

COURSE STRUCTURE & SYLLABUS

FOR

5-YEAR DUAL DEGREE (COMPUTER SCIENCE &ENGINEERING)

(Effective from Academic Sessions 2016-2017
- Applicable for students taken admission in
July 2015 Onwards)



**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
INDIAN SCHOOL OF MINES
DHANBAD- 826 004, JHARKHAND**

I SEMESTER DUAL DEGREE - PHYSICS (GROUP - I)					
Course No.	Name of the Courses	L	T	P	Credit Hours
AMC11101	Mathematics-I	3	1	0	7
APC11101	Physics	3	0	0	6
EEC11101	Electrical Technology	3	1	0	7
MCC11101	Engineering Graphics	1	4	0	6
MCC11103	Engineering Mechanics	3	1	0	7
HSC11301	Value Education, Human Rights and Legislative Procedure (S)	3	0	0	6
GLD/ESD11301	Earth System Science (S)	3	0	0	6
APC11201	Physics Practical	0	0	3/2	1.5
EEC11201	Electrical Technology Practical	0	0	3/2	1.5
SWC11701	Counseling / Special Class / Co-Curricular Activities *	0	0	0	0
Total					48
Contact Hrs.		19	7	3	29

* Credit in II Semester.

I SEMESTER DUAL DEGREE - CHEMISTRY (GROUP - II)					
Course No.	Name of the Courses	L	T	P	Credit Hours
AMC11101	Mathematics-I	3	1	0	7
ACC11101	Chemistry	3	0	0	6
ECC11101	Electronics Engineering	3	0	0	6
MCC11102	Manufacturing Processes	1	4	0	6
HSC11101	English for Science & Technology	3	0	0	6
CSC11301	Computer Programming (S)	3	0	0	6
MSD/APD11301	Disaster Management & Energy Resources (S)	3	0	0	6
ACC 11201	Chemistry Practical	0	0	3/2	1.5
ECC 11201	Electronics Engineering Practical	0	0	3/2	1.5
CSC 11201	Computer Programming (S)	0	0	2	2
SWC 11701	Counseling / Special Class / Co-Curricular Activities *	0	0	0	0
Total					48
Contact Hrs.		19	5	5	29

* Credit in II Semester.

II SEMESTER DUAL DEGREE - CHEMISTRY (GROUP - I)					
Course No.	Name of the Courses	L	T	P	Credit Hours
AMC12101	Mathematics-II	3	1	0	7
ACC12101	Chemistry	3	0	0	6
ECC12101	Electronics Engineering	3	0	0	6
MCC12102	Manufacturing Processes	1	4	0	6
HSC12101	English for Science & Technology	3	0	0	6
CSC12301	Computer Programming (S)	3	0	0	6
MSD/APD12301	Disaster Management & Energy Resources (S)	3	0	0	6
ACC 12201	Chemistry Practical	0	0	3/2	1.5
ECC 12201	Electronics Engineering Practical	0	0	3/2	1.5
CSC 12201	Computer Programming (S)	0	0	2	2
SWC 12701	Counseling / Special Class / Co-Curricular Activities *	0	0	0	3
Total					51
Contact Hrs.		19	5	5	29

II SEMESTER DUAL DEGREE - PHYSICS (GROUP - II)					
Course No.	Name of the Courses	L	T	P	Credit Hours
AMC12101	Mathematics-II	3	1	0	7
APC12101	Physics	3	0	0	6
EEC12101	Electrical Technology	3	1	0	7
MCC12101	Engineering Graphics	1	4	0	6
MCC12103	Engineering Mechanics	3	1	0	7
HSC12301	Value Education, Human Rights and Legislative Procedure (S)	3	0	0	6
GLD/ESD12301	Earth System Science (S)	3	0	0	6
APC12201	Physics Practical	0	0	3/2	1.5
EEC12201	Electrical Technology Practical	0	0	3/2	1.5
SWC12701	Counseling / Special Class / Co-Curricular Activities *	0	0	0	3
Total					51
Contact Hrs.		19	7	3	29

III SEMESTER DUAL DEGREE- CSE					
Course No.	Name of the Courses	L	T	P	Credit Hrs.
CSC13102	Data Structures	3	1	0	7
CSC13103	Discrete Mathematics	3	0	0	6
CSC13104	Object Oriented Programming	3	0	0	6
EIR13101	Digital Electronics	3	0	0	6
AMR13101	Methods of Applied Mathematics -I	3	1	0	7
CSC13202	Data Structures Lab	0	0	3	3
CSC13204	Object Oriented Programming Lab	0	0	3	3
CSC13801	Project	0	0	2	2
Total					40
Contact Hrs.		15	2	8	25

IV SEMESTER DUAL DEGREE- CSE					
Course No.	Name of the Courses	L	T	P	Credit Hrs.
CSC14102	Algorithm Design & Analysis	3	1	0	7
CSC14103	Theory of Computation	3	0	0	6
CSC14104	Computer Organization	3	0	0	6
AMR14101	Numerical & Statistical Methods	3	1	0	7
HSC14306	English for Professional Communication	3	0	0	6
CSC14202	Algorithm Design & Analysis Lab	0	0	3	3
CSC14204	Computer Organization Lab	0	0	3	3
CSC14501	Composite Viva-Voce	0	0	0	4
SWC14701	Co-Curricular Activities	0	0	0	3
CSC14801	Project	0	0	2	2
Total					47
Contact Hrs.		15	2	8	25

V SEMESTER DUAL DEGREE- CSE					
Course No.	Name of the Courses	L	T	P	Credit Hrs.
CSC15101	Combinatorics & Graph Theory	3	0	0	6
CSC15102	Operating Systems	3	0	0	6
CSC15106	Computer Networks	3	0	0	6
CSC15107	Computer Architecture	3	0	0	6
CSC15202	Operating Systems Lab	0	0	2	2
CSC15206	Computer Networks Lab	0	0	2	2
CSC15801	Project	0	0	4	4
Total					32
Contact Hrs.		12	0	8	20

V SEMESTER DUAL DEGREE - CSE					
CSE (Honours)					
Course No.	Name of the Courses	L	T	P	Credit Hrs.
CSH15101	Advanced Algorithms	3	0	0	6
CSH15201	Advanced Algorithms Lab	0	0	2	2
Total					8
Contact Hrs.		3	0	2	5

VI SEMESTER DUAL DEGREE- CSE					
Course No.	Name of the Courses	L	T	P	Credit Hrs.
CSC16101	Artificial Intelligence	3	0	0	6
CSC16105	Database Management Systems	3	0	0	6
CSC16106	Compiler Design	3	0	0	6
MSR14151	Managerial Economics	3	0	0	6
CSC16205	Database Management Systems Lab	0	0	2	2
CSC16206	Compiler Design Lab	0	0	2	2
CSC16501	Composite Viva Voce	0	0	0	4
CSC16801	Project	0	0	4	4
Total					36
Contact Hrs.		12	0	8	20

VI SEMESTER DUAL DEGREE - CSE					
CSE (Honours)					
Course No.	Name of the Courses	L	T	P	Credit Hrs.
CSH16101	Computer Graphics	3	0	0	6
CSH16201	Computer Graphics Lab	0	0	2	2
Total					8
Contact Hrs.		3	0	2	5

VII SEMESTER DUAL DEGREE- CSE					
Course No.	Name of the Courses	L	T	P	Credit Hrs.
CSC17102	Parallel & Distributed Computing	3	0	0	6
CSC17103	Software Engineering	3	0	0	6
CSC17104	Data Mining	3	0	0	6
CSC171xx	Elective – I	3	0	0	6
CSC17202	Parallel & Distributed Computing Lab	0	0	2	2
CSC17203	Software Engineering Lab	0	0	2	2
CSC17801	Project	0	0	6	6
Total					34
Contact Hrs.		12	0	10	22

LIST OF ELECTIVES FOR VII SEMESTER DUAL DEGREE - CSE					
Course No.	Name	L	T	P	Credit Hrs.
CSE17103	Functional & Logic Programming	3	0	0	6
CSE17104	Object Oriented Data Modeling	3	0	0	6
CSE17105	Information and Coding Theory	3	0	0	6
CSE17108	Advanced Compilers	3	0	0	6
CSE17110	Computational Geometry	3	0	0	6
CSE17111	Evolutionary Computation	3	0	0	6
CSE17112	Complexity Theory	3	0	0	6
CSE17113	Computational Number Theory	3	0	0	6
CSE17114	Data Analytics	3	0	0	6
CSE17115	Natural Language Processing	3	0	0	6

VII SEMESTER DUAL DEGREE - CSE					
CSE (Honours)					
Course No.	Name of the Courses	L	T	P	Credit Hrs.
CSH17101	Cryptography	3	0	0	6
CSH17201	Cryptography Lab	0	0	2	2
Total					8
Contact Hrs.		3	0	2	5

VIII SEMESTER DUAL DEGREE- CSE					
Course No.	Name of the Courses	L	T	P	Credit Hrs.
CSC18103	Wireless & Mobile Communication	3	0	0	6
CSC18105	Image and Video Processing	3	0	0	6
CSC181xx	Elective – II	3	0	0	6
CSC181xx	Elective – III	3	0	0	6
CSC18205	Image and Video Processing lab	0	0	2	2
CSC18502	Composite Viva Voce	0	0	0	4
CSC18801	Project	0	0	6	6
Total					36
Contact Hrs.		12	0	8	20

LIST OF ELECTIVES FOR VIII SEMESTER DUAL DEGREE - CSE					
Course No.	Name	L	T	P	Credit Hrs.
CSE18101	Digital System Testing and Testable Design	3	0	0	6
CSE18102	Soft Computing	3	0	0	6
CSE18106	Distributed Operating Systems	3	0	0	6
CSE18108	Computer Vision	3	0	0	6
CSE18110	Fault Tolerant Computing Systems	3	0	0	6
CSE18111	E-Commerce Technologies	3	0	0	6
CSE18112	Quantum Computing	3	0	0	6
CSE18113	Multimedia Systems	3	0	0	6
CSE18115	Algorithmic Game Theory	3	0	0	6
CSE18116	Modern Cryptography	3	0	0	6
CSE18117	Algorithmic Graph Theory	3	0	0	6
CSE18118	Cloud Computing	3	0	0	6

VIII SEMESTER DUAL DEGREE - CSE					
CSE (Honours)					
Course No.	Name of the Courses	L	T	P	Credit Hrs.
CSH18101	Information Retrieval	3	0	0	6
Total					6
Contact Hrs.		3	0	0	3

IX SEMESTER DUAL DEGREE- CSE					
Course No.	Name of the Courses	L	T	P	Credit Hrs.
CSC19101	System Simulation	3	1	0	6
CSC19102	Computational Biology	3	0	0	6
CSC191xx	Elective – IV	3	0	0	6
CSC19201	System Simulation Lab	0	0	2	2
CSC19801	Dissertation (Interim)	0	0	8	8
CSC19501	Seminar and Viva-voce	0	0	0	5
CSC19001	Vocational Training	0	0	0	5
Total					38
Contact Hrs.		9	1	10	20

LIST OF ELECTIVES FOR IX SEMESTER DUAL DEGREE - CSE					
Course No.	Name	L	T	P	Credit Hours
CSE19101	Advanced DBMS	3	0	0	6
CSE19102	Internet Technology	3	0	0	6
CSE19103	Nature Inspired Computing	3	0	0	6
CSE19104	Pattern Recognition	3	0	0	6
CSE19105	Public-Key Cryptography and Infrastructures	3	0	0	6
CSE19106	Computational Finance	3	0	0	6
CSE19107	VLSI Design & Testing	3	0	0	6

X SEMESTER DUAL DEGREE- CSE					
Course No.	Name of the Courses	L	T	P	Credit Hours
CSC110801	Dissertation	0	0	0	20
CSC110802	Seminar on Dissertation	0	0	0	5
CSC110803	Viva-voce on Dissertation	0	0	0	10
CSC110804	Teaching Assignment Evaluation/Lab Development	0	0	0	5
Total					40

COURSE DETAILS OF III SEMESTER DUAL DEGREE - CSE

CSC13102	DATA STRUCTURES	3-1-0
<p>Basic concepts; Mathematical Background; Complexity Analysis; Arrays: one dimensional, multi-dimensional, Sparse Matrix, Elementary Operations; Stacks: Representation, elementary operations and applications such as infix to postfix, postfix evaluation, parenthesis matching; Queues: Simple queue, circular queue, dequeue, elementary operations and applications; Linked lists: Linear, circular and doubly linked lists, elementary operations and applications such as polynomial manipulation; Trees: Binary tree representation, tree traversal, complete binary tree, heap, binary search tree, height balanced trees like AVL tree and 2-3 tree, tries, red-black tree, B-tree, other operations and applications of trees; Graphs: representation, Adjacency list, graph traversal, path matrix, connected components, DAG, topological sort, Spanning tree; Sorting: Selection sort, bubble sort, quick sort, merge sort, heap sort, radix sort; Searching: linear and binary search; Hashing: hash tables, hash functions, open addressing, File structures: Introduction, data file types, file organization, file access methods.</p>		
CSC13103	DISCRETE MATHEMATICS	3-0-0
<p>Logic: Propositional logic; Predicates and Quantifiers; Rule of Inferences; Basic Logical Operations: Conjunction, Disjunction, Negation; Tautology; Conjunctive and Disjunctive Normal Forms; De Morgan's Laws; Sets: Types of Set; Set Operations; Partitions of Sets; Partial Ordered Set; Relation: Relations and Their Properties; Equivalence Relations; Partial Orderings; Functions: Injective, Surjective, Bijective Functions; Composition of Functions; Inverse of a Function; Induction and Recurrence: Mathematical Induction; Linear Recurrence Relations; Divide-and-Conquer Recurrence Relations; Congruence Arithmetic: Elementary properties; Linear Congruence equation; Combinatorics: Basic Counting Principles; The Inclusion-Exclusion Principle; Pigeonhole Principle; Permutations and Combinations; Group: Properties; Types of Group; Lagrange's Theorem; Ring: Properties; Types of Ring; Integral Domain; Field; Graph Theory: Basic Terminologies, Degree, Connectivity, Trees; Lattices and Boolean Algebra: Basic Theorems on Boolean Algebra; Duality Principle.</p>		
CSC13104	OBJECT ORIENTED PROGRAMMING	3-0-0
<p>Object Oriented Programming and languages: fundamentals, necessity and advantages, Objects and Classes, Encapsulation; data and method binding; 'self' or 'this' reference, access specification: private, protected and public; modularity based encapsulation, Inheritance: passing knowledge down. single versus multiple inheritance, sub- and super-classes. Code reuse, inheritance and sub-typing. Polymorphism: Simple (or static) polymorphism (in C++), method overloading, subtype polymorphism (extending a class) through method overriding, 'virtual' methods (in C++) and distinction with non-virtual ones, abstraction through polymorphism, 'abstract' classes and methods, 'pure' virtual functions in C++; Interfaces: OOPs allowing interfaces (like Java), interfaces versus multiple inheritance, distributed-objects through decoupled interfacing; brief glimpse of CORBA, COM, Enterprise Java, etc. Exception Handling: the 'try-catch-throw-finally' paradigm; catching and throwing errors; ensuring cleaning up using 'finally'; Stack-unrolling in error handling, exception classes and their hierarchy, error handling as a built-in feature (as in Java), exception specification, the 'throws' keyword and compiler behavior. Templates: parametric polymorphism through templates, type safety through templates, templates and compiler behavior; Just-in-time compiling, template libraries; generic collections using templates. Comparison of Popular OOPs, OOP varieties. Pure versus mixed OOPs, Compiled versus interpreted, Statically typed versus dynamically typed, Strongly typed versus</p>		

weakly typed, Comparing C++, Java, C#, Javascript and Python.		
EIR13101	DIGITAL ELECTRONICS	3-0-0
Basic of Boolean Algebra and Minimization Techniques; Combinational and sequential circuits; Introduction to finite state machine concept; Bipolar logic families: DTL, TTL, ECL, I2L; MOS logic families: NMOS (EE and ED) and CMOS. Basic Digital circuits, Shift Register and Flip-flops and Counters; Semiconductor memories; Logic Implementation on ROM, PAL, PLA and Gate Array; Wave from generation using gates; Timing Circuits, Arithmetic Systems.		
AMR13101	METHODS OF APPLIED MATHEMATICS - I	3-1-0
<p>Part: I Complex Variables: Limit, continuity and differentiability of function of complex variables. Analytic functions. Cauchy-Reimann's and Cauchy's integral theorem, Morera's theorem, Cauchy's Integral formula, Taylor's and Laurent's series, singularities. Residues theorem, contour integration. Special Functions: Solution of Bessel Equation, Recurrence relations and generating functions for $J_n(x)$ orthogonal property and integral representation of $J_n(x)$. Solution for Legendre Equation, Legendre polynomial, Rodrigue's formula, orthogonal property and generating function for $P_n(x)$.</p> <p>Part II Laplace Transform and PDE: Laplace transform of simple functions, first and second shifting theorems, t-multiplication and t-division theorems; Laplace transforms of derivatives, integrals and periodic functions. Inverse of Laplace transform and convolution property. Use of Laplace transform in evaluating implicated and improper integrals and solution of differential equations related to engineering problems. Partial Differential Equations: Classification of partial differential equations, solutions of one dimensional wave equation, one dimensional unsteady heat flow equation and two dimensional steady heat flow equation in Cartesian and Polar coordinates by variable separable method with reference to Fourier trigonometric series.</p>		
CSC13202	DATA STRUCTURES LAB	0-0-3
Laboratory assignments will be based on the implementation of the basic operations and application algorithms using various data structures. Programs are to implemented using any preferable language such as C, C++, Java.		
CSC13204	OBJECT ORIENTED PROGRAMMING LAB	0-0-3
Laboratory experiments will be set based on the materials taught in CSC13104. It mainly includes programming Lab. assignments in various languages. Emphasis will be given on the implementation of the programs using OOPs (C++ / Java)		

COURSE DETAILS OF IV SEMESTER DUAL DEGREE - CSE

CSC14102	ALGORITHM DESIGN AND ANALYSIS	3-1-0
<p>Notions of algorithms, Algorithm paradigms, Complexity analysis, Asymptotic notations, Practical Complexities; Divide-and Conquer paradigm: Recurrence relations, finding maximum and minimum, kth smallest selection, Strassen's matrix multiplication; Greedy Algorithms: Knapsack problem, tree vertex splitting, job sequencing, activity selection problem, minimum cost spanning tree; optimal storage on tapes, optimal merge patterns, single-source shortest paths; Dynamic Programming: Multistage graph problem, single-source and all pairs shortest paths, Traveling sales person problem, Longest common subsequence problem; Back Tracking: 8-queens problem, sum-of-subsets, graph coloring, Hamiltonian cycles; Branch-and-Bound: Least cost search, 15-puzzle problem; NP-Hard and NP complete problems, Introduction to approximation algorithms.</p>		
CSC14103	THEORY OF COMPUTATION	3-0-0
<p>Notation of Languages; Deterministic and Non-Deterministic Finite Automata, Regular Expression and their relation to Regular Language, Pumping Lemma for Regular Languages; Context Free Grammar and Languages and their relation to Push Down Automata; Turing Machines; Decidability and Undecidability; Introduction to Computational Complexity; NP Completeness Problems.</p>		
CSC14104	COMPUTER ORGANIZATION	3-0-0
<p>Introduction: Basics of computer, Von-Neumann architecture, Generations of computer, Basic functional blocks of a computer, Instruction execution, Register transfer and micro operations; Data representation: Signed number representation, fixed and floating point representations, character representation; Programming basic computer: Machine language, Assembly language, Programming arithmetic and logic operations, Double precision operations, Shift operations; Organization of a computer: Central processing unit (CPU)-Hardwired and micro-programmed design approaches, ALU organization, Instruction formats, Three-, two-, one- and zero-address instructions, Addressing modes- Immediate, Register direct and indirect, Indexed, Based-indexed; Input-Output organization: Input-output subsystems, I/O transfers- Program controlled, Interrupt driven and DMA, Privileged and non-privileged instructions; Memory organization: Memory hierarchy, Main memory, Auxiliary memory, Cache memory- Organization, Mapping, Replacement, Writing policies, Virtual memory-Page table, Page replacement, Associative memory; Computer arithmetic: Integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication - shift-and-add, Booth multiplier, carry save multiplier, etc. Division - non-restoring and restoring techniques, floating point arithmetic, Decimal arithmetic-Operations, BCD adder, BCD subtraction; Introduction to peripheral devices and their characteristics.</p>		
AMR14101	NUMERICAL AND STATISTICAL METHODS	3-1-0
<p>Part I Numerical Methods: Solution of algebraic and transcendental equation by bisection, iteration, false position, and Newton-Raphson methods. Solution of a system of linear simultaneous</p>		

equations by Gauss elimination, Gauss-Jordan, Crout's triangularization, Jacobi and Gauss-Seidel iterative methods. Finite difference, Symbolic relations, Interpolation and Extrapolation, Newton-Gregory forward and backward, Gauss forward and backward, Stirling, Bessel, Lagrange's formulae, Inverse interpolation by Lagrange and iterative methods, Numerical differentiation and integration: Trapezoidal, Simpson's 1/3rd, Simpson's 3/8th, and Wieddle quadrature formulae. Numerical solution of first order ordinary differential equations by Taylor's series, Picards, Euler's, Modified Euler's, Runge-Kutta, and Milne's methods. Solution of simultaneous first order and second order ordinary differential equations with initial conditions by Runge-Kutta and Milne's methods. Numerical solution of boundary value problems by finite difference methods.

Part II

Statistical Methods: Moments, Skewness and Kurtosis. Probability: Various approaches of probability, two theorems (without proof), conditional probability, Bayes theorem. Random variable: Definition, probability mass and density functions, distribution functions, Mathematical expectation and Moment generating function. Probability distributions: Bernoulli, binomial, Poisson and normal distributions. Theory of least squares and curve fitting. Correlation and Regression: Simple, multiple and partial correlation coefficients, regression lines, regression coefficients and their properties. Test of Significance: Normal test, t-test, Chi-square test and F-test.

HSC14306	ENGLISH FOR PROFESSIONAL COMMUNICATION	3-0-0
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PART 1: PROFESSIONAL ORAL COMMUNICATION

1. The nature of group discussion: forms, functions, structural dimensions and interaction dimensions.
2. The conduct of group discussion: leadership functions, meeting management, providing the beginning, providing optimal participation, responding to problems, maintaining communication, coordinating, consensus testing, seeking clarification, providing clarification, co-operation, initiating topic shift, guiding for progress, ensuring objectivity, creating the atmosphere, effecting closure and follow-up; participant responsibilities, preparing for participation, communicating effectively, contributing systematically, maintaining friendly attitudes; process evaluation
3. Starting meetings and discussions: Opening the discussion, problem analysis, stating objectives, suggesting good group procedure (Time management, speaking procedure, etc.)
4. Presenting and supporting opinions: asking for opinions, supporting opinions, giving opinions, making suggestions, asking for suggestions
5. Balancing points of views: expressing advantages, disadvantages and consequences; presenting alternatives; accepting and rejecting ideas and proposals, building up arguments
6. Professional listening: decoding and comprehending, taking notes, listening cues, micro-markers and macro-makers.

Job Interviews:

1. Job Interview (JI): The Interviewing Process, types of interviews and interview formats
2. Pre-interview Preparation techniques, Self analysis, Skills Assessment, company analysis, Job Analysis, Practice, Developing the Interview file
3. Projecting success: The beginning, the middle and the end of the interview
4. Interviewing Strategies
5. Upholding the personality and overcoming interviewing hazards

PART 2: PROFESSIONAL WRITING

Report Writing:

1. Mechanics of Professional writing: stages of writing, research and preparation, some basics
2. Report writing (RW) : Characteristics of Business and Project Reports, Reports and other forms of communication, features of good reports
3. Types of reports (formal/Informal)
4. Structure of formal Reports: Front Matter, Main Body and Back Matter
5. Elements of formal reports: Organization, format and graphics
6. Style of Reports: Readability of reports, Choice of words and phrases, Construction and length of sentences and paragraphs

Business Correspondence

1. Nature and Principles of Business correspondence
2. Structure of Business letters
3. Business Letter formats
4. Letters giving instructions, inquiry letters, letters of complaints, letters urging action
5. Employment letters and applications; job query letters, job application letters, recommendation letters, follow-up letters, letters of acceptance, letters of refusal
6. C.V. & Resume writing
7. Business memos: form and structure
8. Writing an effective memo

Methods:

1. Theoretical input
2. Practical exercises, handouts and worksheets
3. Interactive classroom tasks, simulation and role play
4. Group communication tasks, simulation and role play
5. Guided discussions and practice discussions
6. Mock interview sessions
7. Self and peer evaluation
8. Audio-video input
9. Written assignments
10. Student Portfolio
11. Quizzes

TUTORIAL & PRACTICE SESSIONS

For tutorial and practice sessions, students will be divided into small groups. The time-table for these sessions will be communicated to the students. The sessions will include guided group discussions, open group discussions, case study discussions, mock interviews, student's seminars, paper presentations, writing practice, and group writing projects.

CSC14202	ALGORITHM DESIGN AND ANALYSIS LAB	0-0-3
Laboratory experiments will be set based on the materials covered in CSC14102. It includes programming assignments for practicing and designing on different algorithm design paradigms.		
CSC14204	COMPUTER ORGANIZATION LAB	0-0-3
Laboratory experiments will be set based on the materials covered in CSC14104. Laboratory includes design of registers, shift registers, ALU, Serial adder, Carry Look-ahead adder design, Array Multiplier, Memory design.		

COURSE DETAILS OF V SEMESTER DUAL DEGREE - CSE

CSC15101	COMBINATORICS AND GRAPH THEORY	3-0-0
<p>Combinatorics: Introduction and scopes, permutations, combinations, derangements, Binomial and Multinomial coefficients, Principles of inclusion and exclusions; Generating functions, Theory of counting, Fibonacci numbers, Recurrence relations, Catalan numbers, Permutation groups, Burnside's theorem, Polya's theorem of counting, Cycle index, Stirling numbers, Euler numbers.</p> <p>Graph theory: Introduction, Graphs and sub-graphs, representations, Paths, Cycles, diameter, girth, trees, connectivity, Eulerian tours, Hamilton cycles, matching, systems of distinct representatives, edge coloring, independent sets, cliques, vertex coloring, Ramsey theory, planar graphs, regular polyhedral, directed graphs, properties of some special graphs.</p>		
CSC15102	OPERATING SYSTEMS	3-0-0
<p>Introduction: Categories of OS, Interrupts, Storage Structure, Hardware Protection; OS Structures: OS Components, System Calls, System Structures; Process Management: Process Concept, Process State, PCB, Process Creation, Process Termination, Co-operating Process, Producer Consumer Problem, Inter-process Communication, Threads; CPU Scheduling: CPU Scheduler, Scheduling Criteria, Scheduling Algorithms: FCFS, SJF, Priority Scheduling, Round Robin Scheduling, Multilevel Queue Scheduling, Multilevel Feedback Queue Scheduling; Process Synchronization: Critical Section Problem, Bakery Algorithms, Semaphores, Reader's Writer's Problem, Dining Philosopher's Problem; Deadlock: Introduction, Deadlock Prevention, Deadlock Avoidance, Resource Allocation Graph Algorithms, Deadlock Detection, Prevention and Recovery; Memory Management: Memory Hierarchy, Memory Types, Main Memory Architecture, Cache Memory, Address Binding, Dynamic Loading, Linking, Logical vs Physical Addresses, Swapping, Contiguous Memory allocation, Fragmentation, Segmentation, Virtual Memory, Paging, Demand Paging, Page Replacement Algorithms, Thrashing; Secondary Storage Structure: Disk Structure, Disk Scheduling, Case study: Unix.</p>		
CSC15106	COMPUTER NETWORKS	3-0-0
<p>Overview of Data Communication and Networking: Network Architecture, OSI Reference Model, TCP/IP Protocol Suite; Physical Layer: Physical Characteristics of Interface and Media, Representation of Bits, Synchronization of Bits, Data Rate, Line Configuration, Physical Topology, Transmission Mode, Switching; Data Link Layer: Framing, Physical Addressing, Flow Control, Error Control, Access Control: Pure/slotted ALOHA, CSMA/CD, CSMA/CA, TDMA, FDMA, CDMA; Network Layer: Routing Algorithms, Congestion Control, Internet Protocol version 4 (IPv4), Address Resolution Protocol (ARP), Internet Control Message Protocol (ICMP), Networking & Internetworking Devices, Introduction to IPv6; Transport Layer: TCP, UDP; Network Applications: Electronic Mail (SMTP, POP), Client-Server Model, Socket Interface, Introduction to HTTP, FTP, DNS, DHCP.</p>		
CSC15107	COMPUTER ARCHITECTURE	3-0-0
<p>Overview of von Neumann architecture: Instruction set architecture; Control Unit, Arithmetic and Logic Unit, Memory and I/O devices; Measuring and reporting performance; CISC and RISC processors; Pipelining: Basic concepts of pipelining, Structural hazards, Data hazards and Control hazards; Techniques for handling various hazards; Implementation hardness for pipelining; Pipeline for floating-point operations, its hazards and minimization; Memory hierarchy design:</p>		

Inclusion, Coherence and locality properties; Reducing cache miss and miss-penalty; Virtual memory organization, mapping and management techniques, memory replacement policies; Parallel computer architecture: Design issues, Taxonomy of parallel architectures; Shared-memory multiprocessors-Memory semantics, Uniform and Non-uniform memory access multiprocessors, Message-passing multicomputers- MPPs, Supercomputers.

CSC15202	OPERATING SYSTEMS LAB	0-0-2
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It includes experiments that supplement Process Synchronization, Deadlock Handling, CPU and Disk Scheduling etc. Shell programming, concurrent programming with IPC. The programming assignments may be given to build parts of an OS as mini projects forming small groups.

CSC15206	COMPUTER NETWORKS LAB	0-0-2
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Laboratory experiments will be set to supplement the theory taught in CSC15106. Protocol simulation, Socket programming, Program development for rlogin, ftp, SNMP, SMTP, etc. Exercises in network programming.

HONOURS PAPER

CSH15101	ADVANCED ALGORITHMS	3-0--0
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Amortized Analysis, Dynamic programming: Assembly Line Scheduling, Graph Algorithms: Topological Sorting, Strongly Connected Components, Single Source Shortest path in DAG, All Pair Shortest Path Algorithm: Floyd Warshell, Johnson's algorithm, Geometric algorithms: Segment intersections using sweep line, Polynomials and FFT: Representation, DFT, FFT (Recursive & Iterative), Parallel FFT Circuit Design, Number-theoretic algorithms: Euclid's algorithm, Modular arithmetic, Powers of an element using repeated squaring; String matching algorithms: Naïve and Finite Automata approach, Rabin-Karp and Knuth-Morrispratt algorithm, Matrix operations: Linear equations solver, Approximation algorithms: Vertex Cover Problem, Local Search Heuristics, Randomized Algorithms: Randomized quicksort, Parallel Algorithms, kd-trees, Binomial and Fibonacci Heaps

CSH15201	ADVANCED ALGORITHMS LAB	0-0--2
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Laboratory experiments will be set to supplement the theory taught in CSH15101.

COURSE DETAILS OF VI SEMESTER DUAL DEGREE - CSE

CSC16101	ARTIFICIAL INTELLIGENCE	3-0-0
<p>Problem solving, search techniques, control strategies, game playing (minimax), reasoning, knowledge representation through predicate logic, rule-based systems, semantic nets, frames, conceptual dependency formalism; Planning. Handling uncertainty: Bayesian Networks, Dempster-Shafer theory, certainty factors, Fuzzy logic; Learning through Neural nets -- Back propagation, radial basis functions, Neural computational models - Hopfield Nets, Boltzmann machines. PROLOG programming.</p>		
CSC16105	DATABASE MANAGEMENT SYSTEMS	3-0-0
<p>Introduction and Overview of a DBMS - Purpose of Database Systems, View of Data, Data Models, DDL, DML, Transaction Management, Storage Management, Database Administrator, Database Users, Overall System Structure, Entity-Relationship Model: Basic Concepts, Design Issues, Mapping Constraints, Keys, ER-Diagram, Weak Entity Sets, Extended ER-Diagram, Reduction of ER-Schema to Tables Relational Model Concepts: Structure of Relational Databases, Relational Algebra, Tuple Relational Calculus, Domain Relational Calculus, Extended Relational-Algebra Operations, Modification of the Database, Views Structured Query Language, Integrity Constraints: Domain Constraints, Referential Integrity, Assertions, Triggers, Functional Dependencies, Relational Database Design: Decomposition, Normalization, Transactions and Concurrency Control: Transaction Concepts, Transaction State, Concurrent Executions, Serializability, Recoverability, Lock-Based Protocols, Timestamp-Based Protocols, Deadlock Handling Basics of Database File Organization & Query Processing: File Organization, Organization of Records in Files, Data Dictionary Storage, Steps in Query Processing.</p>		
CSC16106	COMPILER DESIGN	3-0-0
<p>Introduction to compiler, phases and passes of a compiler, Cousins of compilers: loaders and assemblers; Lexical analysis: Role, tokens, regular expressions, transition diagrams, Design of lexical analyzer generator; Syntax analysis: Role, context free grammars, ambiguity, top down parsing, bottom up parsing, operator precedence parsing, LR parsers (SLR, LALR, LR); Syntax-Directed Translation (SDT): Scheme, Implementation of SDT, postfix notation, SDT to postfix code; Intermediate code generation: Intermediate language, translation of assignment statements, Boolean expressions, case statements; Error Detection and Recovery: Lexical-phase errors, Syntactic-phase errors; Code optimization: Sources, optimization of basic blocks, loops in flow graphs, loop optimization; Code generation: Issues, target machine, runtime storage management, basic block and flow graphs, next use information, a simple code generator, register allocation, DAG representation of basic blocks, peephole optimization, code generation from DAGs.</p>		
MSR14151	MANAGERIAL ECONOMICS	3-0-0
<p>Fundamentals of Economics - Microeconomics and Macroeconomics; Marginal analysis and Time Value of Money; Firm – meaning and objectives; Demand and Supply Analysis - law of demand and law of supply, price mechanism, price ceilings and floors; Utility Analysis – cardinal and ordinal utility, law of diminishing marginal utility, Indifference curves, budget constraints, consumer’s equilibrium – utility maximization; Production and Cost Analysis – short run and long run production functions, returns to scale, economies of scale and scope, different costs, producer’s equilibrium – cost minimization; Market Analysis – types of markets, short run and long run equilibrium in each market; Pricing Strategies – price discrimination; Public Goods and</p>		

Externalities; Asymmetric Information – adverse selection and moral hazard; Economics of Uncertainty and Risk; Inflation: Measures, Causes and Remedies.		
CSC16205	DATABASE MANAGEMENT SYSTEMS LAB	0-0-2
Laboratory experiments will be set based on the materials covered in CSC16105. It includes ER Modeling, Schema Designing, writing SQL queries, and team work to study, design and implement a mini-project related to the subject.		
CSC16206	COMPILER DESIGN LAB	0-0-2
Laboratory experiments are based on the materials covered in CSC16106. It includes programming assignments to build parts of a compiler a c-like programming language as mini projects in small groups.		

HONOURS PAPER

CSH16101	COMPUTER GRAPHICS	3-0--0
Introduction; Graphics Hardware: I/O Devices, printers, non-VDU devices; Basic raster graphics algorithms for drawing primitives; Scan conversion; Region filling; Anti-aliasing: different types of solutions; Clipping techniques : lines, polygons, text; Generating characters; Geometrical transformations; viewing in 2D & 3D; Input devices; interaction techniques and tasks; Dialogue design; Object hierarchy; Representing curves and surfaces: Hermite, Bezier, and other related interpolation techniques, splines; Solid modeling; Projections: parallel, perspective, affine; Color: achromatic and colored light, color models and their inter conversion, CIE diagram; visible surface detection; illumination models & shading, mathematics for computer graphics, GUI: concepts of window programming, X-windows programming on unix / linux platforms, OpenGL programming in windows/linux environments.		
CSH16201	COMPUTER GRAPHICS LAB	0-0--2
Laboratory experiments will be set to supplement the theory taught in CSH16101. It includes the familiarization of different graphic packages, programming assignments on different algorithms taught with special emphasis on drawing graphics primitives, projection, clipping, shading, removal of hidden surfaces, windows programming, OpenGL.		

COURSE DETAILS OF VII SEMESTER DUAL DEGREE - CSE

CSC17102	PARALLEL AND DISTRIBUTED COMPUTING	3-0-0
<p>Need, Parallelism in uniprocessors systems; Models of Parallel computation; Topology of interconnection networks; review of pipelining, pipelined vector processing methods, Embedding other networks, Parallel algorithm design; Performance and scalability; Algorithms for array processors: sum, prefix computation, matrix multiplication; parallel sorting: odd-even transposition sorting, odd-even merging, enumeration sorting, bitonic sorting, odd-even merging network; Communication algorithms: One-to-all, all-to-one, all-to-all, Multiprocessor interconnection networks and algorithms; Dataflow computers; Parallel algorithms on systolic array; Reconfigurable processor array. Models of distributed computation; Design issues; Operating systems for distributed computing; Distributed algorithms and applications, Clock synchronization algorithms; Distributed memory systems; Message passing; Middleware; Point-to-point communication; Fault Tolerance; Fault tolerant routing.</p>		
CSC17103	SOFTWARE ENGINEERING	3-0-0
<p>Introduction: Objectives and Scope of SE, Introduction to System, Software Definition, Characteristics of Software, Evolution of Software, Software Quality, Software Problems, Software Engineering Definition, Software Engineering Problem, Software Development Methodologies, Software Process: Introduction, Components of Software Process, Characteristics of Software Process, Software Development Process, Software Development Models, Project Management Process, Software Configuration Management Process, Process Management Process, Object Oriented Modeling & Design - Object Modeling, Dynamic Modeling, Functional Modeling, Object Oriented Design Methodology, Software Requirements Analysis: Introduction, Problem Analysis, Data Flow Diagram, Requirement Specifications, Validation, Planning a Project - Cost Estimation, Project Scheduling, Staffing and Personal Planning, SCM Plans, Quality Assurance Plans, Project Monitoring Plans, Risk Management, Designing a Project: Introduction, Function-Oriented Design, Object-Oriented Design, Detailed Design, Coding: Programming Principles and Guidelines, Coding Process, Metric, Testing: Testing Fundamentals, Types of Testing, Levels of Testing; Design of test cases with examples.</p>		
CSC17104	DATA MINING	3-0-0
<p>Introduction: Data mining functionalities, classification and integration of a data mining system with data warehouse system; Data preprocessing: data summarization, data cleaning, data integration and transformation and data reduction; Data warehouse and OLAP Technology: a multidimensional data model, data warehouse architecture, Data warehouse implementation, from data warehousing to data mining; Mining Frequent Patterns; Associations and correlations: efficient and scalable frequent item-set mining methods, mining various kinds of association rules, constraints based association mining; Classification and prediction: classification by decision tree induction, rule-based classification, classification by back propagation, evaluating the accuracy of classifier or predictor, accuracy and error measures, model selection; Cluster analysis: data types, cluster analysis, partitioning, hierarchical and density based methods, outlier analysis. Mining data streams, Time series data, and sequence data, Graph mining, spatial data mining, multimedia data mining, text mining, mining the World Wide Web, data mining applications.</p>		
CSC17202	PARALLEL AND DISTRIBUTED COMPUTING LAB	0-0-2

The laboratory will be based on the simulation and implementation of the parallel algorithms (on a PC-cluster under Linux platform). The programs will be based on MPI programming. The laboratory assignments will be given as small projects.

CSC17203

SOFTWARE ENGINEERING LAB

0-0-2

Laboratory experiments will be set to supplement the theory taught in Software Engineering. It includes programming and implementation for software design, testing and verification, Preparation of Test Cases etc. Working with the various IBM RSA CASE.

LIST OF ELECTIVES FOR VII SEMESTER DUAL DEGREE – CSE

CSE17103

FUNCTIONAL AND LOGIC PROGRAMMING

3-0-0

The functional style of programming, paradigms of developments of functional programs. The relationship between logic programming and functional programming. Functional Programming Language LISP- a case study. Propositional logic, First Order Logic: syntax and semantics, deduction, Herbrand interpretation and resolution methods, Syntax and Semantics of Logic Programs, Inference Rules, Unification and SLD- and SLDNF-Resolution, Logic programming language PROLOG - a case study. Basic concepts, Recursive programming, Cuts and negation, Non-deterministic programming, Abstract computational model - Warren's Abstract Machine (WAM), Implementation of Prolog on WAM. Introduction to Constraint Logic Programming: Constraint logic programming scheme, Constraint satisfaction, constraint propagation, Constraint Logic Programming over the reals, Constraint Logic Programming over finite domains. Introduction to nonclassical logics. Modal logic. Accessibility. Relation and Kripke possible world semantics. The logic of knowledge and belief, Autoepistemic knowledge, Temporal logic. Introduction to declarative programming paradigms. Logic as a system for declarative programming. The use of resolution and theorem-proving techniques in logic programming. Logic programming foundations: preliminaries, definite program, Herbrand model, SLD and SLDNF resolution, cut operator. Prolog programming Techniques (Nondeterministic programming Parsing with DCG's) .CASE studies: LISP, PROLOG.

CSE17104

OBJECT ORIENTED DATA MODELING

3-0-0

Review of programming practices and code-reuse; Object model and object-oriented concepts; Object-oriented programming languages and implementation; Object-oriented analyses and design using UML structural, behavioral and architectural modeling; Unified development process, Software reuse design patterns, components and framework; Distributed object computing, interoperability and middleware standards COM/DCOM and CORBA; Object-oriented database system data model, object definition and query language, object-relational system.

CSE17105

INFORMATION AND CODING THEORY

3-0-0

Information Theory: Introduction, measure of Information, Mutual information, Joint and conditional Entropy, Discrete memoryless Source(DMS), Channel capacity, Huffman encoding, Arithmetic encoding, Lempel-Ziv encoding Coding Theory: Introduction, Error detection and Correction, Binary Symmetric Channel(BSC), Linear block codes: Encoding and Decoding, Parity and Generator matrices, Hamming Code, Tanner Graph, Low Density Parity Check Code

and its types, Cyclic code: Generation and Decoding, Burst error detection and correction, Syndrome calculation, Bose-Chaudhuri Hocqenghem(BCH) codes and Reed-Solomon codes, Convolution code, Code tree and state diagram, Turbo coding.		
CSE17108	ADVANCED COMPILERS	3-0-0
Introduction to code optimization, efficient code generation and parallelizing compilers. Data-flow analysis: Classical theory, bi-directional flows, unified algorithms, etc. Efficient code generation: Algorithms, register allocation heuristics and automated tools. Parallelism detection: Data dependence, control dependence, various restructuring transformations on loops. Inter-procedural analysis: Constant propagation, data dependence, etc. Selected case studies.		
CSE17110	COMPUTATIONAL GEOMETRY	3-0-0
Introduction: Historical perspective, Towards Computational Geometry, Data Structures, Geometric Preliminaries. Convex Hulls: Graham's scan, Jarvis's march, Quick hull technique, Divide-and-conquer algorithm, Dynamic convex hull algorithm, Extension and Applications. Point Searching: Point location problems, Location of a point in a planar subdivision, The slab method. Proximity: A collection of problems, Locus Approach, Voronoi diagram and its construction, Delaunay triangulations, Proximity problems solved by Voronoi diagram. Orthogonal Range Searching: 1-dimensional range searching, Higher-dimensional range trees. Window Searching: Priority search trees, Segment trees. Polygon Triangulations: Art Gallery Problem, Guarding and triangulations, Triangulating a monotone polygon. Sweep Techniques: Trapezoidalization, Intersection of segments, Union of rectangles.		
CSE17111	EVOLUTIONARY COMPUTATION	3-0-0
Introduction, Machine learning and evolutionary computation, Genetic programming and biology, formalism, Fundamental of genetic programming, Application of genetic programming, Genetic programming software, Evolutionary optimization, Evolutionary neural networks, Learning classifier systems, Development of evolutionary systems for application in Industry and Medicine, Case studies.		
CSE17112	COMPLEXITY THEORY	3-0-0
Turing machines and non-determinism, Models of computation like RAM and pointer machines, Relations between complexity classes. Time-space trade-off for some fundamental problems. Reduction and completeness, Randomized complexity classes, Boolean circuit complexity. Cryptography, cryptanalysis and one-way hash function. Polynomial hierarchy, P-space completeness, Interactive proofs and hardness of approximation, Parallel complexity classes.		
CSE17113	COMPUTATIONAL NUMBER THEORY	3-0-0
Divisibility, GCD, modular arithmetic, Congruence, Chinese remainder theorem; Prime and extension fields, representation of extension fields, polynomial basis, primitive elements, normal basis, irreducible polynomials. Primality testing algorithms: Fermat test, Miller-Rabin test, Solovay-Strassen test, AKS test. Integer factoring algorithms: Trial division, Pollard rho method, p-1 method, CFRAC method, quadratic sieve method, elliptic curve method. Computing discrete logarithms over finite fields: Baby-step-giant-step method, Pollard rho method, Pohlig-Hellman method, index calculus methods, linear sieve method, Coppersmith's algorithm. Applications: Algebraic coding theory, cryptography.		

CSE17114	DATA ANALYTICS	3-0-0
Introduction, BigData, Overview of DBMS, R and RStudio, Regression Modeling, Multivariate Analysis, Bayesian Modeling, Inference and Bayesian Networks, Support Vector and Kernel Methods, Analysis of Time Series: Linear Systems Analysis, Nonlinear Dynamics, Decision trees, Market Based Model, Apriori Algorithm, Handling Large Data Sets, Limited Pass Algorithm, Clustering High Dimensional Data, Hadoop and HDFS, MapReduce, Hive, MapR, Sharding, NoSQL Databases, Visualizations, Visual Data Analysis Techniques.		
CSE17115	NATURAL LANGUAGE PROCESSING	3-0-0
Introduction to Natural Language Understanding: The study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems; Linguistic Background: An outline of English Syntax. Grammars and Parsing: Grammars and sentence Structure, Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top-Down Chart Parsing. Features and Augmented Grammars: Feature system and Augmented Grammars, Basic Feature system for English, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks. Grammars for Natural Language: Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling questions in Context-Free Grammars, Hold mechanisms in ATNs. Efficient Parsing: Human preferences in Parsing, Encoding uncertainty, Deterministic Parser. Ambiguity Resolution- Statistical Methods: Probability Theory, Estimating Probabilities, Part-of-Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best First Parsing; Semantics and Logical Form: Word senses and Ambiguity, Encoding Ambiguity in Logical Form. Ambiguity Resolution: Selectional Restriction, Word Sense Disambiguation.		

HONOURS PAPER

CSH17101	CRYPTOGRAPHY	3-0--0
Introduction to Cryptography and Its Applications, Classical Cryptosystems, Cryptanalysis of Classical Ciphers, Mathematical Tools for Cryptography; Private-Key Cryptosystems: Feistel Cipher, DES, Differential and Linear Cryptanalysis, AES, IDEA, CAST, RC4, RC5, Blowfish; Mode of operations; Public Key Cryptosystems: Knapsack cryptosystems, RSA; Attacks on RSA, Diffie-Hellman Key Exchange, Discrete Logarithm problem, ElGamal cryptosystems, Elliptic Curve cryptosystems; Cryptographic Hash functions: MD5, SHA-1, SHA-512, Birthday Attack; Message Authentication Codes, HMAC; Digital Signatures: RSA Signatures, ElGamal Signature, DSA, Blind Signatures; Key Establishment: Kerberos, PKI, X.509 Certificates.		
CSH17201	CRYPTOGRAPHY LAB	0-0--2
Laboratory is mainly based on the materials taught i.e. development of code for Classical Cryptosystems, DES, AES, IDEA, RSA, MD5, SHA, DSA etc. and do experimentation. Mini projects may be given in small groups.		

COURSE DETAILS OF VIII SEMESTER DUAL DEGREE - CSE

CSC18103	WIRELESS & MOBILE COMMUNICATION	3-0-0
<p>Introduction and evolution of wireless communication systems; Radio propagation and path-loss: Free-space model, Reflection, ground reflection, Diffraction, Scattering; Fundamentals of cellular communications: Cell geometry, Frequency reuses, Co-channel interference and reduction, Adjacent channel interference, Cell splitting, sectoring and micro-cell; Multiple access technique: Narrowband systems- FDD, TDD; Wideband systems- FDMA, TDMA, Spread Spectrum and CDMA, OFDM, CSMA, CSMA/CA, Error control schemes; Mobility management: Mobility models, Mobile registration, Paging, Handoff, Location management, HLR-VLR scheme, Hierarchical scheme, Predictive location management schemes; GSM systems: Architecture, GSM evolution for data, 3G wireless systems, UTMS networks; Wireless LAN: IEEE 802.11 standards, Architectures and services, HIPERLAN, WiFi, and WiMAX; Mobile network and transport layers: Mobile IP, DHCP, Mobile ad hoc routing protocols, Multicast routing, TCP over wireless networks, Mobile TCP, Retransmission, Timeout and Transaction, TCP over 2.5G/3G networks; Application layer: WAP model, Mobile location based services, WAP protocols, WML; Security in wireless systems.</p>		
CSC18203	WIRELESS & MOBILE COMMUNICATION LAB	0-0-2
<p>Estimation of path-loss based on different models and conditions, Estimation of frequency-reuse, user-capacity, Co-channel-interference, etc of cellular system, Estimation of GSM speed based on different logical and physical frame-format, Cost estimation of location management and paging in mobile communication; Simulation of the protocols like FDD, TDD, FDMA, TDMA, DS-CDMA, FH-CDMA, CSMA/CA, Routing protocols for ad hoc networks, WAP, WML, Wireless security schemes.</p>		
CSC18204	INFORMATION RETRIEVAL LAB	0-0-2
<p>The laboratory is based on the course information retrieval emphasizing the experiments on Text Preprocessing, Indexing and Retrieval with standard IR tool like TERRIER, LEMUR etc., Experiments on Text Clustering, Classification, Evaluation of IR systems. Experiments on WEB search, WEB data and social research.</p>		

LIST OF ELECTIVES FOR VIII SEMESTER DUAL DEGREE – CSE

CSE18101	DIGITAL SYSTEM TESTING AND TESTABLE DESIGN	3-0-0
<p>Physical faults and their modeling. Fault equivalence and dominance; fault collapsing. Fault simulation: parallel, deductive and concurrent techniques; critical path tracing. Test generation for combinational circuits: Boolean difference, D-algorithm, Podem, etc. Exhaustive, random and weighted test pattern generation; aliasing and its effect on fault coverage. PLA testing: cross-point fault model, test generation, easily testable designs. Memory testing: permanent, intermittent and pattern-sensitive faults; test generation. Delay faults and hazards; test generation techniques. Test pattern generation for sequential circuits: time-frame expansion method, ad-hoc and structures techniques, scan path and LSSD, boundary scan. Built-in self-test techniques. Testing issues in embedded core based systems.</p>		

CSE18102	SOFT COMPUTING	3-0-0
<p>Artificial Neural Networks (ANN): Basics of artificial neural networks, Characteristics and Comparison with biological neural networks. Advantages of ANNs, Synaptic dynamics, Applications of ANNs, Basic Models of ANNs: Mc-Culloch Pitt's model, Single Layer Perceptron model of neural networks, Hebb's model, Learning Laws, Learning: Supervised, unsupervised, and Reinforcement Law of learning. Comparison and differences among learning laws. LMS and Delta Learning, Gradient descent method, Multilayer Perceptron Model (MLP), Back propagation algorithm for weight updates, classification problem using MLP. Architecture for complex pattern recognition tasks, Competitive Learning: Hopfield model, Self Organizing Feature Map, ART; Fuzzy Logic: Fuzzy sets, application: basic operations, membership functions, Properties; Fuzzy Relations, Fuzzification, Fuzzy Inference, Fuzzy Rule Based System, Defuzzification; Genetic Algorithm: working Principle, Cross over mutation, roulette wheel selection, tournament selection, population, binary encoding and decoding for any optimization problem. Multi objective Gas, Concepts on Non-domination, tournament selection, crowding distance operator, ranking, SPEA, Evolutionary strategies etc.; Rough Sets: basic operations, lower and upper approximations, discernibility matrix, distinction table etc.; Hybridization of Soft Computing tools like Neuro-fuzzy, rough fuzzy, Rough-Fuzzy-GA with applications.</p>		
CSE18106	DISTRIBUTED OPERATING SYSTEMS	3-0-0
<p>Introduction: Distributed Computing System Models, OS, Goals of Distributed System, Hardware Concept; Message Passing: Desirable features, Issues in IPC, Synchronization, Buffering, Encoding and Decoding, Process Addressing, Failure Handling, Group Communication; Remote Procedure Calls: RPC Model, Transparency of RPC, Implementation of RPC Mechanism, RPC Messages, Marshalling, Server Management (Stateful and Stateless Server), Parameter-Passing Semantics (Call-by-Value, Call-by-Reference), Call-Semantics, Communication Protocols for RPCs, Client-Server Binding, Special Types of RPCs; Distributed Shared Memory: General Architecture of DSM Systems, Design and Implementation Issues of DSM, Structure of Shared-Memory Space, Consistency Models, Replacement Strategy, Thrashing, Advantages of DSM; Synchronization: Clock Synchronization, Event Ordering, Mutual Exclusion, Deadlock, Election Algorithms; Resource Management: Task Assignment Approach, Load-Balancing Approach, Load-Sharing Approach; Process Management: Process Migration, Threads; Distributed File Systems: File Models, File-Accessing Models, File-Sharing Semantics, File-Caching Schemes, File Replication; Security: Potential Attacks to Computer Systems, Cryptography, Authentication, Access Control, Digital Signatures.</p>		
CSE18108	COMPUTER VISION	3-0-0
<p>Introduction, image formation and early processing, imaging geometry camera modeling and calibration, representation of 2D and 3D structures, feature detection and matching, segmentation, feature based alignment, optical flow, structure from motion, structure from shading, dense motion estimation, image stitching, computational tomography, stereo correspondence, 3D reconstruction, image based rendering, recognition, structure from X.</p>		
CSE18110	FAULT TOLERANT COMPUTING SYSTEMS	3-0-0
<p>Origin of fault-tolerant computing, reliability, maintainability, testability, dependability. Fault, errors and fault-model, Design technique for fault-tolerance, triple modular redundancies, m-out-</p>		

of-n codes, check sums, cyclic codes, Berger codes etc. Fault tolerant design of VLSI circuits and systems, concepts of t-diagnosable systems, self-checking, BIST, LSSD etc. Testing and design testability, fault-equivalence, dominance, checkpoints, test generations, D-algorithms, PODEM, FAN, Boolean difference, testability analysis, fault testing, signature analysis, CMOS and PLA testing.		
CSE18111	E-COMMERCE TECHNOLOGIES	3-0-0
Introduction to e-Commerce, e-Commerce infrastructure, Business model and e-Commerce, e-Commerce strategy, Supply chain management and e-Commerce, Marketing strategies and e-Commerce, e-Commerce security and control, Electronic payment system, Legal and ethical issues in e-Commerce, Global, Social and other issues in e-Commerce.		
CSE18112	QUANTUM COMPUTING	3-0-0
Introduction to Quantum Mechanics, Quantum bits and complex vector spaces, Quantum evolution and quantum Gates, Quantum Registers, Universal gates, Quantum circuits, No-Cloning theorem, Quantum Entanglement and Teleportation, Quantum Algorithms, Quantum search, Quantum Fourier Transform, Phase estimation, Quantum counting, Order finding for periodic functions, Quantum factoring of Integers, Physical realization of Quantum Gates, Quantum error correction.		
CSE18113	MULTIMEDIA SYSTEMS	3-0-0
An overview of multimedia system and media streams; Source representation and compression techniques text, speech and audio, still image and video; Graphics and animation; Multi-modal communication; Multimedia communication, video conferencing, video-on-demand broadcasting issues, traffic shaping and networking support; Trans-coding; Multimedia OS and middleware; Synchronization and QoS; Multimedia servers, databases and content management; Multimedia information system and applications.		
CSE18115	ALGORITHMIC GAME THEORY	3-0-0
Games on Networks, congestion games, selfish routing in networks, Nash and Wardrop equilibria, coordination ratios (price of anarchy), pricing network edges, network designs with selfish agents. Algorithmic Aspects of Equilibria: existence and complexity of equilibria (including Nash and cooperative), complexity of market equilibria, fast algorithms for specific games, games with incomplete information, evolutionary games. Economic aspects of Internet routing: fairness, charging schemes, and rate control. Mechanism Design: general principles, algorithmic mechanism design, distributed aspects, specific applications, e.g multicast pricing, cot-sharing mechanisms. Auctions: combinatorial auctions, frugality, auctions for digital goods, computational aspects of auctions.		
CSE18116	MODERN CRYPTOGRAPHY	3-0-0
Foundations and applications of modern cryptography, Secret-key and Public key cryptography, One-way and trapdoor one-way functions, cryptanalysis; Block ciphers: Modes of operation, DES and its variants, IDEA, SAFER, FEAL, Blowfish, AES, Linear and Differential Cryptanalysis; Stream ciphers: stream ciphers based on linear feedback shift registers, SEAL; Message digest:		

Properties of hash functions, MD2, MD5 and SHA-1 keyed hash functions, attacks on hash functions; Public-key parameters: Modular arithmetic, GCD, Primality testing, Chinese remainder theorem, modular square roots, finite fields; Intractable problems: Integer factorization problem, Diffie-Hellman problem, Known algorithms for solving the intractable problems; Public-key encryption: RSA, Rabin and El Gamal; Key exchange: Diffie-Hellman and MQV algorithms; Digital signatures: RSA, DAS and NR signature schemes, Blind and Undeniable signatures; Entity authentication: Passwords, challenge-response algorithms; Zero-knowledge protocols.

CSE18117	ALGORITHMIC GRAPH THEORY	3-0-0
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Basics of graphs, undirected graphs, weighted graphs, directed graphs, planar graphs, connected graphs, bipartite graphs, edge graph, representation, adjacency matrix, incidence matrix, path matrix, parameters of graphs (degree, diameter, girth etc.), techniques and algorithms for studying the basic parameters and properties of graphs, trees, connectivities, blocks, cycles and tours, Eulerian and Hamiltonian graphs, closure of graphs, components of graphs, matching, covering, independent set, cliques, vertex and edge coloring, planar graphs, dual graphs, directed graphs. applications of graphs in various fields like telecommunications, networking, image processing, pattern recognition, graph cut algorithms, graph traversals (DFS and BFS), topological sorting, planarity testing, finding strongly connected components, applications to searching in massive graphs (e.g. page ranking), use of structural properties and algebraic properties.

CSE18118	CLOUD COMPUTING	3-0-0
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Introduction to Cloud Computing: Overview of distributed computing, Cloud introduction and overview, Different types of cloud services, cloud deployment models, Advantages and Disadvantages of Cloud Computing, and Companies in the Cloud today; Infrastructure as a Service (IaaS): Introduction to Infrastructure as a Service (IaaS), CPU Virtualization – Hypervisors, Storage Virtualization - SAN, ISCSI, Network Virtualization – VLAN; Platform/ Software as a Service (PaaS/ SaaS): From IaaS to PaaS, What is PaaS, PaaS properties and characteristics, PaaS Techniques: File System - GFS, HDFS, Programming Model-MapReduce, Storage System for Structured Data - BigTable, Hbase. SaaS: web service, web based applications, web portal; Security in Cloud computing environments: Cloud Computing threats, Security for Cloud Computing; Case studies: Amazon EC2, Google App Engine, IBM Clouds, Microsoft's Windows Azure etc.

HONOURS PAPER

CSH18101	INFORMATION RETRIEVAL	3-0-0
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Introduction: Boolean retrieval, term-vocabulary, postings-lists, Dictionaries; Index Construction: Hardware Basics, Blocked sort-based indexing, Single-pass in-memory indexing, Dynamic indexing; Retrieval Models: term weighting, vector space model, probabilistic model, language models, computing scores in a complete search system; Evaluation: system evaluation, standard test collection, concept of relevance, metrics like precision, recall, average precision, mean average precision, F-measure; Relevance feedback and query expansion: Rocchio algorithm; Text classification: Naïve Bayes; Text clustering: Flat Clustering, Hierarchical Clustering; XML Retrieval: Basic concepts, Challenges, Evaluation; Web search: Introduction, web characteristics, web graph; Web crawl: overview, crawler architecture; Link Analysis: PageRank, Hubs and Authorities; Social search.

COURSE DETAILS OF IX SEMESTER DUAL DEGREE - CSE

CSC19101	SYSTEM SIMULATION	3-1-0
<p>Introduction: Systems Types: Discrete and Continuous systems, Model types: Physical: Static, Dynamic; Mathematical: Static, Dynamic; System characteristics, different views of systems, modeling of systems, physical and symbolic models Discrete system simulation: Event, Activity, and process, time representation, fixed time step vs. event-to-event model, analysis of a discrete system generation of a random numbers and non-uniformly distributed random numbers, pseudo random numbers, Monte-Carlo computation vs. stochastic simulation, simulation of a real life discrete system Continuous System simulation: Digital vs. Analog simulation, Notations and basic operations for analog simulation, Linear system, Equation representation by simulation equations, digital computer simulation, simulation of a real life dependent system via a programming language. Simulation of a Program Evaluation and Review Technique (PERT) Network, Queuing Systems, Inventory Control and Forecasting, Design and Evaluation of Simulation experiments, Simulation languages for Discrete and Continuous systems.</p>		
CSC19102	COMPUTATIONAL BIOLOGY	3-0-0
<p>Molecular Biology Premier, Genetic material, Genes, Structure of DNA, Analyzing DNA, Proteins, Genome Projects; exact matching problem, suffix trees, Boyer-Moore and Knuth-Morris-Pratt, keyword trees; Sequence Comparison, Edit distance and alignment, Local alignment, Alignment with gap penalties, global alignment, Multiple alignment; Profiles, EST, Motif finding problem, Evolutionary Phylogenetic trees; Protein Structure and Folding, Biological databases, Primary and secondary databases, Specialized Genomic Resources, Secondary database searching, Gene expression analysis.</p>		
CSC19201	SYSTEM SIMULATION LAB	0-0-2
<p>Laboratory is mainly based on the materials taught i.e. Generation of Random Numbers, Testing for Random Number Generators and Standard Normal Distribution, Chi-square goodness-of-fit test, Monte-Carlo Simulation, Simulation of single/two server queuing system etc.</p>		

LIST OF ELECTIVE FOR IX SEMESTER DUAL DEGREE – CSE

CSE19101	ADVANCED DBMS	3-0-0
<p>Relational Databases: Integrity Constraints, Functional Dependency, Multi-valued Dependency; Query Processing and Optimization: Evaluation of Relational Operations, Transformation of Relational Expressions, Indexing and Query Optimization, Limitations of Relational Data Model; Objected Oriented and Object Relational Databases: Modeling Complex Data Semantics, Specialization, Generalization, Aggregation and Association, Objects, Object Identity, Equality and Object Reference, Architecture of Object Oriented and Object Relational Databases; Parallel and Distributed Databases: Distributed Data Storage, Fragmentation & Replication, Location and Fragment Transparency, Distributed Query Processing and Optimization, Distributed Transaction Modeling and Concurrency Control, Distributed Deadlock, Commit Protocols, Design of Parallel Databases, Parallel Query Evaluation; Advanced Transaction Processing: Nested and Multilevel Transactions, Compensating Transactions and Saga, Long Duration Transactions, Weak Levels of</p>		

Consistency, Transaction Work Flows, Transaction Processing Monitors; Expert Databases: Use of rules of deduction in data bases, recursive rules; Fuzzy Databases: Fuzzy set & fuzzy logic, Use of fuzzy techniques to define inexact and incomplete data bases.		
CSE19102	INTERNET TECHNOLOGY	3-0-0
Introduction to Internet - Internet Architecture, Evolution and Internet Network Architecture, OSI Reference Model, TCP/IP, Internet Routing Protocols, Transport Protocol – TCP & UDP, Other Protocols - ARP, RARP, BOOTP, DHCP, DNS, Mail Server & E-mail Protocol - SMTP, MIME, POP, HTML Web Tools - Introduction to HTTP, HTTP Transaction, HTTP Request and Response Message, Introduction to WWW, Browser Architecture, Client-Server Approach - Client-Server Model, Socket Interface, Voice & Multimedia over IP - Introduction to Real-Time Traffic, User Interface Design, Multimedia authoring, Multimedia and interactive hardware, Multimedia Database.		
CSE19103	NATURE INSPIRED COMPUTING	3-0-0
Basics of optimization problems: mathematical formulation, constrained and unconstrained optimization, Unimodal and multimodal problems. Genetic algorithm (GA): Main algorithm with encoding/decoding, selection, crossover and mutation schemes, Schema theorem, Multi-objective genetic algorithm (MOGA): Non-dominated sorting, crowding distance, elitist model, NSGA-II, Simulated annealing (SA): Main algorithm, basic components, issues and variations, Particle swarm optimization (PSO): Main algorithm, basic components, issues and variations, Ant colony optimization (ACO): Main algorithm, basic components, issues and variations, Gravitational search optimization (GSA): Main algorithm, basic components, issues and variations, Central force optimization (CFO): Main algorithm, basic components, issues and variations, Chemical reaction optimization (CRO): Main algorithm, basic components, issues and variations, Biogeography Based Optimization (BBO) or similar recent techniques based on nature/bio-inspired metaphor. Few applications based on nature inspired optimization techniques.		
CSE19104	PATTERN RECOGNITION	3-0-0
Introduction, probability distribution, linear models for regression, linear models for classification, classifiers based on Bayes decision theory, linear and nonlinear classifiers, feature selection, generation, dimensionality reduction, template matching, context dependent classification, system evaluation, clustering, cluster validity, kernel methods, sparse kernel methods, graphical methods, mixture model and EM.		
CSE19105	PUBLIC-KEY CRYPTOGRAPHY AND INFRASTRUCTURES	3-0-0
Digital certificates and PKIs; Different PKIs: PGP(Pretty Good Privacy)-Web of Trust, Applications, X.509:X.500, Certification Authority(CA), Registration Authority(RA), Root-CA, X.509 Protocols, Hierarchy of Trust, Simple PKI (SPKI), Simple Distributed Security Infrastructure (SDSI); Access Control Mechanisms including Role based access control; Issues of revocation, Anonymity and Privacy issues; Smartcard integration with PKIs, Trust Management Systems; Risks; Impact on E-Commerce and E-Business.		
CSE19106	COMPUTATIONAL FINANCE	3-0-0
Three main area to be covered are pricing by formulas and approximations, pricing using lattices		

(one, two and n-dimensional) and finite differences and pricing using Monte-Carlo simulation. Pricing using exotic derivatives (such as barrier), Asian lookback, and multi-asset options. Pricing interest rate derivatives in the Heath-Jarrow-Morton and Libor Market Models, low discrepancy sequences for financial computations and the pricing of American options using simulation.

CSE19107	VLSI DESIGN AND TESTING	3-0-0
<p>VLSI Design: Introduction to VLSI Design, MOS logic: nMOS, pMOS and CMOS, Electrical characteristics, operation of MOS transistors as a switch and an amplifier, MOS inverter, stick diagram, design rules and layout, delay analysis, different type of MOS circuits: Dynamic logic, BiCMOS, pass transistors etc. CMOS process, Combinational logic cells, Sequential logic cells, Datapath logic cells, I/O cells. ASIC Library Design: Transistors as Resistors and parasitic Capacitance, Logical effort, gate array, standard cell and datapath cell design. Introduction to hardware description language (HDL) Verilog/VHDL. A logic synthesis example; Physical design algorithms.</p> <p>Testing: Physical faults and their modeling. Fault equivalence and dominance; fault collapsing. Fault simulation: parallel, deductive and concurrent techniques; critical path tracing. Test generation for combinational circuits: Boolean difference, D-algorithm, Podem, etc. Exhaustive, random and weighted test pattern generation; aliasing and its effect on fault coverage. PLA testing: cross-point fault model, test generation, easily testable designs. Memory testing: permanent, intermittent and pattern-sensitive faults; test generate on. Delay faults and hazards; test generation techniques. Test pattern generation for sequential circuits: ad-hoc and structures techniques, scan path and LSSD, boundary scan. Built-in self-test techniques.</p>		