth Station: Introduction, earth station subsystem, different types of earth stations. The Role and Application of Satellite Communication.

Texts:

1. 1. John M. Senior , Optical Fiber Communication, 3rd Edition, Pearson Education, 2009
   2. Gerd Keiser, Optical Fiber Communication, 3rd Edition, Mc Graw Hill, 2000
   3. Timothy Pratt, Charles W. Bostian, Satellite Communications, 2nd Edition, John Wiley & Sons, 2003.

References:

1. J.Gower, Optical Communication System, 2nd Edition, Prentice Hall of India, 1993.
2. Rajiv Ramaswami, , Kumar N Sivarajan, Galen H. Sasaki, Optical Networks, 3rd Edition, Morgan Kufmann, 2010.
3. Govind P. Agrawal, Fiber-optic communication systems, 3rd edition, John Wiley & sons, 2002.
4. R.P. Khare, Fiber Optics and Optoelectronics, Oxford University Press, 2004
5. Dennis Roddy, Satellite Communications, 3rd Edition, Mc. Graw-Hill International Ed. 2001

EC441	Image Processing	3-0-0-6

Syllabus:

Digital image fundamentals: Visual perception, image sensing and acquisition, sampling and quantization, basic relationship between pixels and their neighborhood properties.

Image enhancement in spatial domain: Gray-level transformations, histogram equalization, spatial filters- averaging, order statistics filter, smoothing and sharpening filter.

Edge detection: first and second derivative filters, Sobel, Canny, Laplacian and Laplacian-of Gaussian masks.

Image filtering in frequency domain: One and two-dimensional DFT, properties of 2-D DFT, periodicity properties, convolution and correlation theorems, Fast Fourier Transforms, Smoothing and sharpening filtering in frequency domain, ideal and Butterworth filters, homomorphic filtering.

Color image processing: Color models RGB, CMYK, HSI, pseudo-color image processing, full-color image processing, color transformation, color segmentation, noise in color images.

Morphological Image Processing: Basic operations- dilation, erosion, opening, closing, Hit-Miss transformations, Basic morphological algorithms- boundary extraction, region filling, connected components, convex hull, thinning, thickening, skeletons, pruning, extensions to gray-scale morphology.

Image segmentation: Edge linking and boundary detection, Hough transforms, graph-theoretic techniques, global and adaptive thresholding, Region based segmentation, Segmentation by morphological watersheds, motion based segmentation.

Texts:

1. Digital Image Processing by Rafael C. Gonzalez and Richard E. Woods.

References:

1. Fundamentals of Digital Image Processing by Anil K. Jain.

HSS Elective:

(List of Courses)

HS401	Consumer Behaviour and Welfare Economics	3-0-0-6

Syllabus:

Consumer preferences, Budget constraints, Optimal allocation; Choice under uncertainty: Attitude towards risk, risk averter, risk lover; Analysis of markets structure: Evaluating the gains and losses of taxes and subsidy, Consumer and producer surplus; Investment, time and capital markets; Markets with asymmetric information: The problem of moral hazard, Principal – agent problem; Welfare economics: Introduction to basic issues, Pareto optimality, Compensation principle

Texts:

1. R.S. Pindyck and D.L. Rubinfeld, Microeconomics, Prince-Hall International, Inc. 2012.

References:

1. P .A. Samuelson and W. D. Nordhans, Economics, Mc Graw Hill Inc., 1995.
2. H.L. Ahuja. Advanced economic theory, S. Chand & Co. Ltd., 2006.

HS402	Understanding Democracy and Governance in India	3-0-0-6

Syllabus:

Introduction to Politics; The case for Indian Model of democracy, Structures and Process of Governance- Parliament-Lok Sabha and Rajya Sabha, Party System, Party Politics and Electoral behaviour, Theories of Federalism and Indian Experience, The Supreme Court and Judicial Activism, Local Governance-Panchayati Raj Institution special reference to 73rd and 74th Amendment, Women and SC, ST in Panchayati Raj Institution; Theories of development- Emergence of Classical Political Economy; Political Economy and Theories of Free Trade; the Great Depression and the crisis of neo-classical theories; the Keynesian revolution, Debates over Models of Development in India, Liberalisation of Indian Economy, E-governance.

Texts:

2. Gopal Jayal, Niraja and Pratap Bhanu Metha, eds., (2010), *The Oxford Companion to Politics in India* (Delhi: Oxford University Press)

References:

3. Frankel, Francine (2005). *India's Political Economy (1947-2004): The Gradual Revolution.* (Delhi: Oxford University Press).
4. Chari, Sharad and Stuart Corbridge (2008). (eds.). *The Development Reader*. (Delhi: Routledge

B.Tech VIII Sem

CSE:

Sem	Number	Course Name	L	T	P	C
VIII	SC401	Physics II	3	0	0	6
VIII	CS46X	Elective IV	3	0	0	6
VIII	CS46X	Elective V	3	0	0	6
VIII	CS46X	Elective VI	3	0	0	6
VIII	CS410	Project IV	0	0	12	12
VIII	HS	HSS Course	3	0	0	6
		Total	15	0	12	42
		Contact Hours / Week	27			

Department Electives

CS412 **Game Theory** **3-0-0-6**

Syllabus:

Games and equilibria, two player Zero-Sum Games, Nash equilibria and existence properties, complexity of finding Nash equilibria, information, strategic, dynamic and repeated games, bargaining, auction and mechanism design with applications, market equilibria, inefficiency of equilibria, routing games, load balancing games.

Texts:

1. E. N. Barron, Game Theory: An Introduction, Wiley, 2nd edition, 2013.

References:

1. N. Nisan, T. Roughgarden, V. Vazirani and E. Tardos, Algorithmic Game Theory, Cambridge University Press, 1st edition, 2007.

CS414 **Advance Architecture** **3-0-0-6**

Syllabus:

Introduction: review of basic computer architecture, quantitative techniques in computer design, measuring and reporting performance. **Pipelining:** Basic concepts of pipelining, data hazards, control hazards, and structural hazards, Techniques for overcoming or reducing the effects of various hazards. **Hierarchical Memory Technology:** Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses, mapping and management techniques, memory replacement policies. **Instruction-level parallelism:** Concepts of instruction-level parallelism (ILP), Techniques for increasing ILP, Superscalar and VLIW processor architectures. **Multiprocessor Architecture:** Centralized shared-memory architecture, synchronization, memory consistency, interconnection networks; Distributed shared-memory architecture.

Texts:

1. Computer Architecture: A Quantitative Approach - J. L. Hennessy and D. A. Patterson, Morgan Kaufmann, (fourth edition) 2006.

References:

1. Parallel Computer Architecture: A Hardware/Software Approach - David Culler, J.P. Singh and Anoop Gupta, Morgan Kaufmann, (first edition) 1998.

CS415 **Ubiquitous Computing** **3-0-0-6**

Syllabus:
Introduction to ubiquitous systems: properties and challenges – pervasive solutions, architectural design of UbiCom systems: smart DEI model – Applications and requirements: tabs, pads, liveboards, smart classroom, smart home, smart transport system, other projects in the domain of IoT – Smart device access: tagging physical objects – RFID tags – MEMS – controllers – Context awareness: types, representation, adaptation, modeling and architecture, mobility, spatial and temporal awareness – Location in ubiquitous systems: location representation, location tracking, location systems, location management principles and techniques – Introduction to mobile middleware: adaptation – agents – service discovery – Introduction to sensor and ad hoc networks: properties – applications – design challenges – autoconfiguration – communication scheduling – mobility requirements – deployment and self organization – data routing – fault tolerance and reliability – energy efficiency – Ubiquitous communication: NFC, ADLS broadband, Bluetooth, ZigBee, WLAN, WiMax, 6LoWPAN, RPL, PLC, PAN, Body Area Network – network access control – group communication – service oriented network – Privacy in Ubiquitous Computing: understanding privacy – motivation – challenges – privacy enhancing technologies basics

Text Books:
1. **Ubiquitous Computing: smart devices, environments and interactions** by Stefan Poslad, Willey Publication
2. **Fundamentals of Mobile and Pervasive Computing** by Frank Adelstein, Sandeep K.S. Gupta, Golden G. Richard III, Loren Schwiebert, McGraw Hill Education Pvt Ltd

References:
1. **Ubiquitous Computing Fundamentals** by John Krumm, CRC Press

CS460	**Financial Engineering**	**3-0-0-6**

Syllabus:
Introduction of financial system, financial markets, and financial instruments: stocks, bonds, derivatives, mutual funds; Interest rates, present and future values of cash flow streams; Bonds and bonds pricing, yield, duration and convexity; Mean-variance portfolio optimization, two and one fund theorems, capital asset pricing model, security market line; no-arbitrage principle; Hedging, pricing, forward and futures contracts and their pricing, hedging strategies using futures; Call and put options, hedging strategies involving options, Pay-off curves of options combinations, single and multi period binomial lattice models, risk neutral probabilities, pricing American options, Cox-Ross-Rubinstein(CRR) formula, Black-Scholes option pricing formula.

Text Books:
1. D. G. Luenberger (1998), Investment Science, Oxford University Press, New York.
2. J. C. Hull (2000), Options, Futures and other Derivatives, Fourth edition, Prentice Hall Inc., Upper Saddle River.

References:
1. M. Capinski and T. Zastawniak (2003), Mathematics for Finance: An Introduction to Financial Engineering and Springer-Verlar, London.
2. S. Chandra, S. Dharmaraja, A. Mehra, R. Khemchandani , Financial Mathematics: An Introduction, Alpha Science International Ltd.

ECE:

Sem	Number	Course Name	L	T	P	C
VIII	EC401	Project II	0	0	12	12
VIII	ECxxx	Elective II	3	0	0	6
VIII	ECxxx	Elective III	3	0	0	6
VIII	ECxxx	Elective IV	3	0	0	6
VIII	SC401	Physics II	3	0	0	6
VIII		HSS Course	3	0	0	6
		Total	15	0	12	42
		Contact Hours / Week	27			

Departmental Electives					
Number	Course Name	L	T	P	C
EC452	Detection and Estimation Theory	3	0	0	6
EC471	Antenna and Wave Propagation	3	0	0	6

EC480	Digital Control Systems	3	0	0	6

Department Electives

EC452	Detection and Estimation Theory	3-0-0-6

Syllabus:

Review of probability; Hypothesis testing: Neyman-Pearson, Receiver operating characteristics (ROC), Minimax, and Bayesian detection criteria; Randomized decision; Composite hypothesis testing: Bayesian approach, Generalized likelihood-ratio test; Detection of deterministic and random signals with unknown parameters.

Parameter estimators: properties- consistency, bias, and variance; Bayesian parameter estimation: Minimum mean square error estimation, Maximum a posteriori estimation; Nonrandom parameter estimation: Minimum variance unbiased estimation, Fisher information, Cramer-Rao lower bound, sufficient and complete statistics, Rao-Blackwell theorem; Maximum-likelihood estimation; Least squares; Signal estimation: Linear minimum mean square estimation, Weiner and Kalman filters.

Texts:

3. S. M. Kay, Fundamentals of Statistical Signal Processing: Detection Theory, 1st edition, Prentice Hall PTR, 1998.
4. S. M. Kay, Fundamentals of Statistical Signal Processing: Estimation Theory, 1st edition, Prentice Hall PTR, 1993.

References:

3. H. V. Poor, An Introduction to Signal Detection and Estimation, 2nd edition, Springer, 1994.
4. H. L. Van Trees, Detection, Estimation and Modulation Theory, Part I, 1st edition, John Wiley, 1968.
5. D. L. Melsa and J. L. Cohn, Detection and Estimation Theory, 1st edition, McGraw Hill, 1978.

EC471	Antenna and Wave Propagation	3-0-0-6

Syllabus:

Wire antennas: Dipole, Monopole, Loop; Aperture antennas: Slot, Open-ended waveguide, Horn, Reflector antennas, Antenna arrays: Linear array and Pattern Multiplication, two element array, uniform array, array with non-uniform excitation; Yagi – Uda array, Log-periodic dipole array, Long wire, V, Rhombic Antennas, Turnstile antenna, Helical, Biconical, Spiral, Microstrip antennas, Antenna Measurements: Radiation pattern, Gain, Directivity, Polarization, input impedance and reflection coefficient, Radio Wave Propagation: Ground wave, Ionospheric propagation.

Texts:

1. A.R. Harish, M. Sachidananda, Antennas and Wave Propagation, 1st Edition, Oxford, 2007.

References:

1. C. A. Balanis, Antenna Theory: Analysis and Design, 3rd Edition John Wiley, 2005.
2. J. D. Kraus, R. J. Marhefka, A. S Khan, Antennas and Wave Propagation, 4th Edition, Tata McGraw-Hill, 2011

EC480	Digital Control Systems	3-0-0-6

Syllabus :

Introduction to digital control: Introduction, discrete time system representation, mathematical modeling of sampling process, data reconstruction.

Modeling discrete-time systems by pulse transfer function: Revisiting Z-transform, mapping of s-plane to z-plane, pulse transfer function, pulse transfer function of closed loop system, sampled signal flow graph.

Time response of discrete systems: Transient and steady state responses, time response parameters of a prototype second order system.

Stability analysis of discrete time systems: Jury stability test, stability analysis using bi-linear transformation.

Design of sampled data control systems: Root locus method, controller design using root locus, root locus based controller design using MATLAB, Nyquist stability criteria, Bode plot, lead compensator design using Bode plot, lag compensator design using Bode plot, lag-lead compensator design in frequency domain.

Deadbeat response design: Design of digital control systems with deadbeat response, practical issues with deadbeat response design, sampled data control systems with deadbeat response;

Discrete state space model: Introduction to state variable model, various canonical forms, characteristic equation, state transition matrix, solution to discrete state equation, controllability, observability and stability.

State feedback design: Pole placement by state feedback, set point tracking controller, full order observer, reduced order observer, output feedback design.

Introduction to optimal control: Basics of optimal control, performance indices, linear quadratic regulator (LQR) design.

Text:

1. B. C. Kuo, Digital Control Systems, 2nd Edition, Oxford University Press, 2007

References :

1. K. Ogata, Discrete Time Control Systems, 2nd Edition, Prentice Hall, 1995.
2. M. Gopal, Digital Control and State Variable Methods, 2nd Edition, Tata Mcgraw Hill, 2003.
3. G. F. Franklin, J. D. Powell and M. L. Workman, Digital Control of Dynamic Systems, 3rd Edition, Addison Wesley, 1998, Pearson Education, Asia, 2000.
4. K. J. Astroms and B. Wittenmark, Computer Controlled Systems - Theory and Design, 3rd Edition, Prentice Hall, 1997.

Common courses:

SC401	**Physics II**	**3-0-0-6**

Syllabus:

Nuclear Physics: General Properties of Nucleus – radius, size, mass, spin, moments, binding energy, nuclear angular momentum and parity; Nuclear Forces; Nuclear Models; Nuclear decays and Radioactivity – Fundamental laws of radioactivity, α, β and γ Decays; Nuclear reactions and their conservation laws; Nuclear reactors; Nuclear fission and fusion; Accelerators.

Astrophysics: Astronomical scale and dimensions, Night sky, Stars and Constellations, Sidereal time, The Sun and Solar system, Orbital dynamics, Kepler's Laws, Astronomical coordinate systems, Space velocity and motion of stars; Photometric study – Stellar luminosity, Magnitude scale system, The Color Index, Stellar temperatures; Stellar spectra and classification – Saha equation, HR Diagram; The milky way.

Nanophysics: Introduction: Nanoscale regime, Emergence of nanoscience, Nanoparticles, Nanowires, Nanotubes, Nanoscience to nanotechnology, Challenges of nanotechnology; Nanostructure synthesis: Natural occurrence, Chemical route, Chemical bath deposition, Sol-gel techniques, Chemical vapour deposition (CVD), Physical vapour deposition, Magnetron sputtering, Pulsed laser deposition(PLD); Characterization of Nanostructures: X-ray diffraction (XRD), Electron microscopy (SEM and TEM), Spectroscopic techniques, X-ray photoelectron spectroscopy.

Texts:

1. K. S. Krane, Introductory Nuclear Physics, John Wiley, 1987.
2. I. Kaplan, Nuclear Physics, Addison-Wesley, 2002.
3. Pankaj Jain, Introduction to Astronomy and Astrophysics, Boca Raton: CRC Press, 2015.
4. Charles P. Poole and Frank J. Owens, Introduction to Nanotechnology, Wiley-Interscience, 2003.
5. G. Cao, Nanostructures and Nanomaterials: Synthesis, Properties and Applications, Imperial College Press, 2004.

References:

1. S.N. Ghoshal, Nuclear Physics, S.Chand, 2010.
2. Bradley W. Carroll and Dale A. Ostlie, An introduction to modern Astrophysics, Addison Wesley, 2007.
3. K. D. Sattler, Handbook of Nanophysics, CRC Press, 2011.
4. G. Schmid, Nanotechnology: Principles and Fundamentals, Wiley-VCH Verlag, 2008

HSS Electives

HS403	Science Fiction II	3-0-0-6

Syllabus:

Gender theory, cyborg theory, utopianism, posthumanism and futurism.

The course will revisit the themes discussed in Science Fiction I and explore various methods of approaching a literary text: theme-based approach, character-based approach, new historicism-based approach, context-specific approach.

Texts:

1. F. Paweł, Introduction: Digital Science Fiction(s), Science Fiction Studies. 43.1, 2016.
2. Select chapters from B. W. Aldiss (Ed.), *A Science Fiction Omnibus,* Penguin UK, 2007.

References:

1. D. Seed, Science Fiction: A Very Short Introduction, OUP, 2011.
2. K. Amis, New Maps of Hell: A Survey of Science Fiction, Harcourt, 1960.
3. R. Latham, (Ed). The Oxford Handbook of Science Fiction, Oxford UP, 2014.

HS 404	Language, Cognition and Culture II	3-0-0-6

Syllabus:

Various approaches to study of mind: Philosophical, psychological, cognitive, evolutionary, neuroscience, linguistic, network, AI

Cognitive semantics: Theoretical, methodical, empirical issues; Concepts and language: Interrelations; Embodiment: Bio-cultural and social factors

Texts:

1. W. Croft and D.A. Cruse, Cognitive Linguistics, Cambridge University Press, 2004.
2. G. Lakoff and M. Johnsen, Metaphors We Live By, The University of Chicago Press, 2003.
3. Select papers to be provided by Instructor.

References:

1. J. Friedenberg and G. Silverman, Cognitive Science: An Introduction to the Study of Mind, Sage Publications, 2006.
2. V. Evans and S. Pourcel, New Directions in Cognitive Linguistics. Human Cognitive Processing (HCP) Series: Vol. 24, John Benjamins Publishing Company, 2009.
3. L. Albertazzi, Meaning and Cognition: A Multidisciplinary Approach, John Benjamins Publishing Company, 2000.
4. D. Geeraerts, Cognitive Linguistics: Basic Readings. Cognitive Linguistics Research, Vol 34, 2006.
5. S. Pinker, The Language Instinct, Penguin, 1995.