Department of Computer Engineering
Curricular Structure (B.Tech Computer Engg.)

Semester III

S.No.	Semester	Course Code		Course Name	Category	Type	Credit	L-T-P
1	III	CST201		Logic in Computing	PC	Theory	3	3-0-0
2	III	CST203		Data Structures and Algorithms	PC	Theory	4	3-1-0
3	III	CST205		Digital Logic Design	PC	Theory	4	3-1-0
4	III	CST207		Programming Methodology	PC	Theory	3	3-0-0
5	III	CST209		Introduction to Signals and Communication	PC	Theory	4	3-1-0
6	III	HST201		Effective Communication	PC	Theory	3	2-1-0
1	III	CSP211		Programming Lab	PC	Lab	2	0-0-4
2	III	CSP213		Digital Logic Design Lab	PC	Lab	2	0-0-3
							25	29

Contact Hours

Semester IV

S.No.	Semester	Course Code		Course Name	Category	Type	Credit	L-T-P
1	IV	CST202		Computer Organization and Microprocessors	PC	Theory	3	3-0-0
2	IV	CST204		Discrete Structures	PC	Theory	4	3-0-0
3	IV	CST206		Formal Languages and Automata Theory	PC	Theory	4	3-1-0
4	IV	CST208		Design and Analysis of Algorithms	PC	Theory	4	3-1-0
5	IV	CST210		Systems Programming	PC	Theory	3	3-0-0
6	IV	HST202		Economic Environment	PC	Theory	3	2-1-0
1	IV	CSP212		Assembly Language Programming Lab	PC	Lab	2	0-0-3
2	IV	CSP214		Algorithms Lab	PC	Lab	2	0-0-3
3	IV	CSP216		System Programming Lab	PC	Lab	2	0-0-3

							27	29	Contact Hours

Semester V

S.No.	Semester	Course Code		Course Name	Category	Type	Credit	L-T-P
1	V	CST301		Computer Architecture	PC	Theory	3	3-0-0
2	V	CST303		Concurrent and Parallel Programming	PC	Theory	3	3-0-0
3	V	CST305		DBMS	PC	Theory	4	3-1-0
4	V	CST307		Computer Networks	PC	Theory	3	3-0-0
5	V	CST309		Compiler Design	PC	Theory	3	3-0-0
6	V	CST311		Software Engineering	PC	Theory	3	3-0-0

1	V	CSP313		DBMS Lab	PC	Lab	2	0-0-3	
2	V	CSP315		Concurrent Programming Lab	PC	Lab	2	0-0-3	
3	V	CSP317		Computer Network Lab	PC	Lab	2	0-0-3	
							25	28	Contact Hours

Semester VI

S.No.	Semester	Course Code		Course Name	Category	Type	Credit	L-T-P
1	VI	CST302		Operating System	PC	Theory	3	3-0-0
2	VI	CST304		Embedded Systems	PC	Theory	3	3-0-0
3	VI	CST306		Object Oriented Analysis and Design	PC	Theory	3	3-0-0
4	VI	CST308		Computer and Network Security	PC	Theory	3	3-0-0
5	VI	CST310		Computer Graphics	PC	Theory	3	3-0-0
6	VI	CST312		AI and Expert System	PC	Theory	3	3-0-0

1	VI	CSP314		OS and Security Lab	PC	Lab	2	0-0-3
2	VI	CSP316		Graphics Lab	PC	Lab	2	0-0-3
3	VI	CSP318		Advanced Programming Lab	PC	Lab	2	0-0-3
4	VI	CSP320		Embedded System Design Lab	PC	Lab	2	0-0-3
							26	30

Contact Hours

* Letter grades to be awarded.

Semester VII

S.No.	Semester	Course Code		Course Name	Category	Type	Credit	L-T-P
1	VII	CSS401		Training Seminar	PC	Theory	2	0-2-0
2	VII			Management	PC	Theory		
3	VII			*Open Elective I*	OE	Theory		
4	VII			*Open Elective II*	OE	Theory		
5	VII			Program Elective I	PE	Theory	4	3-0-2
6	VII			Program Elective II	PE	Theory	4	3-0-2

Semester VIII

S.No.	Semester	Course Code		Course Name	Category	Type	Credit	L-T-P
1	VIII			Management	PC	Theory		
2	VIII	CSD402		Major Project	Projec	Theory		
3	VIII			*Open Elective III*	OE	Theory		

4	VIII			*Open Elective IV*	OE	Theory		
5	VIII			Advanced Program Elective I	AEC	Theory	4	3-0-2
6	VIII			Advanced Program Elective II	AEC	Theory	4	3-0-2

Advanced Elective Courses

S.No.		Course Code		Course Name				
		CST432		Topics in Data Strutures and Algorithms				
		CST434		Parallel and Distributed Computing				
		CST436		Selected Topics in Operating System				
		CST438		Advanced Topics in Computer Graphics				
		CST440		Advanced Topics in Databases				
		CST442		Network Performance Modelling				
		CST444		Software Testing and Validation				
		CST446		Topics in SOC Design				
		CST448		Advances in Compiler Design				
		CST450		Wireless Sensor Networks				
		CST452		Digital Image Analysis				
		CST454		Data Mining and Data Warehousing				
		CST456		Topics in High Speed Networking				
		CST458		E-Commerce				
		CST460		High Level Synthesis of Digital Systems				
		CST462		Parallelizing Compiler				
		CST464		Public Key Infrastructure and Trust Management				
		CST466		Selected Topics in Cryptography				
		CST468		Robotics and Control				
		CST470		FPGA based System Design				
		CST472		Security in Computing				
		CST474		Intelligent Agents				
		CST476		Critical Systems				
		CST478		Pattern Recognition				

		CST480		Biometric Security				
		CST482		Computer Forensics				
		CST484		Semantic Web				
		CST486		Intrusion Detection				
		CST488		Internet Security				
		CST490		Malware Analysis and Detection				

Program Electives

S.No.		Course Code		Course Name					
		CST433		Wireless Communications					
		CST435		VHDL					
		CST437		Neural Networks					
		CST439		Speech Recognition					
		CST441		Software Project Management					
		CST443		Data Compression					
		CST445		Natural Language Processing					
		CST447		Wireless & Ad-hoc Networks					
		CST449		Real Time Systems					
		CST451		Cryptography					
		CST453		VLSI Algorithms					
		CST455		Digital Image Processing					
		CST457		Evolving Architectures					
		CST459		Topics in Computing					
		CST461		Machine Learning					
		CST463		Modelling and Simulation					
		CST431		Programming in Java					
		CST465		Python Programming					
		CST467		Multimedia Technology					
		CST469		Computer Human Interaction					

B.Tech (Computer Engineering) - Semester III

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST201**	**Course**	**Logic in Computing**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Logic: Introduction to Logic, Propositional Logic and Predicate Logic Propositional logic: Elements, Truth table, Declarative sentences, Construction of Proposition, Converse and Contrapositive, Reasoning with Propositions, Natural deduction – rules, Provable equivalence, Semantics, logical connectives, Soundness and completeness of propositional logic, Normal forms, Identities of Propositions and Dual, Use of Identities, Implications, Reasoning with Propositions, Proof of Identities, Proof of Implications, Semantic equivalence, satisfiability and validity, Conjunctive normal forms. Predicate logic: Terms, Formulas - Well Formed Formula (WFF) of Predicate Logic, Constructing Formulas; Free and bound variables, Reasoning with Predicate Logic, deduction rules, Quantifier, Semantics , Undecidability of predicate logic, Expressiveness, second-order logic. Verification: Linear-time temporal (LTL) logic, Syntax and Semantics, Model checking: systems, tools, properties, Branching-time temporal logic - Syntax and Semantics of CTL, Model-checking algorithms Program verification: Partial and total correctness, Proof calculus, Modal logic – syntax and semantics, Binary decision diagrams.		
Books:	Michael Huth, Mark Ryan: Logic in Computer Science: Modelling and Reasoning about Systems, Cambridge University Press.		

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B.Tech (Computer Engineering) - Semester III

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST203**	**Course Name:**	**Data Structures and Algorithms**
Credit:	**4**	**L-T-P:**	**3-1-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Introduction to data structures, dynamic aspects of operations on data, analysis of algorithms. Creation and manipulation of data structures: arrays, lists, stacks, queues, trees – binary, threaded, multiway; heaps, height balanced trees, graphs, hashing and hash tables, dictionaries, tries. Algorithm approaches: greedy, dynamic programming, divide and conquer, branch and bound, introduction to complexity analysis and measures. Algorithms: sorting and searching, merging, tree and graph traversals, shortest path, minimum spanning tree, order statistics, string matching. Selected topics: computational geometry, emerging areas.		
Books:	1. Kruse R.L., Data Structure and Program Design, PHI. 2. Rivest, Cormen, Introduction to Algorithms, MIT Press 3. Horowitz and Sahni: Data Structure in C++ , Glagotia 4. Ellis Horowitz, Sartaj Sahni, Fundamentals of Data Structures 5. Aaron M. Tenenbaum, Y. Langsam, Moshe J. Augenstein, Data Structures Using C		

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B.Tech (Computer Engineering) - Semester III

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST205**	**Course**	**Digital Logic Design**
Credit:	**4**	**L-T-P:**	**3-1-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Boolean algebra: Binary connectives, Evaluation of truth functions, Duality, Simplification of Boolean expressions. Realisation of Logic Circuits: Minterm, Maxterm, Karnaugh maps, incompletely specified functions, simplification. Quine-Mckluskey's tabular method, prime implicants, map and tabular minimization of multiple output circuits. Combinational and Sequential circuits: Adders - Ripple carry, Carry look ahead, Carry select, carry save; subtraction, encoder/decoder, multiplexer, demultiplexer, parity checker and generator. Latches, Flip Flops : JK, SR, D Type and T type Flip Flops; Shift registers, Counters - Ripple, decade, up-down counters, Mod-*n* counters, Multiplication - Add and Shift method, Booth's Multiplier, m -Array Multiplier, Division - Restoring/Non restoring method.. Clock, pulse and level mode sequential circuits; Analysis and design of sequential circuit. Synthesis of state diagrams, finite memory circuits, equivalence relations, equivalent states and circuits, simplification by implicant tables. Mealy and Moore machines, state assignment and memory element input equation, General pulse-mode circuits, clock input counters, extended state tables. Asynchronous Mode Circuits: Analysis of a fundamental mode circuits, Synthesis of flow tables, minimization, transition tables, excitation maps and output maps, Cycles and Races, Race free assignments, Hazards in sequential circuits. Introduction to A/D and D/A converters. Sampling and Quantization.		
Books:	1.Digital Systems and Hardware and Firmware Algorithms: M.Ercegovac and T. Lang, Pearson. 2.Hill & Peterson: Switching Theory and Logic Design, John Wiley 3.J.F.Wakerly: Digital Design, Principle and Practices, Pearson.		

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B.Tech (Computer Engineering) - Semester III

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST207**	**Course Name:**	**Programming Methodology**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Introduction to flow charts, programming paradigms. Abstractions in programming languages. Declarations, variables and constants, data types, arithmetic expressions, statements, precedence and associativity of operators. User-defined data types, data abstraction, array, records, character string, variable size data structure, pointer and reference types, design and implementation uses of these types, type checking and type conversion. Control constructs – branching and looping, relational and boolean expressions, conditional execution and iteration, exception handling. Sub-programs, procedures and functions, parameter passing mechanism, scope and lifetime of variables, environment, activations, and allocation. Recursion and recursive functions, Co-routines and scheduled subprograms, task and concurrent exception. Name and referencing environments, static dynamic and block structures. Dynamic and static scope of shared data. Block structure, parameters and their transmission. Dynamic memory management. Storage management: Static, Stack, Heap (Fixed/variable size), File processing, debugging strategies.		

Books:	*Ghezzi and Jazayeri: Programming Language Concepts, .* *Sethi Ravi: Programming Language Concepts & Constructs, Addison Wesley* *Louden: Programming Languages- Priciples and Practice, Cengage Learning.* *Friedman and Wand: Essential of Programming Languages, PHI.* *Sebasta: Concept of programming language, Addison Wesley* *Pratt: Programming language design and implementation PHI.*

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B.Tech (Computer Engineering) - Semester III

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST209**	**Course Name:**	**Introduction to Signals and Communication**
Credit:	**4**	**L-T-P:**	**3-1-0**
Version:		**Approved on:**	
Pre-requisite Course :			

Syllabus	Signals: representation, Sampling and aliasing; quantization, Review of Fourier, Laplace and z-transform; Linear Time Invariant System Filters: Transfer functions, FIR filters, IIR filters; Spectrograms; Spectral analysis: DFT for periodic and non-periodic signals, FFT. Analog Communication: Signal modulation, FM, PM, SSB, VSB. Frequency Division Multiplexing and Time Division Multiplexing. Digital Communication: Pulse transmission over Band limited signals, sampling theory; Pulse Modulation - PAM, PCM, DPCM, DM, ADM, metrics - bit transmission, signaling rate, error probability, S/N ratio, bandwidth requirement. Modulation: PSK, FSK, QPSK (QAM), MSK. Transmission Media: Guided and Unguided Media, Transmission Impairments, Multiplexing, Switching: Circuit, Message, Packet, Datagram, Virtual Networks, DSL. Fiber Optic Communication : Principles of light communication in fiber, losses in fiber, dispersion, light source and detectors, multiple access – TDMA, FDMA, CDMA. Codes : Information theory, Shannon's theorem, Source coding, error control coding, Block codes, Cyclic codes, Linear code, checksum.
Books:	1. Oppenheim , Willsky: *Signals and Systems* , Prentice Hall. 2. Proakis: *Digital Signal Processing* , Maxwell Macmillan. 3. Oppenheim: *Discrete-time Digital Signal Processing* , PHI. 4. N K Sinha, *Linear systems* , John Wiley. 5. Haykins, Analog and Digital Communications, Wiley Publications. 6. Forouzan, Data Communications and Networking, McGraw Hill, . 7. B.P.Lathi : Modern Digital Communication, Oxford. 9. Taub: Introduction to Communication Systems, Mcgraw Hill. 10. R.Coolen : Electronic Communication, PHI

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B.Tech (Computer Engineering) - Semester III

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**HST201**	**Course Name:**	**Effective Communication**
Credit:	**3**	**L-T-P:**	**2-1-0**

Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Importance of Effective Communication Principles to Increase Clarity of Communication Technical Report Writing Soft Skills for the first Job (Time Mgmt, attitude, responsibility, self-confidence and courage, teamwork, consistency, ethics ,integrity and values,etc.) Presentation skills (defining purpose, analysis of audience and locale, organizing contents, visual aids, and nuances of delivery) Resume', Group discussions and Job Interviews Avoiding Errors; Active Listening; Condensation Reading Comprehension Effective Speaking Guidelines Vocabulary Building (Root Words, Prefixes and suffixes, words often confused, and frequently used foreign phrases)		
Books:	1.Technical Communication Principles and Practice :*Raman and Sharma* (Oxford)		

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B.Tech (Computer Engineering) - Semester III

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CSP211**	**Course**	**Programming Lab**
Credit:	**2**	**L-T-P:**	**0-0-3**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Programming assignments for conceptual understanding of control constructs, scoping rules, functions, recursion, file handling, dynamic memory management.		
Books:			

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B.Tech (Computer Engineering) - Semester III

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CSP213**	**Course Name:**	**Digital Logic Design Lab**
Credit:	**2**	**L-T-P:**	**0-0-3**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	The following proposed coverage are broad guiding areas lab. The instructor offering the course in consultation with the theory offered can adopt further variations in tune with concerned theory courses. 1. Design and test a 2-bit and 4-bit half adder. 2. Design and test a 2-bit and 4-bit adder (ripple, carry look ahead). 3. Design and test of encoder/decoder (binary-gray, self-complementing). 4. Design and test of parity generator and detector. 5. Design and test of one bit error detecting and correcting circuit. 6. Design and test of a 2-bit multiplier. 7. Design and test of *n* -bit comparator. 7. Design and test of flip flops – RS/JK/D/T. 8. Design and test of SISO and PIPO shift registers. 9. Design and test of counters. Programming Implementation and simplification of *k* -map (upto 3 variables. Implementation of Quine-Mckluskey's method. Design of a simulator.		
Books:	Text/Reference books for Digital Logic Design. Online reference material.		

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B.Tech (Computer Engineering) - Semester IV

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST202**	**Course Name:**	**Computer Organization and Microprocessors**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Organization of Computer Systems – CPU, Memory and I/O organization, Instruction encoding and addressing modes. Von-neumann versus Harvard Architecture, RISC and CISC architectures. Introduction to microprocessors, control unit, and interrupt system design. Design of hardware and software for microprocessor applications. Assembly language programming. Microprocessor system case studies – x86, IA, ARM.		
Books:	1. Patterson and Hennessy: Computer Organization and Design, Morgan Kaufmann. 2. Hamacher and Zaky: Computer Organization, McGraw Hill. 3. Pal Chaudhuri: Computer Organization and Design, PHI. 4. Hayes: Computer Architecture and Organization, McGraw Hill. 5. Barry B. Brey: The Intel microprocessors. Pearson 6. Douglas V. Hall: Microprocessors and Interfacing, McGraw Hill.		

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B.Tech (Computer Engineering) - Semester IV

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST204**	**Course Name:**	**Discrete Structures**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Mathematical Reasoning – Induction; Counting – Pigeonhole principle, permutation, combination, probability Sets, relations, functions, operations, and equivalence Relations, relation of partial order, partitions, binary relations, Equivalence relations. Recursion, Number-theoretic algorithms: Greatest Common Divisor, Chinese Remainder Theorem, Primality testing, polynomial representation of binary number, Galois fields, primitive roots, discrete logarithms. Graph Theory: Connectivity, Binary tree, Spanning tree, tree enumeration, cycles, Planarity, cut-set, coverings, colourings, matroid.		
Books:	1. Kolman B., Busby R: Discrete Mathematical Structures for Compute Science, PHI. 2. Liu: Introduction to Discrete Mathemetics, McGraw-Hill. 3. Graham, Knuth, Pratshnik : Concrete Mathematics. 4. Grimaldi: Discrete Mathematical Structures. 5. Rosen, Discrete Mathematics and Its Applications, McGraw Hill. 6. Koshy, Discrete Mathematics with Applications, Elsevier. 7. Foulds: Graph Theory Applications, Narosa. 8. Harary: Graph Theory, Narosa. 9. N. Deo: Graph Theory, PHI.		

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B.Tech (Computer Engineering) - Semester IV

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST206**	**Course Name:**	**Formal Languages and Automata Theory**
Credit:	**4**	**L-T-P:**	**3-1-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Introduction to automata theory, finite automata and regular languages, regular expressions, transition graphs. Non-determination, finite automata with output, regular languages, minimization of finite automata, pumping lemma for regular languages. Chomsky classification of languages, regular grammars, context free grammars, simplification of context free grammars, Normal forms of context free grammars. Push Down Automata Theory: push down automata and languages, push down automata and context free grammars, pumping lemma for context free languages. Turing hypothesis, Turing machine, Minskey's theorem, TM variation and encoding, Post machines, computability and acceptability. Introduction to automata theory, finite automata and regular languages, regular expressions, transition graphs.		
Books:	1. Hopcroft, Motwani and Ullman: Introduction to Automata Theory, languages and Computation, Pearson Education. 2. Cohen: Introduction to Computer Theory, Addison Wesley. 3. Martin: Introduction to Languages and Theory of Computation, TMH. 4. Papadimitriou, Introduction to Theory of Computing, Prentice Hall.		

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UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST208**	**Course Name:**	**Design and Analysis of Algorithms**
Credit:	**4**	**L-T-P:**	**3-1-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Algorithm Analysis: Asymptotic notation, solution of recurrence, model of computation, time and space complexities, average and worst case analysis, Amortized analysis. Algorithm Design Techniques: Greedy algorithm, dynamic programming, divide and conquer, backtracking, branch and bound. Graph Algorithms: Shortest path algorithms, Disjoint set operations, minimum spanning tree algorithm, network flow, matching, coverings, applications of DFS:- bi-connectivity, Euler circuits, strongly connected components, topological sort, and articulation point. Matrix Algorithms – Strassen Matrix multiplication, LUP decomposition. Construction of codes: Shannon Fano and Huffman codes. Dynamic Programming: Chained matrix multiplication, longest common subsequence. Divide and Conquer: Order Statistics – finding the median, exponentiation, matrix multiplication, LCS. Computational Geometry: Line segments, Optimal polygon triangulation. Approximate Algorithm: Travelling Salesman Problem, vertex-cover problem. Primality testing, Integer factorization, Randomized algorithms, Probabilistic algorithms. String Matching algorithms: Rabin Karp, KMP, Boyer Moore. Introduction to problem classes – NP, NPC, NP-Hard.		
Books:	1.Cormen, Leiserson, Rivest: Introduction to Algorithms, Prentice Hall of India. 2.Horowitz and Sahani: Fundamental of Computer algorithms. 3.Aho A.V , J.D Ulman: Design and analysis of Algorithms, Addison Wesley 4.Brassard : Fundamental of Algorithmics, PHI. 5.W.W. Peterson and E. J. Weldon: Error correcting codes. 6.Sara Baase, Allen Van Gelder: Computer Algorithms: Introduction to Design and Analysis, Pearson Education		

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B.Tech (Computer Engineering) - Semester IV

UG/PG	**UG**	**Department:**	**Computer Engineering**

Course Code:	**CST210**	**Course Name:**	**Systems Programming**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Overview Of Systems Software, Language Processors. Concept Of Machine And Assembly Language, Representation Of Instruction And Data, Macro Processor, Macros And Macro Programming, Assemblers. Linker, Loader, Dynamic Link Library, relocation, Editors And Debuggers. Unix/ Linux Shell programming, Device Drivers, Kernel and Low Level Programming.		
Books:	1. D. M. Dhamdhere ; Introduction to Systems Software ,TMH 2. Beck L.L. : System Software-An Introduction to Systems Programming, Addition Wesley 3. Rebecca Thomas : Adv. Programmer guide to Unix system V. MH 4. Glingaert : Assemblers, Loaders and Compilers, Prentice Hall 5. John R. Levine : Linkers and Loaders, Harcourt India 6. Kanetkar : Unix Shell Programming.		

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B.Tech (Computer Engineering) - Semester IV

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**HST202**	**Course Name:**	**Economic Environment**
Credit:	**3**	**L-T-P:**	**2-1-0**
Version:		**Approved on:**	
Pre-requisite Course :			

Syllabus	Economic growth & development; primary, secondary and tertiary sectors; structural changes & emerging sectors of the Indian economy. National Income; concepts & measurement; circular flows of income. Review of five year plans in India, planning strategy and objectives. Current trends in industrial growth, industrial and licensing policy, growth of private sector, problems of public sector units, policy changes for industrial growth; environment for the SME sector. Design and strategy of economic reforms and liberalization: India's growth post liberalization. Main trends in imports and exports, balance of payments in recent years, environment for foreign capital and investment. Intellectual property rights and R & D environment. Banking reforms and challenges; business opportunities in the rural sector. Monetary & Fiscal Policies; meaning, importance & instruments. Global economic environment and opportunities.
Books:	1) Ishwar C. Dhingra, "The Indian Economy: Environment and Policy", Sultan Chand, New Delhi 2) H. L. Ahuja, "Economic Environment of Business: Macroeconomic Analysis", Sultan Chand, New Delhi 3) Amartya Sen & Jean Dreze, "INDIA: Development and Participation", Oxford University Press, India 4) S. K. Mishra & Puri, "Development Issues of Indian Economy", Himalaya 5) Ahluwalia, I.J. & IMD Little, "India's Economic Reform and Development", Oxford University Press, India

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B.Tech (Computer Engineering) - Semester IV

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CSP212**	**Course Name:**	**Assembly Language Programming Lab**
Credit:	**2**	**L-T-P:**	**0-0-3**
Version:		**Approved on:**	
Pre-requisite Course :			

Syllabus	Programming assignments on microprocessor kits (8085, 8086), FPGA programming, Programs on ARM processor, mini-emulator
Books:	Text/Reference books of “Microprocessors and Computer Organization” Online material on Assembly Language programming.

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B.Tech (Computer Engineering) - Semester IV

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CSP214**	**Course Name:**	**Algorithms Lab**
Credit:	**2**	**L-T-P:**	**0-0-3**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	The following proposed are broad guiding areas lab. The instructor offering the course can adopt further variations. Implementation of graph algorithms – DFS, Shortest Path, MST, articulation point, topological sorting, Network Flow, matching, covering; pattern matching algorithms; kth shortest number in a given sequence; Dynamic programming; Approximation algorithms for NP problems; Randomized algorithms implementation.		
Books:	Text/Reference books of “Design and Analysis of Algorithms”..		

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B.Tech (Computer Engineering) - Semester IV

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CSP216**	**Course Name:**	**System Programming Lab**

Credit:	**2**	**L-T-P:**	**0-0-3**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Programming lab assignments related to 1. Assemblers 2. Macro assembler 3. Loader 4. Linker 5. Editor 6. Interpreter 7. Device driver 8. Kernel mode programming		
Books:	Text books of “System Programming”		

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B.Tech (Computer Engineering) - Semester V

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST301**	**Course Name:**	**Computer Architecture**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Flynn Classification, Stack machines, subroutine calls, allocation and evaluation of data in stack machines. SIMD, SPMD and MIMD. CPU Organization: Addressing techniques, Instruction formats: Instruction set design, Instruction types: example for zero address, one address, two address and three address machines, Stack, accumulator and general purpose register organization. Register Transfer Language: arithmetic, logic and shift micro operations and their hardware implementations as a simple ALU. Control Unit, Hardwired and Micro programmed control unit design. Memory Organization: device characteristics, RAM organization: 1D and 2D organization, Virtual memory - Paging and Segmentation, High speed memories: Associative and Cache memory. Input-Output Design: IO interface, Bus structure, Modes of data transfer, Interrupts, Input Output Processor, Serial Communication Pipelining: Pipeline structure, Pipeline types - Instruction and Arithmetic pipelines. Interleaved memory organization, instruction prefetch, data buffers, pipeline performance measures. Array processors : Routing mechanisms, Static v/s dynamic network. Multiprocessor systems, data flow concepts. Parallel processing languages.		
Books:	1. J.L. Hennessy and D.A. Patterson, Computer Architecture: A Quantitative Approach, 4th Edition Elsevier. 2. Flynn : Computer Architecture, Narosa 3. David Culler: Parallel Computer Architecture: A Hardware/Software Approach, Morgan Kaufmann. 4. Hwang and Briggs: Computer Architecture and Parallel Processing, McGraw-Hill.		

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B.Tech (Computer Engineering) - Semester V

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST303**	**Course Name:**	**Concurrent and Parallel Programming**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Concurrent versus sequential programming. Concurrent programming constructs and race condition. Synchronisation primitives. Processes and threads. Interprocess communication. Livelock and deadlocks, starvation, and deadlock prevention. Issues and challenges in concurrent programming paradigm and current trends. Parallel algorithms – sorting, ranking, searching, traversals, prefiix sum etc., Parallel programming paradigms – Data parallel, Task parallel, Shared memory and message passing, Parallel Architectures, GPGPU, pthreads, STM, OpenMP, OpenCL, Cilk++, Intel TBB, CUDA Heterogeneous Computing: C++AMP, OpenCL		
Books:	1. Mordechai Ben-Ari. Principles of Concurrent and Distributed Programming, Prentice-Hall International. 2. Greg Andrews. Concurrent Programming: Principles and Practice, Addison Wesley. 3. Gadi Taubenfeld. Synchronization Algorithms and Concurrent Programming, Pearson. 4. M. Ben-Ari. Principles of Concurrent Programming, Prentice Hall. 5. Fred B. Schneider. On Concurrent Programming, Springer. 6. Brinch Hansen. The Origins of Concurrent Programming: From Semaphores to Remote Procedure Calls, 7. Introduction to Parallel Computing by Ananth Grama, Anshul Gupta, Geroge Karypis, Vipin Kumar – Pearson 8. CUDA Programming – David Kirk 9. Parallel Algorithms – Joseph Ja Ja 10. Heteregeneous Computing with OpenCL by Ben Gaster, Lee Howes et al (Morgan Kaufmann)		
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B.Tech (Computer Engineering) - Semester V

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST305**	**Course Name:**	**DBMS**
Credit:	**4**	**L-T-P:**	**3-1-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Need, purpose and goal of DBMS, Three tier architecture, ER Diagram, data models- Relational, Network, Hierarchical and Object Oriented. Data Base Design: Conceptual data base design, Theory of Normalization, Primitive and Composite data types, concept of physical and logical databases, data abstraction and data independence, data aggregation, Relational Calculus. SQL : DDL and DML, Relational Algebra. Application Development using SQL : Host Language interface, embedded SQL programming, Stored procedures and triggers and views, Constraints assertions. Internal of RDBMS : Physical data organisation in sequential, indexed random and hashed files. Inverted and multilist structures, B trees, B+ trees, Query Optimisation, Join Algorithm, Statistics and Cost Base optimisation. Transaction Processing, concurrency control, and recovery management. Transaction model properties and state serialisability . Lock base protocols, two phase locking.		
Books:	1. H.f. Korth and Silberschatz: Database Systems Concepts, McGraw Hill 2. Almasri and S.B. Navathe: Fundamentals of Database Systems, 3. C.J. Date: Data Base Design, Addison Wesley 4. Hansen and Hansen : DBM and Design, PHI		

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B.Tech (Computer Engineering) - Semester V

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST307**	**Course Name:**	**Computer Networks**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Computer Network Architecture, Circuit switching, Packet And Massage Switching, Network Structure. OSI 7-layer architecture. Physical Layer, Data Link Layer, Framing, Error detection. Retransmission algorithms. Queueing models and introduction to Little's theorem, M/M/1 and M/M/m queues. Network of queues. Introduction to M/G/1 queues, reservations and priority. Stability of queueing systems. Multiple access and Aloha. CSMA/CD and Ethernet. High Speed LANs and Token Ring. High speed switch scheduling. Broadcast routing and spanning trees. Shortest path routing. Distributed routing algorithms, optimal routing. Flow control – window/credit schemes, rate control schemes. Transport layer and TCP/IP. Introduction to ATM networks and Network Management And Interoperability. Performance Issues Of LAN And WAN.		
Books:	1. Data Networks: Bertsekas and Gallagher, Phi. 2. Computer Networking A top down Approach: J.F.Kurose, Pearson. 3. Data & Computer Communication : W. Stalling , Phi 4. Computer Networks: L. Peterson and Davie, MKP 5. Computer Networks and Internet: D.E. Comer, Pearson		

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B.Tech (Computer Engineering) - Semester V

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST309**	**Course Name:**	**Compiler Design**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	

Pre-requisite Course :	
Syllabus	Translators: Introduction to compilers, translators, and interpreters, compilation process. Lexical Analysis: Finite automata, Regular expressions, Design & implementation of lexical analysers. Syntax Analysis: Context Free Grammars, Derivation and Parse trees, Bottom-up and Top-down Parsing. Ambiguity, Shift Reduce Parser, Operator Precedence Parser, Predictive Parsers, canonical collection of items, LR parsers. Syntax directed translation: Syntax directed translation, Attributes, Intermediate codes, Three address codes. Symbol table organization: Hashing, linked list, tree structures. Memory allocation: Static and dynamic structure allocation. Code optimization: Basic blocks, Flow graphs, DAG, Global data flow analysis – ud-chaining, available expressions, Loop optimization. Code generation: Compilation of expression and control structures. Error detection and recovery.
Books:	1. Aho, Ullman and Sethi: Compilers – Principles, techniques and tools, Pearson Education. 2. Tremblay, Sorenson: The Theory and Practice of Compiler Writing, BSP. 3. Holub, Compiler Design in C, PHI.

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B.Tech (Computer Engineering) - Semester V

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST311**	**Course Name:**	**Software Engineering**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	

Pre-requisite Course :	
Syllabus	Engineering paradigms. System analysis: Feasibility study requirement analysis, Cost benefit analysis, Planning systems, Analysis tools and techniques. System Design: design fundamentals, Modular Design, Data and procedural design, object oriented design. System Development: Code documentation, Program design paradigms. Verification, Validation and Testing: testing methods, Formal Program Verification, Testing Strategies. Software Maintenance: Maintenance Characteristics, Maintainability, Maintenance tasks and side effects.
Books:	1. Pressman R.S: Software Engineering: A Practitioner approach, McGraw Hill. 2. Sommerville I: Software Engineering, Addison Wesley 3. Ghezzi C. Jazayeri M and Mandrioli: Fundamentals of Software Engg. , PHI.

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B.Tech (Computer Engineering) - Semester V

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CSP313**	**Course Name:**	**DBMS Lab**
Credit:	**2**	**L-T-P:**	**0-0-3**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	The following are broad guiding areas lab. The instructor offering the course can adopt further variations in tune with DBMS Conceptual designs using ER diagrams; Design and implementation of small DBMS; SQL queries.		
Books:	Text/Reference books for course on “DBMS”		

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B.Tech (Computer Engineering) - Semester V

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CSP315**	**Course Name:**	**Concurrent and Parallel Programming Lab**
Credit:	**2**	**L-T-P:**	**0-0-3**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Programming exercises to implement synchronization primitives – semaphores and monitors. Parallel algorithm implementation (CUDA and OpenMP) Implementing solutions for Producer-Consumer problem – infinite buffer, bounded buffer; Reader – Writer problem; Sleeping Barber problem; Dining Philosopher problem lex(flex), yacc(bison) for lexical and parsing Design of a mini-compiler		
Books:	Text/Reference books for course on “Concurrent Programming”		
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B.Tech (Computer Engineering) - Semester V

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CSP317**	**Course Name:**	**Computer Network Lab**
Credit:	**2**	**L-T-P:**	**0-0-3**
Version:		**Approved on:**	
Pre-requisite Course :			

Syllabus	The following proposed coverage are broad guiding areas lab. The instructor offering the course in consultation with the theory offered can adopt further variations in tune with CP-325. 1. Programming for data encoding, CRC detection and Correction. 2. Estimation of network delay through OS utilities. 3. Simulation and Emulation of Bus and Star topology, DLC, MAC protocols using Benchmark LAN trainer kits. 4. Packet measurement and observation using network sniffing tools. 5. Use of sniffers for protocol dynamics. 6. Introduction to Socket programming and application development for internet. 7. ns-3 based assignments
Books:	1.Computer Networks and Internet: D.E. Comer, Pearson 2.TCP/IP Illustrated, W. Stevens, Vol 1-2, Pearson Eds

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B.Tech (Computer Engineering) - Semester VI

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST302**	**Course Name:**	**Operating System**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Operating System and its evolution, batch, multiprogramming, time sharing systems, real time systems. Processes and processor management: process concept, Process scheduling, interprocess communication and synchronization, race condition, mutual exclusion, semaphores, monitors, messages. Deadlocks prevention , avoidance, detection and recovery. Processes and Threads, Concurrency control. Memory Management: Contiguous, partitioned – fixed and variable partitioning, Non contiguous allocation – Paging, segmentation. Virtual memory, page replacement, cache coherence. File management: disk space management directory structure, shared files, file system performance. File servers, security, protection mechanism, Directory and File structure, File sharing, NFS, Storage management. Input/Output Management: Device drivers, disk scheduling. Distributed OS: Issues, process management, inter-process communication, scheduling, deadlocks Design and implementation of distributed file systems, distributed shared memory, Distributed Concurrency, Transactions. Design issues of Distributed OS, Distributed v/s network operating system.		
Books:	1. Silberschatz,Galvin: Operating System Concepts, AddisonWesley. 2. Tanenbaum, Modern Operating Systems, Prentice Hall. 3. W. Stallings, Operasting Systems, Prentice Hall. 4. Tanenbaum: Operating Systems: Design and Implementation. PHI. 5. Deitel, An introduction to operating systems. Addison-Wesley. 6. Sinha: Distributed Operating Systems: Concepts and Design, IEEE 7. Crowley: Operating System A Design Approach-, TMH. 8. Tanenbaum: Distributed Operating Systems, Pearson Education. 9. Bach, Design of Unix O/S.		

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B.Tech (Computer Engineering) - Semester VI

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST304**	**Course Name:**	**Embedded Systems**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Introduction to embedded systems., design representations, level of abstractions, design methodologies. Models and architectures, Taxonomy of models and architectures, Brief descriptions of specification languages, Specification requirement for embedded systems, Spec Chart and Spec Chart Description. Design challenges & issues, hardware and software design, co-design of software and hardware, ASIC. Design quality estimation : Quality matrix, software and hardware estimation.Introduction Sample design Specification of Answering machine/ Microcontroller 8051.		
Books:	1.Denial D. Gajski , Frank Vahid: Specification and design of embedded systems, PH 2.Jonathan W. Valvano: Embedded Microcomputer Systems, Thomson Learning 3.Myke Predko: Programming and Customizing the 8051 Micro Controller, TMH 4.Ayala : 8051 Micro controllers, Penram Press		
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B.Tech (Computer Engineering) - Semester VI

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST306**	**Course Name:**	**Object Oriented Analysis and Design**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	

Pre-requisite Course :	
Syllabus	Object Oriented Programming and Design: Review of abstraction, objects and other basics, Encapsulation, Information hiding, method, Signature, Classes and Instances, Polymorphism and inheritance. C++ Programming Basics: Fundamentals, variables and assignments, Input and Output, Data types and expressions, flow of control, subprograms, top-down design, predefined functions, user defined functions, procedural abstractions, local variables, overloading function names, operator overloading, parameter passing, this pointer, destructors, copy constructor, overloading the assignment operator, virtual functions, function calling functions, friend functions, recursive functions, recursive member functions. Static member function. C++ Object oriented concepts: Objects and classes, use of file for I/O, formatting output with stream functions, Character I/O, inheritance, structures for diverse data, structures as function arguments, initializing structures, defining classes and member functions, public and private members, constructors for initialization, standard C++ classes, derived classes, flow of control, use of Boolean expressions, multiway branches, use and design of loops. Friend function and friend class. C++ Data structures and Advanced Topics: Arrays – programming with arrays, arrays of classes, arrays as function arguments, strings, Multidimensional arrays, Arrays of strings, pointers Dynamic arrays, Classes and dynamic arrays, Base classes, access control, Templates-generic classes and functions, namespaces. Standard Template Library.
Books:	1. Balaguruswamy: Object-oriented Programming with C++. 2. Robert Lafore: C++ Programming 3. Ashok N. Kamthane : Object Oriented with C++, Pearson Education

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B.Tech (Computer Engineering) - Semester VI

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST308**	**Course Name:**	**Computer and Network Security**
Credit:	**3**	**L-T-P:**	**3-0-0**

Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Computer Security: Threats and Countermeasures; Malware taxonomy, infection and propagation mechanisms, Countermeasures – Scanning, Anomaly detection, behavioural analysis; static and dynamic analysis Review of wired/wireless network protocols, intrusion detection systems, malicious software. Review of cryptographic algorithms, protocols, cryptanalysis, authentication and signature protocols. Kerberos, PKI, real-time communication security, IPSec: AH, ESP, IKE. SSL/TLS, e-mail security, PEM and S/MIME, PGP, web security, network management security, wireless security. Threats in networks, network security controls, firewalls, intrusion detection, administering security Honeypots, password management, malicious software, viruses and countermeasures		
Books:	1) C. Kaufman, R. Perlman, Network Security, Prentice Hall. 2) Kurose & Ross, Computer Networking, Pearson Education. 3) Schiller J., Mobile Communications, Pearson Education. 4) W. Stallings, Cryptography and Network Security Principles and practice, Pearson Education.		
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B.Tech (Computer Engineering) - Semester VI

UG/PG	**UG**	**Department:**	**Computer Engineering**

Course Code:	**CST310**	**Course Name:**	**Computer Graphics**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Basic raster and vector graphics. Scan conversion algorithms for line, circle, and ellipse. Filling: seed fill and polygon filling. Clipping lines and polygons. Geometrical transformations: 2D and 3D transformations, homogeneous coordinates, composition of transformations, the Window-to-Viewport transformation. matrix representation of transformations. Projections: mathematics of planar geometric projections, implementation of planar geometric projections. Visible surface determination: object space and image space techniques for visible surface detection, algorithms, z-buffer, list priority, scan line, area subdivision, back face removal, BSP tree and ray tracing algorithms. Illumination and shading: illumination models, shading for polygons, constant, Gouraud and Phong shading models. Curves: parametric cubic curves, Hermite, Bezier and B-spline curves.		
Books:	1. Computer Graphics, principles and practice, Foley, VanDam, Feiner, Hughes, Addison Wesley. 2. Computer Graphics, Hearn and Baker, PHI 3. Mathematical Elements for Computer Graphics, David F. Rogers, Adams, McGraw Hill. 4. Procedural Elements for Computer Graphics, David F. Rogers, McGraw Hill.		

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B.Tech (Computer Engineering) - Semester VI

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST312**	**Course Name:**	**AI and Expert Systems**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	
Pre-requisite Course :			

Syllabus	Overview of AI, Problems, Problem space and searching techniques, Definition production system, Control strategies, Heuristic search techniques. Introduction to AI languages: PROLOG and LISP. Knowledge representation, Representation, mappings, approaches and issues, Predicate logic, prepositional logic, Resolution, Procedural and declarative knowledge, forward and backward reasoning, Matching, Logic Frames and Semantic Nets etc. Domain Exploration Knowledge elicitation, conceptualization, methods of knowledge acquisition, formalization Learning and learning systems: Introduction to Hopfield networks, introduction to neural networks, learning in neural networks, applications of neural networks, Recurrent network. Natural Language Processing, Perceptions and actions. Expert Systems: Introduction, Definition types, Component, development process. Learning Planning and Explanation in Expert Systems. Implementation Tools : Prolog, Study of existing expert systems, MYCIN & AM.
Books:	1. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-Graw Hill. 2. Introduction to AI & Expert System: Dan W. Patterson, PHI. 3. Patterson : Introduction to AI Expert Systems, PHI 4. Jackson : Building Expert Systems, John Wiley

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B.Tech (Computer Engineering) - Semester VI

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CSP314**	**Course Name:**	**OS and Security Lab**
Credit:	**2**	**L-T-P:**	**0-0-3**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	This lab shall cater to programming assignments in area of Operating System and Security.		

Books:	Text/Reference material as suggested in “Operating System” and “Computer and Network Security”	
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B.Tech (Computer Engineering) - Semester VI

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CSP316**	**Course Name:**	**Graphics Lab**
Credit:	**2**	**L-T-P:**	**0-0-3**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	This lab shall cater to programming assignments in area of Computer Graphics.		
Books:	Text/Reference material as suggested in “Operating System” and “Computer Graphics”		
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B.Tech (Computer Engineering) - Semester VI

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CSP318**	**Course Name:**	**Advanced Programming Lab**
Credit:	**2**	**L-T-P:**	**0-0-3**
Version:		**Approved on:**	
Pre-requisite Course :			

Syllabus	Programming exercises from the different paradigms mainly include Procedure-oriented Programming, Object-Oriented Programming, Aspect-Oriented Programming, and Functional programming (AI and expert system related assignments)
Books:	Text/Reference material as suggested in “Object Orineted Analysis and Design” and “AI and Expert Systems”

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B.Tech (Computer Engineering) - Semester VI

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CSP320**	**Course Name:**	**Embedded System Design Lab**
Credit:	**2**	**L-T-P:**	**0-0-3**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	The topics selection covering the latest and relevant topics related to the emerging areas in “Embedded System”		
Books:	Text/Reference material as suggested in “Embedded Systems”		

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B.Tech (Computer Engineering) - Semester VII

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CSS401**	**Course Name:**	**Seminar**
Credit:	**3**	**L-T-P:**	
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus			
Books:			
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B.Tech (Computer Engineering) - Semester VII

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:		**Course Name:**	**Program Elective I**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus			
Books:			
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B.Tech (Computer Engineering) - Semester VII

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:		**Course Name:**	**Program Elective II**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus			

Books:	

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B.Tech (Computer Engineering) - Semester VIII

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CSD402**	**Course Name:**	**Project**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus			
Books:			
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B.Tech (Computer Engineering) - Semester VIII

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:		**Course Name:**	**Advanced Elective Course I**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus			
Books:			
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B.Tech (Computer Engineering) - Semester VIII

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:		**Course Name:**	**Advanced Elective Course II**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus			
Books:			
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B.Tech (Computer Engineering) - Semester VIII

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:		**Course Name:**	**Program Elective III**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus			
Books:			
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B.Tech (Computer Engineering) - Semester VIII

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:		**Course Name:**	**Program Elective IV**
Credit:	**3**	**L-T-P:**	**3-0-0**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus			
Books:			
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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST433**	**Course Name:**	**Wireless Communications**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	History of wireless communication, and future trends. Wireless Generations and Standards. Cellular Concept and Cellular System Fundamentals .Trunking Cell Splitting and Sectoring. Mobile Radio signal propagation, path loss and channel models. Large Scale Path Loss. Small Scale Path Loss - Rayleigh and Rician Fading. Analog Modulation Schemes for Wireless Communication - AM/FM. Digital Modulation Techniques for Wireless Communication Preliminaries. Baseband Modulation Schemes Bandpass Modulation Techniques. Fading Counteraction – Diversity, Coding and Interleaving. Source and Channel Coding. Speech Coding for Wireless Communications. Adaptive Equalization. Multipath Propagation, Doppler. Multiplexing and Multiple Access techniques. TDMA, FDMA , ALOHA - Packet Radio, Spread Spectrum-CDMA ,Frequency Hopped Spread Spectrum, Inter-Symbol Interference (ISI), ISI mitigation; Equalization, Random Access Protocols. Wireless Networking, Wireless Standard. Third generation systems and advanced topics Wideband-CDMA, MCCDMA. OFDM principles: Comparison of OFDM and CDMA. WLAN and Bluetooth		
Books:	1. Wireless Communications: Principles and Practice, 2nd edition, T. Rappaport, Prentice Hall, 2002 2. K. Pahlavan & P. Krishnamurthy, Principles of Wireless Networks, Prentice Hall: 3. Wireless Communications Systems, A. Goldsmith, Cambridge.		

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B.Tech (Computer Engineering) - Program Elective			
UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST435**	**Course Name:**	**VHDL**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	

Pre-requisite Course :	
Syllabus	1. Overview of VHDL, fundamentals of VHDL, Lexical elements Data types and objects 2. Data Flow style: Conditional and selected Concurrent assignment, block assignment If and wait statement, Design for synthesizability 3. Structural style: Instantiation and component declaration, statement configuration declaration, generate statement, examples of structural design 4. Behavioural Style : Signal assignment, statement like case, process and wait loop, exit etc., concurrent signal assignment statements, function and procedures, file I/O operations and Testbenches.
Books:	. Peter J. Ashenden ," The Designer's Guide to VHDL", published by Morgan Kaufmann" Kaufmann Pub. 1.SS Limaye," Digital Design with VHDL", CMR 2.Douglas Parry, " VHDL Programming by Example", MGH 3.Xilinx, " Programmable Logic Design Quick Start Hand Book II ed. 4.Xilinx," A CPLD VHDL Introduction Application Notes"

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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST437**	**Course Name:**	**Neural Networks**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Neural Architecture: Neuron model, transfer function, hamming and Hopfield network, perceptron, learning rule, recurrent networks. Back propagation: generalized delta rule, limitations, modifications – momentum, variable learning rate, conjugate gradient. Learning: Supervised, associative, competitive, unsupervised learning. Unsupervised learning: Self-organizing maps, Adaptive Resonance Theory. Neural network applications: Pattern classification, function approximation		

Books:	1.Simon Haykin: Neural Networks: A Comprehensive Foundation (2nd Edition) 2.Christopher M. Bishop: Neural Networks for Pattern Recognition 3.James A. Freeman, David M. Skapura: Neural Networks, Pearson Education. 4.Martin T. Hagan: Neural Network Design, Thomson Learning.

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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST439**	**Course Name:**	**Speech Recognition**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Overview of Speech Recognition; What is Speech; Why is it important; Applications and issues. Speech Production; Mechanism of speech production; Categories of sounds; Sound units in indian languages. Nature of Speech Signal; Source-system characteristics; Segmental and suprasegmental features; Temporal and spectral parameters for sound units in indian languages. Basics of Digital Signal Processing; Signals and systems; Discrete fourier transform; Digital filtering; Stochastic processes. Speech Signal Processing Methods: Short-time spectrum analysis; Spectrograms; Linear prediction analysis; Cepstrum analysis. Speech Recognition; Isolated word recognition; Connected word recognition Continuous Speech Recognition; Speech recognition problem; Hidden markov models. Other Applications: Word spotting; Speaker recognition; Speech enhancement; Speech synthesis; Practical issues in speech Recognition.		

Books:	1. Spoken Language Processing: A Guide to Theory, Algorithm and System Development by Xuedong Huang, Alex Acero, Hsiao-Wuen Hon, Raj Reddy Prentice Hall PTR; ISBN: 0130226165 2. Speech Communications : Human & Machine by Douglas O'Shaughnessy, IEEE Press, Hardcover 2nd edition, 1999; ISBN: 0780334493. 3. Digital Processing of Speech Signals, Rabiner and Schafer, Prentice Hall, 1978. 4. Fundamentals of Speech Recognition, Rabiner and Juang, Prentice Hall, 1994. 5. Speech and Audio Signal Processing : Processing and Perception of Speech and Music by Nelson Morgan and Ben Gold, July 1999, John Wiley & Sons, ISBN: 0471351547 6. Discrete-Time Speech Signal Processing: Principles and Practice by Thomas F. Quatieri Publisher: Prentice Hall; ISBN: 013242942X; 1st edition (October 29, 2001) 7. Speech Processing and Synthesis Toolboxes by Donald G. Childers, John Wiley & Sons, September 1999; ISBN: 0471349593

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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST441**	**Course Name:**	**Software Project Management**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Software Project Management Concept: The Management Spectrum, People, Product, Process & Project. Software Process & Project Matrix: Software Measurement, Size Oriented Matrices, Function Oriented Matrices. Software Project Planning: Objectives, Decomposition Techniques and Empirical Estimation Model. Risk Analyses and Management: Risk Identification, Projection, Risk Identification, Projection, Risk Refinement, Risk Monitoring and Management. Project Scheduling & Tracking, Software Quality Assurance, Software Configuration Management		
Books:	1.R. S. Pressman, Software Engineering 2.P. Jalote, Software Project Management in Practice. 3.B. Hughest & M. Cotterell, Software Project Management.		

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B.Tech (Computer Engineering) - Program Elective

UG/PG	UG	Department:	Computer Engineering
Course Code:	CST443	Course Name:	Data Compression
Credit:	4	L-T-P:	3-0-2
Version:		Approved on:	
Pre-requisite Course :			
Syllabus	Compression: Need, Lossless v/s lossy compression, review of information theory, prefix codes, uniquely decodable code. Lossless Compression: Huffman coding – minimum variance, optimal, non-binary, extended, adaptive. Applications and limitations of Huffman codes, Run length encoding, Arithmetic coding, Predictive coding – Burrows-Wheeler transform, Delta modulation, Adaptive delta modulation Dictionary based compression - Lempel-Ziv-Welch, LZ77 and LZ-78 Lossy Compression Techniques – JPEG and its application Error detection and correction: Parity, 1,2,n dimensions, Hamming codes, p-out-of-q codes Quantization: Scalar and Vector Quantization.		
Books:	1. Khalid Sayood, Introduction to Data Compression, Morgan Kauffman 2. Greg A. Harris, Darrel R. Hankerson, Peter D. Jr. Johnson, Introduction to Information Theory and Data Compression, Second Edition, Chapman and Hall. 3. Saloman, Data Compression, Springer Verlag. 4. Nelson, The Data Compression book, Hungry Minds		

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B.Tech (Computer Engineering) - Program Elective

UG/PG	UG	Department:	Computer Engineering
Course Code:	CST445	Course Name:	Natural Language Processing

Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Introduction; Goals of Natural Language Processing and Computational Linguistics. Finite State Automata and Transducers, Morphology. Parsing: Context Free Grammars, Generalized Phrase Structure Grammar, Earley Parsing ALgorithm. Transformational Grammar, Computational Models and Knowledge Representation. Semantics; Interpretation, time, tense and lexical semantics. Machine Translation, Natural Language Interfaces, Natural Language Generation.		
Books:	1. Allen James, Natural Language Understanding, Second Edition, Benjamin/Cumming, 1995. Grosz, Sparck-Jones Webber 2. Readings in Natural Lnaguage Processing, Morgan Kaufmann, 1986. Winograd T. 3. Language as a Cognitive Process, Addison Wesley, 1972. Marcus M. 4. A Theory of Synactic Recognition for Natural Language, MIT Press, 1980.		
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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST447**	**Course Name:**	**Wireless & Ad-hoc Networks**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			

Syllabus	Fundamentals of Wireless Communication Technology The Electromagnetic Spectrum – Radio Propagation Mechanisms Characteristics of the Wireless Channel - IEEE 802.11a,b Standard Origin Of Ad hoc: Packet Radio Networks , Technical Challenges, Driving Applications, Components of Packet Radios What Is an Ad Hoc Network? Types of Ad hoc Mobile Communications. Key definitions of ad-hoc, Advantages of ad-hoc/sensor networks, Unique constraints and challenges, Driving Applications, Media Access Control (MAC) Protocols, Issues in designing MAC protocols, Classifications of MAC protocols, MAC protocols Routing Protocol: Global State Routing (GSR), Dynamic State Routing (DSR), Fisheye State Routing (FSR), Ad hoc On-Demand Distance Vector (AODV), Destination Sequenced Distance – Vector Routing (DSDV). Transport Layer, Security Protocols :Introduction Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks - Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks - Classification of Transport Layer Solutions, security in Ad Hoc Wireless Networks – Network Security Requirements - Issues and Challenges in Security Provisioning -Network Security Attacks.
Books:	1. C. Siva Ram Murthy and B.S. Manoj “Ad Hoc Wireless Networks: 2. C.K. Toh, Ad Hoc Mobile Wireless Networks: Protocols and Systems, Prentice Hall PTR ,2001 Charles E. Perkins, Ad Hoc Networking, Addison Wesley, 2000 3. Wireless Communications: Principles and Practice, 2nd edition, T. Rappaport, Prentice Hall, 2002 4. K. Pahlavan & P. Krishnamurthy, Principles of Wireless Networks, Prentice Hall

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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST449**	**Course Name:**	**Real Time Systems**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			

Syllabus	Introduction to Real-time systems, Issues in Real-time Systems, Real-time System Components, Classification of Real-time systems and Real-time tasks. Misconceptions about Real-time computing. Real-time System requirements: Speed, Predictability, reliability, adaptability. Specification of timing constraints. Real-time scheduling: Requirements and Issues, Terminology, modeling, Introduction static and dynamic scheduling schemes, cyclic scheduling, priority driven scheduling of periodic tasks, schedulability tests, Aperiodic task scheduling: fixed priority server/non-server based scheduling algorithms. Practical factors/overheads. Task Synchronization: Need and priority inversion problem, Priority Inheritance protocol, priority ceiling protocol and stack-based priority ceiling protocol for fixed priority preemptive system. Introduction to multiprocessor real-time systems, problems and issues. An overview of a real-time operating system
Books:	1. J.W.S.Liu: Real-Time Systems, Pearson Education Asia 2. S.T.Lavi, A.K.Agrawala: Real-time system Design, McGraw Hill 3. P.A.Laplante: Real-time Systems Design and Analysis, An Engineer's Handbook, IEEE Press 4. P.D.Laurence, K.Mauch: Real-time Microcomputer System Design, An Introduction, McGraw Hill

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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST451**	**Course Name:**	**Cryptography**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			

Syllabus	Review of Number theory: Prime numbers, modular arithmetic, Fermat's theorem, Euler's theorem, Chinese remainder theorem, Discrete logarithms, Random number generation, factoring, prime number generation. Cryptography: Need, conventional techniques, stream ciphers, block cipher, steganography. Public v/s private key cryptography. Stream Ciphers: Caesar Cipher, mono-alphabetic and poly-alphabetic ciphers, Playfair Cipher, Hill Cipher, Rotor machines, One time pad,. Random Number Generation: Pseudo Random Number, PRNG, LFSR, Blum-Blum Shub generator Private-key cryptography: Feistel structure, DES (Data encryption standard), design of S-boxes, AES, Triple DES. Public key cryptography: Key management, Key exchange – Diffie-Hellman, El-Gamal, Merkle's Puzzle, Authentication, Signatures, Deniability, RSA. Threshold Cryprography: Sharing Secrets. Digital Signature: DSA and its variants, discrete logarithm based digital signatures. One-way hash functions – MD5, SHA (Secure Hash Algorithm). Cryptanalysis: Differential and linear cryptanalysis - cracking DES.
Books:	1. Stallings, Cryptography and Network Security: Principles and Practice, Pearson Education Asia. ISBN 981-403-589-0. 2. B Schneier, Applied Cryptography, Wiley. ISBN 0-471-11709-9 3. D Kahn. The Codebreakers, Sphere books. ISBN 0-7221-51497 4. P Wayner, Disappearing Cryptography, Academic Press. ISBN 0-12-738671-8 5. Cracking DES, Electronic Frontier Foundation. ISBN 1-56592-520-3 6. A.J. Menezes, P.C. van Oorschot and S.A. Vanstone, Applied Cryptography, CRC Press, ISBN 0-8493-8523-7, 1997 7. D.R. Stinson, Cryptography - Theory and practice, CRC Press, ISBN 0-8493-8521-0, 1995

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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST453**	**Course Name:**	**VLSI Algorithms**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	

Pre-requisite Course :	
Syllabus	1. Introduction of VLSI Technology, VLSI design cycle, design styles, basic Layout rules and circuit abstraction, introduction to standard Cell, Gate array, FPGA 2. Overview of basic graph algorithms, Graph algorithms for physical Design 3. Partitioning: Classification of partitioning algorithms, Karnighan-Lin Algorithm, FM Algorithm, Ratio cut algorithm 4. Floor-planning: Rectangular dual graph approach of floor-planning, hierarchical tree based approach, Integer programming based floor-planning. 5. Placement: placement by simulated annealing and force directed method 6. Routing: classification of routing algorithms, Global routing: Maze routing algorithms, line probe algorithms, Steiner tree based algorithms, Detailed Routing: Single layer and two layer routing algorithms, routing in FPGAs
Books:	1. Naveed Shervawani, " Algorithms for VLSI physical Design Automation " III Ed Springer 2. Sarrafzadeh and Wong " An introduction to VLSI Physical design " MGH 3. Sze: VLSI Technology 4. Weste and Eshranghan, " Introduction toVLSI Design". Pearson Edu. 5. Sadiq M. Sait, Habib Youssef, "VLSI Physical Design Automation: Theory and Practice", World Scientific Publishing Company; 0. Cormen Leiserson, Rivest, " Introduction to Algorithms", Pearson Edu.

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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST455**	**Course Name:**	**Digital Image Processing**
Credit:	**4**	**L-T-P:**	**3-0-2**

Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Digital Image Fundamentals: Image Model, Sampling, Quantization, Neighborhood, connectivity of pixels, Labelling of connected components, Distance measures Image Transforms: Fourier Transform, Discrete Fourier Transform, Properties of 2D Discrete Fourier Transform, The fast Fourier Transform and its algorithm, number of operations, the inverse FFT. Discrete Cosine Transform and its applications, KL Transform, Convolution and correlation Image Enhancement: Enhancement by point processing, spatial filtering, enhancement in frequency domain, generation of spatial masks from frequency domain specifications Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding, region oriented segmentation Representation and Description: Representation schemes, boundary descriptors, regional descriptors. Morphology: Dilation, erosion, opening, closing, Hit-or-Miss Transform, some basic morphological algorithms like pruning, thinning and thickening		
Books:	1.Gonzalez and Woods. Digital Image Processing, Addison Wesley. 2.Castleman. Digital Image Processing. Prentice Hall. 3.Duda and Hart. Pattern Classification. John Wiley.		
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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST457**	**Course Name:**	**Evolving Architectures**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Special, and emerging advanced topics in different areas of Computer Engineering will be covered under this course.		

Books:	.1. Research reports and papers from journals

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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST459**	**Course Name:**	**Topics in Computing**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Autonomic and Fault Tolerant Computing: Fault Tolerance Strategies - Fault detection, masking, containment, location, reconfiguration, self-repairing, self-healing and recovery. Fault Tolerant Design Techniques - Hardware redundancy, software, redundancy, time redundancy, and information redundancy. Parallel and Distributed Computing: Concepts and issues in parallel and distributed computing. Concepts and issues in quantum computing, Trusted Computing, Grid Computing, Multi-core and GPGPU computing Introduction to Cloud computing Any other contemporary and relevant issues.		
Books:	1. P. Jalote, Fault Tolerance in Distributed Systems, Prentice-Hall Inc., 1994 2. D. K. Pradhan (editor), Fault-Tolerant Computing, Theory and Techniques, Prentice-Hall, 1998. 3. Los Alamitos, CA, "Fault-tolerant Software Systems: Techniques and Applications", IEEE Computer Society Press, 1992. 4. Design and Analysis of Fault Tolerant Digital Systems, Barry W. Johnson, Addison Wesley, 1989 (Chapters 1-5). 5. A.K. Somani and N.H. Vaidya,`Understanding fault-tolerance and reliability," IEEE Computer, vol.30, no.4, pp.45-50, Apr. 1997. 6. Research papers and internet resources.		

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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST461**	**Course Name:**	**Machine Learning**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Introduction: Definition of learning systems. Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation. Inductive Classification: The concept learning task. Concept learning as search through a hypothesis space. General-to-specific ordering of hypotheses. Finding maximally specific hypotheses. Version spaces and the candidate elimination algorithm. Learning conjunctive concepts. The importance of inductive bias.Decision Tree Learning: Representing concepts as decision trees. Recursive induction of decision trees. Overfitting, noisy data, and pruning.Ensemble Learning Using committees of multiple hypotheses. Bagging, boosting, and DECORATE. Active learning with ensembles.Experimental Evaluation of Learning Algorithms: Measuring the accuracy of learned hypotheses. Comparing learning algorithms: cross-validation, learning curves, and statistical hypothesis testing. Rule Learning: Propositional and First-Order: Translating decision trees into rules. Heuristic rule induction using separate and conquer and information gain. First-order Horn-clause induction (Inductive Logic Programming) and Foil. Learning recursive rules. Inverse resolution. Artificial Neural Networks: Neurons and biological motivation. Linear threshold units. Perceptrons: representational limitation and gradient descent training. Multilayer networks and back propagation. Hidden layers and constructing intermediate, distributed representations. Overfitting, learning network structure, recurrent networks. Bayesian Learning: Probability theory and Bayes rule. Naive Bayes learning algorithm. Parameter smoothing. Generative vs. discriminative training. Logistic regression. Bayes nets and Markov nets for representing dependencies.Instance-Based Learning: Constructing explicit generalizations versus comparing to past specific examples. k-Nearest-		

Books:	1. Bishop, C. (2006) Mitchell, T. M. (1997) Machine Learning. McGraw-Hill 2. Pattern Recognition and Machine Learning. Berlin: Springer-Verlag. 3. Richard O. Duda, Peter E. Hart and David G. Stork. Pattern Classi_cation. Wiley-Interscience,second edition, 2001. 4. Thomas Mitchell. Machine Learning. McGraw Hill Higher Education, First edition, 1997. 5. Stuart Russell and Peter Norvig. Articial Intelligence: A Modern Approach. Prentice Hall,second edition, 2003. (Machine-learning related chapters.) 0. Information Theory, Inference and Learning Algorithms by David MacKay.

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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST463**	**Course Name:**	**Modelling and Simulation**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite : Course			

Syllabus	Analytical v/s simulation modeling, performance measurement and benchmarking, Workload modeling, random variables, commonly used distributions, Stochastic Processes, Performance evaluation methods, Evaluation Metrics' Markov chains, Birth and Death Processes, Markov chain models of Computer systems, Steady-state and transient analysis Queuing models, M/M systems and their steady state analysis, Single server and multi-server queues, open and closed queuing networks Petri Net based Performance Modeling : Classical Petri Nets, Timed Petri Nets, Discrete Petri Nets, Modeling multiprocessor systems Discrete event simulation – Simulation languages, random number generation and testing, model verification and validation, analysis of simulation results, confidence intervals, variance reduction techniques, Case studies of analytical and simulation studies of computer systems
Books:	1. Law and Kelton, Simulation Modeling and Analysis, Mcgraw Hill 2. Raj Jain, The Art of Computer System Performance Analysis, John Wiley 3. K.S.Trivedi, Probability and Statistics with Reliability, Queuing and Computer Science Applications, PHI 4. Kant, Introduction to Computer System Performance Evaluation, Mcgraw Hill

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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST431**	**Course Name:**	**Programming in Java**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			

Syllabus	Introduction: Internet, Java as a tool for internet applications, Byte Code and its advantages. Object Oriented Programming and Design: Review of Abstraction, Objects and other basics, Encapsulation, Information hiding, Method, Signature, Classes and Instances, Polymorphism, Inheritance, Exceptions and Exception Handling with reference to object modeling, Coupling and Cohesion in object oriented software. Object Oriented Design – Process, Exploration and Analysis. Java Programming Basics: Fundamentals: Variables and assignments, Input and Output, Data Types and Expressions, Flow of control, Local variables, Overloading Parameter passing, this pointer, Java Object Oriented Concepts: Objects and Classes: Use of file for I/O, Formatting output with stream functions, Character I/O, Inheritance, Public and private members, Constructors for initializations, Derived classes, Flow of Control Java Data Structures and Advanced Topics Arrays – Programming with arrays, arrays of classes, arrays as function arguments, Strings, Multidimensional arrays, Arrays of strings, vectors, Base classes. Introduction to Java Applets
Books:	4.Herbert Schildt: JAVA 2 - The Complete Reference, TMH, Delhi 5.U.K. Chakraborty and D.G. Dastidar: Software and Systems - An Introduction, Wheeler Publishing, Delhi. 6.Joseph O'Neil and Herb Schildt: Teach Yourself JAVA, TMH, Delhi.

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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST465**	**Course Name:**	**Python Programming**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			

Syllabus	Introduction to Python: Data types, variables, expressions, operators. Sequence, set, dictionary, print statement, control-flow statements, functions. Objects and classes, metaclasses. Decorators, special methods. Exception handling. Modules sys, os, etc. Strings and regular expressions. File operations. Working with processes and threads. Pipes and signals Graphical user interface design in Python (including the Tkinter module), Widgets and basic components, Layout options, Event handling Network scripting (sockets, FTP, and e-mail clients), Server-side scripting Databases and persistence in Python (including pickled objects and shelf files) Custom and built-in data structures in Python C integration with Python (including the SWIG module), Embedding Python calls within C
Books:	1. Programming Python by Mark Lutz, O'Reilly. 2. Learning Python, 3rd Edition by Mark Lutz, O'Reilly 3. Python in a Nutshell by Alex Martelli, O'Reilly. 4. An Introduction to Python by Guido van Rossum and Jr. Fred L. Drake, Network Theory Ltd.

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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST467**	**Course Name:**	**Multimedia Technology**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Introduction to Multimedia, Graphics and Image data representations, Color in image and video CIE, RGB, CMY, HSL color models Fundamental concepts in video, NTSC, PAL and Digital video Compression methods: Lossy and Loss less compression techniques.: Huffman coding, Arithmetic coding, LZW Image compression standards: DCT Transform and Fourier transforms, JPEG coding Video representation and compression techniques Motion vector search: sequential, 2D logarithmic search. I, P and B frames, MPEG Video coding, MPEG-1, MPEG-2 and MPEG-3: video coding and decoding Basic Audio compression: Fletcher- Munson curves, Critical Bands, Psychoacoustic phenomenon, MPEG Layer 3 (MP3) Audio		

Books:	1. J H McClellan, R W Schafer & M A Yoder, DSP First: a Multimedia Approach, Prentice-Hall International 1998

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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST469**	**Course Name:**	**Computer Human Interaction**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Human factors issues in the development of software, use of database systems, and design of user interfaces for interactive systems. Science base (theories, models, usability studies, and controlled experimentation), and software engineering with user interface development environments. Issues include: command languages, menus, forms, and direct manipulation, graphical user interfaces, computer supported cooperative work, information search and visualization, World Wide Web design, input/output devices, and display design.		
Books:	1. B. Shneiderman, Designing the User Interface, 3rd Edition, Addison-Wesley, (1998) 2. Interaction Design by Jenny Preece, Yvonne Rogers, and Helen Sharp. John Wiley & Sons: New York, 2002. ISBN: 0471492787. 3. User Centered Web Site Design, by D.D. McCracken and R.J. Wolfe. Pearson Prentice Hall: Upper Saddle River, NJ, 2004. ISBN: 013041161-2. 4. The Web Wizard's guide to Web Design, J.G. Lengel, Addison-Wesley, 2002. ISBN: 0201745623.		

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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST471**	**Course Name:**	**GUI Programming**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			

Syllabus	Issues and Challenges in GUI design. Overview of intelligent interface design. Graphics versus web interface. Principles of good interface. System Menu and Navigation schemes. Interaction devices. Screen based controls. Usability, testing, design for web, humans. Colors.
Books:	1. Wilbert O. Galitz. The Essential Guide to User Interface Design. Wiley. 2. Susan Weinschenk, Pamela Jamar, Sarah C. Yeo. GUI Design Essentials (Paperback) 3. Jenifer Tidwell. Designing Interfaces: Patterns for Effective Interaction Design, O'Reilly. 4. B. Shneiderman, Designing the User Interface, 3rd Edition, Addison-Wesley.

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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST473**	**Course Name:**	**Wireless and Mobile Computing**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Wireless communication fundamentals: Introduction, wireless transmission, frequencies for radio transmission,signals, antennas, signal propagation, multiplexing, modulations, spread spectrum, MAC, SDMA, FDMA, TDMA, CDMA, cellular wireless networks. Telecommunication networks: Telecommunication systems :GSM,GPRS, DECT, UMTS, IMT-2000, Satellite networks - basics – parameters and configurations – capacity allocation: FAMA and DAMA. Wirless LAN: IEEE-802.11, architecture, services, MAC, physical layer, IEEE 802.11a, 802.11b standards, HIPERLAN, BLUE TOOTH. Mobile network layer: mobile ip, dynamic host configuration protocol,routing,DSDV,DSR . Transport and application layers : traditional TCP, classical TCP improvements – WAP, WAP 2.0.		

Books:	1. Jochen Schiller, “Mobile Communications”, PHI/Pearson Education, Second Edition, 2003. 2. William Stallings, “Wireless Communications and Networks”, PHI/Pearson Education, 2002. 3. Kaveh Pahlavan, Prasanth Krishnamoorthy, “Principles of Wireless Networks”, PHI/Pearson Education, 2003. 4. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, New York, 2003. 5. Hazysztof Wesolowshi, “Mobile Communication Systems”, John Wiley and Sons Ltd, 2002

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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST479**	**Course Name:**	**Implementation of Data Bases**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Issues in Implementation of Centralized Database Systems - Query Processing, Query Optimization, Transaction Processing, Concurrency, Recovery Management. Database System Architectures – Centralized and Client-Server architecture, Parallel Systems, Distributed Database Systems. Implementation of Distributed Database Systems- Distributed Data Storage, Distributed Transactions, Concurrency control in Distributed Database Systems, Distributed Query Processing.		
Books:	1. Silberschatz A, Korth HF, Sudarshan S, Database System Concepts, McGrall Hill. 2. Elmasri R and Navathe SB, Fundamentals of Database Systems, 3rd Edition, Addison Wesley,2000. 3. Ceri S, Pelagatti G, Distributed Databases – Principles and Systems, McGraw Hill.		

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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST481**	**Course Name:**	**Information Retrieval**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	INTRODUCTION- Information storage and retrieval systems, Data Structures and Algorithms Related to Information Retrieval RETRIEVAL STRATEGIES - Vector Space Model, Probabilistic Retrieval Strategies, Language Models, Inference Network, Extended Boolean retrieval, Latent Semantic Indexing RETRIEVAL UTILITIES - Relevance Feedback , Clustering, Passage-Based Retrieval, N-grams, Regression Analysis, Thesauri, Stemming, Semantic Networks, Parsing, Ranking EFFICIENCY- Inverted Index, Query Processing, Signature Files, Duplicate Document Detection INTEGRATING STRUCTURED DATA AND TEXT - Review of the Relation Model, A Historic Progression, Information Retrieval as a Relational Application, Semi-Structured Search using a Relational Schema, Multi-dimensional Data Model		
Books:	1. Information Retrieval Data Structures & Algorithms by William B. Frakes, Ricardo Baeza-Yates 2. Information retrieval- by D A Grossman , Ophir Frieder, Springer International Edition		
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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST483**	**Course Name:**	**Digital Watermarking**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	

Pre-requisite Course :	
Syllabus	Watermarking: Applications, technqiues, models, detection techniques. Visible and invisible watermarks. Embedding. Robust watermarking, watermark security. Steganography – Least Bit, DCT, Spread spectrum. Audio seganography. Steganalysis techniques.
Books:	1. Ingemar Cox, Matthew Miller, Jeffrey Bloom, and Jessica Fridrich . Digital Watermarking and Steganography, 2nd Ed, (The Morgan Kaufmann Series in Multimedia Information and Systems). 2. Frank Y. Shih. Digital Watermarking and Steganography: Fundamentals and Techniques, CRC Press. 3. Stefan Katzenbeisser, Fabien, and A.P. Petitcolas. Information Hiding Techniques for Steganography and Digital Watermarking, Artech House. 4. Neil F. Johnson; Zoran Duric; Sushil Jajodia. Information Hiding: Steganography and Watermarking - Attacks and Countermeasures, Springer. 5. Gregory Kipper. Investigator's Guide to Steganography, Auerbach Publications.

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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST475**	**Course Name:**	**Multi-Core Architectures**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Multiple core programming models. GPGPU programming and streaming data processing. Issues related with coherency, languages and communication overheads in multi-core programming		
Books:	Art of Multiprocessor Programming: Nir Shavit, Elsevier		

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B.Tech (Computer Engineering) - Program Elective

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST477**	**Course Name:**	**Distributed Systems**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Introduction to distributed system: characteristics. Advantages, Disadvantages. Design goals. Issues, Models of distributed systems. Communication in Distributed Systems: Message passing, client/server model. Remote Procedure Call. Group Communication. Time in distributed systems. Logical clocks. Vector clocks. Causal ordering of messages. Global state and state recording. Distributed Mutual Exclusion: Non-token based algorithms. Token based algorithms. Distributed elections. Transaction and concurrency control, Nested transactions, Locks, Timestamp ordering. Concurrency control in distributed transactions, Distributed deadlocks. Transaction recovery Replication: Motivation, Consistency and ordering. Total and causal ordering. Update protocols and voting; Distributed File Systems: Recovery and Fault Tolerance: Transaction recovery. Checkpointing and recovery. Fault tolerance in distributed systems. Hardware and software redundancy. Byzantine agreement.		
Books:	1. Distributed Systems: Concepts and Design, 4rd ed by Coulouris, G, Dollimore, J., and Kindberg, T., Addison-Wesley, 2006. ISBN: 0321263545 2. Distributed Systems: Principles and Paradigms, 2nd ed by Tanenbaum, A. and van Steen, M., Prentice Hall, 2007. ISBN: 0132392275.		

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST432**	**Course Name:**	**Topics in Data Structures and Algorithms**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	RAM model – Notations, Recurrence analysis - Master's theorem and its proof - Amortized analysis - Advanced Data Structures: B-Trees, Binomial Heaps, Fibonacci Heaps, AVL trees, Red-black trees, B-trees, Splay trees. Disjoint set – union and path compression, Amortized analysis Recurrence equations. Time and space complexity, NP, NPC and NP-Hard problems, undecidability. Convex hull and Voronoi diagrams, line segments, Optimal polygon triangulation. Primality testing, Integer factorization, Randomized algorithms, Probabilistic algorithms. Dynamic programming: Longest common subsequence. Chain of matrix multiplication, Approximate Algorithms: Vertex-cover, set-covering problems, Travelling Salesman problem. Combinatorial algorithms, Randomized algorithms: Use of probabilistic inequalities in analysis, applications using examples. Graph algorithms: Matching and Flows. Parallel algorithms: Basic techniques for sorting, seraching, merging.. Complexity classes - NP-Hard and NP-complete Problems - Cook's theorem NP completeness reductions.		
Books:	1) Cormen, Leiserson, Rivest: Introduction to Algorithms, PHI. 2) Horowitz and Sahani: Fundamental of Computer algorithms. 3) Aho, Ulman: Design and analysis of Algorithms, Addison Wesley 4) Brassard : Fundamental of Algorithmics, PHI. 5) Sara Baase: Computer Algorithms, Pearson Education. 6) Papadimitriou, Steiglitz: Combinatorial Optimization: Algorithms and Complexity, PHI. 7) Motwani: Randomized Algorithms, Cambridge University Press 8) Joseph Ja'Ja': Introduction to Parallel Algorithms, Addison-Wesley 9) Vaizirani: Approximation Algorithms, Springer Verlag 10) N. Deo: Graph Theory with Application to Engineering and Computer Science, PHI. 11) N. Deo: Combinatorial Algorithms: Theory and Practice, PHI.		

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST434**	**Course Name:**	**Parallel and Distributed Computing**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Introduction to parallel computing. Parallel processing terminology, Pipelining Vs Data parallelism, Control parallelism, Scalability, Control parallel approach, Data parallel approach, Data parallel approach with I/O Parallel reduction, Prefix sums, List ranking, Preorder tree traversal, Merging two sorted lists, Graph coloring, Reducing the number of processors, Problems defying fast solutions on PRAMS Thread and process level parallel architectures: MIMD, multi-threaded architectures. Distributed and shared memory MIMD architectures. Dynamic interconnection networks. Mapping and scheduling: Mapping data to processors on processor arrays and multicomputers, Dynamic Load Balancing on multicomputers, Static scheduling on UMA multiprocessors, Deadlock. Parallel programming and parallel algorithms: Programming models, parallel programming on multiprocessors and multicomputers. Parallel algorithm structure, analyzing parallel algorithm. Elementary parallel algorithms, Matrix algorithms, sorting, Graph algorithms.		
Books:	1) Quinn, Parallel computing – theory and practice, Tata McGraw Hill. 2) Sima and Fountain, Advanced Computer Architectures, Pearson Education. 3) Mehdi R. Zargham, Computer Architectures single and parallel systems, PHI. 4) Ghosh, Moona and Gupta, Foundations of parallel processing, Narosa publishing. 5) Ed. Afonso Ferreira and Jose' D. P. Rolin, Parallel Algorithms for irregular problems - State of the art, Kluwer Academic Publishers. 6) Selim G. Akl, The Design and Analysis of Parallel Algorithms, PH International.		
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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST436**	**Course Name:**	**Selected Topics in Operating System**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Introduction: Goals, Functions, Design issues of Distributed OS, Distributed v/s network operating system. Communication: Client Server, RPC Distributed OS: Issues, process management, inter-process communication, scheduling, deadlocks Design and implementation of distributed file systems, distributed shared memory Security: Concepts and Distributed Systems Distributed Concurrency, Transactions. Case study: Unix, Amoeba.		
Books:	1) Tanenbaum: Distributed Operating Systems, Pearson Education. 2) Bach, Design of Unix O/S. 3) Coulouris et al, Distributed Systems: Concepts and Design, Addison Wesley. 4) Mullender: Distributed Systems, Addison Wesley. 5) Tanenbaum and Steen: Distributed Systems: Principles and Paradigms, Pearson Education		
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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST438**	**Course Name:**	**Advanced Topics in Computer Graphics**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			

Syllabus	Visibility: Polygon Meshes, Depth Sorting. Triangle decomposition, Geometric Sort, Warnock's Methods Hidden Lines and Surfaces: Special cases, Surfaces defined by a function y=f(x,y), Grid surfaces, visible surface determination . Colour in Computer Graphics: Color Vision, Measuring Color, Color Models, Color output, color usage. Object Lighting and Shading: Illumination and shading models, Local reflection models, shading surfaces, Texture and transparency, Forward & backward Ray-tracing Global Illumination and classical radiosity. Modeling natural phenomena: Fractals and chaos. Animation Techniques: Position, speed or orientation. Animation by hierarchic control, scenario-based systems, movement control. Shadows, Morphing, Texture mapping
Books:	1) J. Foley et al : Computer Graphics-Principles and Practice, Addison Wesley. 2) Alan Watt- 3D Computer Graphics. 3) A. Watt, M. Watt: Advanced Animation & Rendering Techniques, Addison-Wesley. 4) D. Rogers and Adams: Mathematical Elements of Computer Graphics, Mc Graw Hill. 5) Thomas Moller: Real-time Rendering, Eric Haines, A.K Peters Ltd

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST440**	**Course Name:**	**Advanced Topics in Databases**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Issues in Implementation of Database Systems, Query Processing, Query Optimization, Transaction Processing, Concurrency, Recovery Management. Database System Architectures, Distributed Databases, Distributed Transactions, Distributed Query Processing, Parallel Databases, Times in Databases, Multimedia Databases		

Books:	1) Silberschatz A, Korth HF, Sudarshan S, Database System Concepts, McGrall Hill. 2) Elmasri R and Navathe SB, Fundamentals of Database Systems, 3rd Edition, Addison Wesley,2000. This book covers most of the material on the course. 3) Ceri S, Pelagatti G, Distributed Databases – Principles and Systems, McGraw Hill. 4) Date CJ, An Introduction to Database Systems, 7th Edition, Addison Wesley. 5) Khashafian S and Baker AB, Multimedia and Imaging Databases, Morgan Kaufmann.

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST442**	**Course Name:**	**Network Performance Modeling**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Networking as resource sharing: current practices, Traffic Multiplexing, Traffic analysis, Stochastic Traffic Models, Multiple Access: Wireless Networks. Routing: Virtual path routing and Elastic Aggregates, Routing of Stream Type sessions, Routing in Ad-hoc and Sensor Networks. Introduction to High Performance Switching and Routing. QoS and Modeling issues of the Networks.		
Books:	1) Communication Networking: An Analytical Approach, Anurag Kumar, D.Manjunath, Joy Kuri, Elsevier 2) High Performance Communication Networks, Jean Walrand, P.Vaiya, Elsevier 3) Selected papers and online references.		

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST444**	**Course Name:**	**Software Testing and Validation**
Credit:	**2**	**L-T-P:**	**0-0-3**
Version:		**Approved on:**	

Pre-requisite Course :	
Syllabus	Basic software testing principles – Software Quality, Software testing and test management. Acceptance Testing: User acceptance testing, alpha and beta testing. Functional and Non-functional system testing Static and dynamic testing, Black-box or functional testing, structural, white box or glass box testing. Integration testing, component testing. Software testing tools. Software Validation: Issues and Challenges.
Books:	1) Selected papers and online references. .

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST446**	**Course Name:**	**Topics in SOC Design**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Methodologies and design flows of front end and back end designs. Introduction to intellectual property core types and their design issues. Integration issues of IPs on SOC designs. Low power design issues and methodologies. Testing standards and architecture of SOCs.		
Books:	1) Farzad Nekoogar , F.Nekooqar,From ASICs to SOCs: A Practical Approach, Pearson. 2) Steve B. Furber, ARM System-on-Chip Architecture (2nd Edition), AWL 3) Recent papers from conferences and journals.		

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**

Course Code:	**CST448**	**Course Name:**	**Advances in Compiler Design**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	A Tour of Compiler Design, LR Parsers, Lex and Yacc Tools, Control-flow Analysis, Control-flow Graphs, Basic Blocks, Data-flow Analysis, Dependence Analysis, Global Optimizations, Loop Optimizations, Peephole Optimization and Optimal Code Generation, Data Dependence Analysis in Loops, Loop Scheduling, Static Single Assignment, Just-In-Time (JIT) and Adaptive Compilation, Runtime System Architectures and Automatic Memory Management Techniques.		
Books:	1) Aho, Alfred V., Sethi, Ravi, Ullman, Jeffrey D., Compilers: Principles, Techniques and Tools, Addison-Wesley. 2) Steven Muchnick, Advanced Compiler Design & Implementation, Morgan Kaufmann. 3) Keith Cooper and Linda Torczon, Engineering a Compiler, Morgan Kaufmann.		
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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST450**	**Course Name:**	**Wireless Sensor Networks**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Wireless Sensor Networks: Introduction, Overview and Applications. Sensor node – Design issues, power consumption, operating environment, sensor examples. Architecture - Single node, Network, Single hop v/s multi-hop, Performance metrics, QoS Wireless communication – Fundamentals, spread spectrum techniques, CDMA Protocols – Physical layer, MAC, link layer, Routing, middleware. Network management, Topology, operating system. Security in sensor networks. Open issues and Chanllenges.		

Books:	1) Holger Karl, Andreas Willig. Protocols and Architectures for Wireless Sensor Networks, Wiley Interscience. 2) Kazem Sohraby, Daniel Minoli, and Taieb Znati: Wireless Sensor Networks: Technology, Protocols, and Applications, Wiley Interscience. 3) Selected papers and online reference material.

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST452**	**Course Name:**	**Digital Image Analysis**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Digital Image Fundamentals, Point operations. Smoothing, Sharpening, Crispening, Image Enhancement in Spatial Domain, Image Enhancement in Frequency Domain Image Transforms: Hotelling, Hit and Miss transform. Color Image Processing, Multiview Image Processing, Epipolar geometry Image Warping and Restoration. Image Segmentation, Representation and Description Morphological Operators, Erosion, Dilation, Medial Axis, Thining, Skeleton. Image Matching and Classification		
Books:	1) Rafael C Gonzalez, Richard E Woods, Digital Image Processing, Addison-Wesley. 2) Milan Sonka, Vaclav Hlavac, Roger Boyale, Image Processing, Analysis and Machine Vision: PWS Publishing (ITP-International Thomson Publishing). 3) Anil K Jain: Fundamentals of Digital Image Processing, Printice Hall of India (PHI).		

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST454**	**Course Name:**	**Data Mining and Data Warehousing**
Credit:	**4**	**L-T-P:**	**3-0-2**

Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Introduction to Decision Support Systems, Data Warehouse and Online Analytical Processing. Data Warehouse Architecture: System Processes, Process Architecture: Load Warehouse, Query, Detailed and Summarized Information. Design: Data Base Schema Facts, Dimensions and Attributes. Data Base and Metadata. Data Mining : Introduction and need, Descriptive and Predicative Data Mining. Data Processing : Data Cleaning, Data Integration and Transformation, Data Reduction. Data Mining Primitives:, Language DMQL and its Preliminary Clauses. Data Mining Methods: Association – Single and Multilevel, Characterization and Comparison, Regression Analysis, Classification and Predication. Data Mining Algorithms: Clustering, Association, Regression, Decision Trees. Application and Trends in Data Mining. Data Warehouse Implementation.		
Books:	1) Data Warehousing in the Real World – Anahory and Murray, Pearson Education. 2) Data Mining – Concepts and Techniques – Jiawai Han and Micheline Kamber. 3) Building the Data Warehouse – WH Inmon, Wiley.		
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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST456**	**Course Name:**	**Topics in High Speed Networking**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Overview of Internet Technologies, Issues in next generation Internet - Routing, Multicasting, Packet Scheduling, Quality of Service etc. Admission control in Internet: Effective bandwidth, Differentiated services, Policy-based networking, Real time communications over Internet, Internet telephony, Voice over IP, Integrated services. Web QoS, Intelligent caching, Traffic measurement and characterization.		

Books:	1) Kurose: Computer Networking A Top Down Approach, Pearson. 2) Peterson and Davie: Computer Networks: A systems approach, Morgan Kaufman and Elsevier. 3) J.Walrand, High Performance Computer Networks, Elesevier 4) A.Kumar, D.Manjunath, Communication Network MKP. 5) Recent papers from conferences and journals

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST458**	**Course Name:**	**e-Commerce**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Introduction and concepts: networks and commercial transactions, the Internet environment, online commerce solutions. A generic business model for e-commerce. Security technologies: Introduction to cryptography, key distribution and clarification. Architecture for e-commerce: online commerce environment, servers and commercial environments, strategies, techniques and tools. Electronic payment methods: Secure online transaction models, digital payment system, cyber cash, digital currencies, Smart cash, digital purse, anonymity and authentication. Protocol for the public transport of private information: security protocols, secure socket layer. Open issues: legal and technical issues.		
Books:	1) Pete Loshin, Paul A Murphy: Electronic e-commerce, Jaico book. 2) Paul May: The Business of e-commerce, Cambridge University Press. 3) Recent papers from conferences and journals		

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST460**	**Course Name:**	**High Level Synthesis of Digital Systems**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Overview. Design methodologies. Abstractions and views. Review of basic concepts in algorithms and graph theory Design representation and modeling, Modeling languages, Abstract models Synthesis at higher levels of abstraction Scheduling, Resource sharing Structural synthesis: Module selection. Pipeline. Control Synthesis at lower levels of abstraction, Logic synthesis		
Books:	1) G. D. Micheli. Synthesis and optimization of digital systems. 2) N.D. Dutt, D. D. Gajski. High level synthesis, Kluwer, 2000. 3) T. H. Cormen, C. E. Leiserson and R. L. Rivest, “Introduction to Algorithms,” McGraw-Hill, 1990. 4) Recent papers from journals and conferences.		
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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST462**	**Course Name:**	**Parallelizing Compiler**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Motivation and overview, structure of a parallelizing compiler. Review of code optimization techniques in compilers for sequential machines. Parallelism detection - data dependence analysis, direction vectors, loop carried and loop independent dependences; tests for data dependence and their applicability, construction of data dependence graph. Control dependence and control dependence graph. Restructuring transformations and automatic extraction of parallelism; representation of iteration spaces of multiply nested loops; loop based transformations such as loop distribution, loop coalescing, loop inter-change and cycle shrinking transformation.		

Books:	1) Selected papers and online reference material

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST464**	**Course Name:**	**Public Key Infrastructure and Trust Management**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Public key infrastructure - components and architecture. PKI interoperability, deployment and assessment PKI data structures – certificates, validation, revocation, authentication, cross-certification. Repository, Certification Authority (CA) and Registration Authority (RA), trusted third party, digital certificates. PKI services – authentication, non-repudiation, privilege management, privacy, secure communication. Key management – certificate revocation list, root CA, attacks on CA, key backup. PKI standards – SSL, LDAP, IPSec, X.500, X.509, S/MIME Trust models – strict v/s loose hierarchy, four corner, distributed. Certificate path processing – path construction and path validation.		
Books:	1) Ashutosh Saxena, Public Key Infrastructure, Tata McGraw Hill 2) Carlisle Adams, Steve Lloyd. Understanding PKI: Concepts, Standards, and Deployment Considerations, Addison Wesley. 3) John R. Vacca. Public Key Infrastructure: Building Trusted Applications and Web Services, AUERBACH. 4) Messaoud Benantar, Introduction to the Public Key Infrastructure for the Internet, Pearson Education.		

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST466**	**Course Name:**	**Selected Topics in Cryptography**
Credit:	**4**	**L-T-P:**	**3-0-2**

Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Elliptic Curve Cryptography Secret Sharing, Threhold cryptography – Robust ElGamal system Visual Cryptography Interactive zero knowledge proofs, witness hiding protocols. Group encryption, decryption. Group signatures, ring signatures. EVoting: requirements, issues and challenges, existing solutions, write-in ballots. Pair based cryptography – Weil and Tate pairing.		
Books:	1) Selected paper and online reference material.		
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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST468**	**Course Name:**	**Robotics and Control**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Robotics: Introduction to robotics, advantages, applications. Robotic kinematics and dynamics: Direct and inverse kinematics problem. Axis transformations; DH matrix; forward and reverse kinematics, trajectory planning. manipulators and their control. Robot sensors: Active and passive robot sensors, Construction of tactile, touch and vision sensors; interpretation of sensory information; vision processing; kinematic information from sensory data. Robot Intelligence: Robot learning, State space search, robotics in computer vision applications. Robotic end effectors: Stable grip; constraints; types of contact; mathematical representation of stable grip; use of screw twist, and wrench gripper design; tools as end effectors. Problems of implementation of automatic systems.		
Books:	1) Fu K, Gonzalez R and Lee C, Robotics - Control Sensing Vision & Intelligence, McGraw Hill. 2) Craig J J, Introduction to Robotics, Mechanics and Control, Addison Wesley, 1993. 3) McKerrow P J, Introduction to Robotics, Addison Wesley, 1993. 4) Selig M, Introductory Robotics, Prentice Hall, 1992.		

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	UG	Department:	Computer Engineering
Course Code:	CST470	Course Name:	FPGA based System Design
Credit:	4	L-T-P:	3-0-2
Version:		Approved on:	
Pre-requisite Course :			
Syllabus	Introduction to FPGA Architectures. FPGA design flow, partitioning, placement and routing algorithms. Technology mapping for FPGAs, case studies.		
Books:	1) Brown, Francis, Rose and Vranesic. Field programmable Gate arrays. Kluwer. 2) Betz, Rose, Marquardt, Architecture and CAD for Deep-submicron FPGAs. Kluwer. 3) Trimberger, FPGA Technology. Kluwer, 1992. 4) Oldfield, Dorf. FPGAs: Reconfigurable logic for rapid prototyping and implementation of digital systems. John Wiley. 5) Recent papers from conferences and journals.		

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	UG	Department:	Computer Engineering
Course Code:	CST472	Course Name:	Security in Computing
Credit:	4	L-T-P:	3-0-2
Version:		Approved on:	
Pre-requisite Course :			

Syllabus	Computer security, threats, attacks, computer criminals, defense methods, information and network policies, cryptography, symmetric and public-key encryption, uses of encryption. Secure file systems and database security. Program security, secure programs, viruses and other malicious code, control against program threats, protection in general-purpose OS, protected resources and methods of protection, user authentication. Binding programs to machines. Language based security, Integrating security in compilers. Designing trusted OS, models of security, database security, security requirements, reliability and integrity, inference. Administering security, legal, privacy, and ethical issues in computer security.
Books:	1) Pfleeger and Pfleeger, Security in Computing, Pearson Education. 2) M. Bishop and S. S. Venkatramanayya, Introduction to Computer Security, Pearson Education. 3) Stallings W., Cryptography and Network Security Principles and Practice, Pearson Education. 4) Stallings W., Network Security Essentials: Applications and Standards, Pearson Education.

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST474**	**Course Name:**	**Intelligent Agents**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			

Syllabus	Introduction to agent-based computing , Motivations for agent-based computing Key concepts and models, Agent architectures (deliberative, reactive, hybrid), Rational decision making (decision theoretic, belief-desire-intention) Mobile agents, Agent Interactions, Coordination (organisation models, social laws, social dependencies), Cooperation (team-oriented problem solving, coalition formation) Negotiation (mechanism design, heuristic models, argumentation) Computational markets (auctions, competition) Agent-Oriented Software Engineering, Benefits and Potential Drawbacks, Agent Methodologies, Application Case Studies (agent-mediated electronic commerce, business process management, telecommunications network management)
Books:	1) M.J.Wooldridge, An introduction to multi-agent systems. Wiley

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST476**	**Course Name:**	**Critical Systems**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Introduction to time critical systems, Issues, Components, Classification and terminology. Misconceptions about Real-time computing. Real-time System requirements. Specification of timing constraints. Real-time scheduling: Requirements and Issues, Terminology, modeling, Introduction static and dynamic scheduling schemes, cyclic scheduling, priority driven scheduling of periodic tasks, schedulability tests, Aperiodic task scheduling: server/non-server based scheduling algorithms. Practical factors/overheads. Task Synchronization: Need and priority inversion problem, Priority Inheritance protocol, priority ceiling protocol and stack-based priority ceiling protocol. Introduction to multiprocessor real-time systems, problems and issues. An overview of an operating system		

Books:	1) J.W.S.Liu: Real-Time Systems, Pearson Education Asia 2) S.T.Lavi, A.K.Agrawala: Real-time system Design, McGraw Hill 3) Laplante: Real-time Systems Design and Analysis, An Engineer's Handbook, IEEE Press 4) Laurence, K.Mauch: Real-time Microcomputer system design, An introduction, McGraw Hill

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST478**	**Course Name:**	**Pattern Recognition**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Introduction to statistical, syntactic and descriptive approaches, features and feature extraction. Bayes Decision theory- continuous case, 2-category classification, minimum error rate classification, discriminant functions and decision surfaces, discrete case. Parameter estimation, supervised learning- Maximum likelihood, Bayes, general bayesian learning. Nonparametric - density estimation, parzen windows, k-nearest Neighbor, estimation posterior probability. Linear discriminant functions- decision surfaces, generalized linear discriminant functions, 2-category linearly separable case, non-separable behavior, linear programming procedures, SVMs. Supervised learning: Feed forward Neural networks, Backpropagation algorithm, error surfaces. Clustering - data description and clustering, Hierarchical clustering, self organizing maps.		
Books:	1) Duda and Hart P.E, and David G Stork, Pattern classification , John Wiley & Sons. 2) Duda and Hart P.E, Pattern classification and scene analysis, John Wiley and sons.. 3) Earl Gose, Richard Johnsonbaugh, and Steve Jost; Pattern Recognition and Image Analysis, PHI. 4) Fu K.S., Syntactic Pattern recognition and applications, Prentice Hall.s		

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST480**	**Course Name:**	**Biometric Security**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Biometrics: Need, Conventional techniques of authentication, challenges - legal and privacy issues. Biometrics: DNA, fingerprint, Iris, Face, hand geometry, ear. Behavioral: Human gait, speech, thermal imaging, infra-red spectrum, signature, keystroke dynamics Combining biometrics, scaling issues. Privacy, legal and ethical issues.		
Books:	1) Julian D. M. Ashbourn, Biometrics: Advanced Identify Verification: The Complete Guide 2) Davide Maltoni (Editor), et al, Handbook of Fingerprint Recognition 3) L.C. Jain (Editor) et al, Intelligent Biometric Techniques in Fingerprint and Face Recognition 4) John Chirillo, Scott Blaul, Implementing Biometric Security 5) Nalini Ratha (Editor), Ruud Bolle 6) Authentication: From Passwords to Public Keys, Richard E. Smith		
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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST482**	**Course Name:**	**Computer Forensics**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			

Syllabus	File System Forensics: Duplicating hard disks for "dead analysis", reading hidden data on a disk's Host Protected Area (HPA), Direct versus BIOS access, dead versus live acquisition, Disk partitions - DOS, Apple, and GPT partitions, BSD disk labels, Sun Volume; multiple disk volumes - RAID and disk spanning; Analyzing FAT, NTFS, Ext2, Ext3, UFS1, and UFS2 file systems, Finding evidence: File metadata, recovery of deleted files, Using The Sleuth Kit (TSK), Autopsy Forensic Browser, and related open source tools Web Forensics: network-based evidence in Windows and Unix environments, Reconstructing Web browsing, e-mail activity, Tracing domain name ownership and the source of e-mails System Forensics: Windows Registry changes, Duplicating and analyzing the contents of PDAs and flash memory devices Electronic document, computer image verification and authentication
Books:	1) Brian Carrier. File System Forensic Analysis, Addison Wesley. 2) Chris Prosise, Kevin Mandia. Incident Response and Computer Forensics, McGraw Hill. 3) Linda Volonino, Reynaldo Anzaldua, and Jana Godwin. Computer Forensics: Principles and Practices, Prentice Hall. 4) Keith J. Jones, Richard Bejtlich, and Curtis W. Rose. Real Digital Forensics: Computer Security and Incident Response, Addison Wesley 5) Vacca, John R., Computer Forensics Computer Crime Scene Investigation, Charles River Media. 6) Nelson, Phillips, Enfinger, Steuart. Guide to computer Forensics and Investigation, Course Technology.

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST484**	**Course Name:**	**Semantic Web**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			

Syllabus	Introduction to semantic web, architecture, langauages and tools for knowledge management. XML, RDF, OIL, DAML, OWL for semantic web. Semantic Web Technologies: Ontology-based Systems: Ontology based knowledge management; ontology construction; generating, storing, aligning and maintaining ontologies for semantic web; information retrieval from natural language based documents; ontology evolution; ontological indexing and searching techniques for Searching web
Books:	1) John Davies, Rudi Studer, and Paul Warren. Semantic Web Technologies: Trends and Research in Ontology-based Systems, Wiley. 2) John Davies, Dieter Fensel, Frank van Harmelen, and Frank van Harmelen. Towards the Semantic Web: Ontology-Driven Knowledge Management, Wiley.

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST486**	**Course Name:**	**Intrusion Detection**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Introduction- Intrusion detection system (IDS), intrusion prevention system (IPS), Unauthorized access – buffer overflow, packet fragmentation, out-of-spec packets Review of Network protocol – TCP-/IP, Intrusiond detection through tcpdump. IDS and IPS – Architecture and internals. Malicious and non-malicious traffic, IP headers, TDP, UPD and ICMP protocols and header formats, Header information to detect intrusion, logs and their analysis, IDS through reaction and response Intrusion analysis – data correlation, tools, SNORT		

Books:	1) Matt Fearnow, Stephen Northcutt, Karen Frederick, and Mark Cooper. Intrusion Signatures and Analysis, SAMS. 2) Carl Endorf, Gene Schultz, Jim Mellander, Intrusion Detection and Prevention, McGraw Hill. 3) Stephen Northcutt and Judy Novak. Network Intrusion Detection, SAMS. 4) Paul E. Proctor. The Practical Intrusion Detection Handbook, Prentice Hall.

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST488**	**Course Name:**	**Internet Security**
Credit:	**4**	**L-T-P:**	**3-0-2**
Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Security protocols: naming and addressing, IPv6, Network address translation, SNMP, remote login, file transfer protocol, RPC based protocol, peer-to-peer communication Web architecture and protocols, buffer overflow and hacking Internet threats – password stealing, Trojans, phishing, viruses, worms, DOS attack, backdoors, Botnets, port scanning, hacking techniques. Security mechanisms – passwords, one-time password – time based, Lamport's, authentication – smart card, biometrics, RADIUS, SASL framework, host to host authentication, PKI. Firewalls, VPNs, tunneling, Intrusion detection. Server and client security,		
Books:	1) John Chirillo. Hack attacks denied, Wiley. 2) McClure. Web Hacking, Pearson Education. 3) John R. Vacca. Practical Internet Security, Springer. 4) William R. Cheswick, Steven M. Bellovin, and Aviel D. Rubin. Firewalls and Internet Security: Repelling the Wily Hacker, Addison-Wesley. 5) Kenneth Einar Himma. Internet Security: Hacking, Counterhacking ,and Security, Jones & Bartlett Publishers		

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B.Tech (Computer Engineering) - Advanced Elective Course

UG/PG	**UG**	**Department:**	**Computer Engineering**
Course Code:	**CST490**	**Course Name:**	**Malware Analysis and Detection**
Credit:	**4**	**L-T-P:**	**3-0-2**

Version:		**Approved on:**	
Pre-requisite Course :			
Syllabus	Malware Taxonomy, Infection and Propagation mechanisms, Payload delivery, obfuscation, Detection mechanisms: scanning, anomaly detection, behavioural analysis; polymorphic and metamorphic malware, signature, static and dynamic analysis, generic decryptor, disinfection, system vulnerabilities and exploits.		
Books:	1) Peter Szor. The Art of Computer Virus Research and Defense, Addison Wesley. 2) Eric Filliol: Computer Viruses from Theory to Applications, Springer. 3) M. Sikorski and A. Honig: Practical Malware Analysis, No Starch Press.		
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