Narula Institute of Technology

Department of Computer Science and Engineering

Curriculum & Syllabus

Autonomy Regulation 2016

DEPARTMENT OF COMPUTER SCINECE AND ENGINEERING

Departmental Vision

To develop responsible citizens who would ‘think global and act local’ and become the change agents of society to meet the challenges of future.

Departmental Mission

The mission of the Computer Science and Engineering Department is to build and sustain a high quality and broad area-based teaching and research program in computer science, to prepare students for successful professional careers both in industry, academics and as entrepreneur, and to provide service to the nation as a good human being.

Program Educational Objectives (PEOs)

PEO1: Practice with an expertise in academics, entrepreneurship, design and development in computing technology, or research in a specialized area of computer science and Engineering to pursue higher studies.

PEO2: Exhibit analytical, decision making and problem solving skills by applying research principles for handling real life problems with realistic constraints.

PEO3: Ability to communicate the findings or express innovative ideas in an effective manner with an awareness of professional, social and ethical responsibilities.

PEO4: An understanding of the processes of research and an in-depth study of an area of study which will enable the student to independently advance the frontiers of knowledge in computing sciences.

PROGRAM OUTCOMES (POs)

PG students are expected to:

PO1: Apply knowledge of recent computing technologies, skills and current tools of computer science and engineering.

PO2: Ability to design and conduct experiments, as well as to analyze and interpret data.

PO3: Knowledge of contemporary research issues in the different areas of Computer Science and Engineering.

PO4: Ability to explore research gaps, analyze and carry out research in the specialized/emerging areas.

PO5: Design software systems, components, or processes to meet identified needs within economic, environmental and social constraints.

PO6: Ability to express/present ideas in an impressive and professional manner.

PO7: Recognize the need to engage in long time learning through continuing education and research.

PO8: Ability to work in multidisciplinary and multicultural environment.

PO9: Ability to become entrepreneur based upon societal needs.

PO10: An understanding of professional, social and ethical responsibilities.

Curriculum Structure for M TECH in CSE *Programme under Autonomy*

REGULATION-2016

Total Credit- 88

Semester-I

Subject Type	Subject Code	Subject Name	Credits/Subject Th:T:P	Total Credits	Contact Hours/Week
THEORY:					
HS	CSEM101	Teaching & Research Methodologies	4:0:0	4	4
ES	CSEM102	Discrete Structure	3:1:0	4	4
ES	CSEM103	Design and Analysis of Algorithm	3:1:0	4	4
ES	CSEM104	Database and Data Mining	3:1:0	4	4
ES	CSEM105	Software Engineering and Case Tools	3:1:0	4	4
ELECTIVE:					
OE	CSEM106A	Web Technology	3:0:0	3	3
OE	CSEM106B	Theory of Computation	3:0:0	3	3
OE	CSEM106C	Parallel Computing	3:0:0	3	3
OE	CSEM106D	Embedded Systems	3:0:0	3	3
OE	CSEM106E	Modeling and simulation	3:0:0	3	3
OE	CSEM106F	Soft Computing	3:0:0	3	3
OE	CSEM106G	Computational Geometry	3:0:0	3	3
PRACTICAL:					
BS	CSEM193	Algorithm Lab	0:0:3	3	3
ES	CSEM194	Database Lab	0:0:3	3	3
	CSEM181	Seminar (Based of Literature Survey of project to be carried out from III Semester)	0:0:0	2	
MANDATORY:					
		TOTAL: NINE+ONE	**19:4:6**	**31**	**29**

Semester II:

Subject Type	Subject Code	Subject Name	Credits/Subject Th:T:P	Total Credits	Contact Hours/Week
THEORY:					
BS	CSEM201	Probability and Statistic for Engineer	3:1:0	4	4
BS	CSEM202	Advanced Computer Architecture	3:1:0	4	4
BS	CSEM203	Advanced Operating System	3:1:0	4	4
BS	CSEM204	Advanced Computer Network & Security	3:1:0	4	4
ELECTIVE:					
	CSEM205A	Distributed Systems	3:0:0	3	3
	CSEM205B	Cryptography & Network Security	3:0:0	3	3
	CSEM205C	Advanced Compiler Design	3:0:0	3	3
	CSEM205D	Artificial Intelligence	3:0:0	3	3
	CSEM205E	VLSI Design	3:0:0	3	3
	CSEM205F	Pattern Recognition	3:0:0	3	3

	CSEM206A	Bioinformatics	3:0:0	3	3
	CSEM206B	Machine Learning	3:0:0	3	3
	CSEM206C	Natural Language Processing	3:0:0	3	3
	CSEM206D	Mobile Computing	3:0:0	3	3
	CSEM206E	Multimedia and Graphics	3:0:0	3	3
	CSEM206F	Cluster, Grid and Cloud Computing	3:0:0	3	3
PRACTICAL:					
PC	CSEM293	Advanced Operating System Lab	0:0:3	3	3
PC	CSEM294	Advanced Computer Network Lab	0:0:3	3	3
PC	CSEM281	Seminar (Based on problem formulation of project to be carried out from III Semester)	0:0:3	3	3
MANDATORY:					
		TOTAL: TEN+ONE	**18:4:9**	**28**	**28**

HS	Humanities and Social Sciences	PC	Professional –Core
BS	Basic Sciences	PE	Professional –Electives
ES	Engineering Sciences	OE	Open Electives
		MC	Mandatory Course

Semester III:

Subject Type	Subject Code	Subject Name	Credits/Subject Th:T:P	Total Credits	Contact Hours/Week
PRACTICAL:					
	CSEM381	Extra Curricular Activity (NSS/NCC/NSO	0 : 0 : 0	3	3
	CSEM391	Project Part-I	0 : 0 : 6	6	6
MANDATORY:					
		TOTAL: TEN+ONE	**0:0:6**	**9**	**9**

Semester IV:

Subject Type	Subject Code	Subject Name	Credits/Subject Th:T:P	Total Credits	Contact Hours/Week
PRACTICAL:					
	CSEM491	Comprehensive Viva Voce	0 : 0 : 0	8	3
	CSEM492	Project Part-II	0 : 0 : 12	12	6
MANDATORY:					
		TOTAL: TEN+ONE	**0:0:12**	**20**	**9**

HS	Humanities and Social Sciences	PC	Professional –Core
BS	Basic Sciences	PE	Professional –Electives

ES	Engineering Sciences	OE	Open Electives
		MC	Mandatory Course

Semester – 1

Teaching & Research Methodology
Code: CSEM101
Credit: 4
Contacts: 4L
Allotted Lecture: 40L

Teaching Methodology

Module I: [4L]
Introduction to content, Elements of instruction, Learning objectives, Roles of the teacher and the learner in instruction.

Module II: [4L]
Application of theories of learning to teaching and learning, Sequence of learning and Strategies of learning, Teaching methods, their merits and demerits, Use of ICT in teaching & learning, Classroom management, Individual differences.

Module III: [4L]
Understanding the syllabus, Preparation of a scheme of work, Lesson plan preparation, Micro teaching.

Module IV: [4L]
Define measurement, assessment, test, evaluation, Purpose of assessment and evaluation, Types of tests, Grading and reporting the results assessment, Evaluating teaching and learning.

Research Methodology

Module I: [4L]
Research methodology: An Introduction Objectives of Research, Types of Research, Research Methods and Methodology, Defining a Research Problem, Techniques involved in defining a Problem.

Module II: [4L]
Research Design Need for Research Design, Features of Good Design, Different Research Designs, Basic Principles of Experimental Designs, Sampling Design, Steps in Sampling Design, Types of Sampling Design, Sampling Fundamentals, Estimation, Sample size Determination, Random sampling.

Module III: [4L]
Measurement and Scaling Techniques Measurement in Research, Measurement Scales, Sources in Error, Techniques of Developing Measurement Tools, Scaling, Meaning of Scale, Scale Construction Techniques.

Module IV: [4L]
Methods of Data Collection and Analysis Collection of Primary and Secondary Data, Selection of

appropriate method Data Processing Operations, Elements of Analysis, Statistics in Research, Measures of Dispersion, Measures of Skewness, Regression Analysis, Correlation.

Module V: [4L]
Techniques of Hypotheses, Parametric or Standard Tests Basic concepts, Tests for Hypotheses I and II, Important parameters limitations of the tests of Hypotheses, Chi-square Test, Comparing Variance, As a non-parametric Test, Conversion of Chi to Phi, Caution in using Chi-square test.

Module VI: [4L]
Analysis of Variance and Co-variance ANOVA, One way ANOVA, Two Way ANOVA, ANOCOVA Assumptions in ANOCOVA, Multivariate Analys is Technique Classification of Multivariate Analysis, factor Analysis, R-type Q Type factor Analysis, Path Analysis

Text Books:

1. "Teaching Methodology", Caroline W. Ndirangu, African Virtual University.
2. "Research Methodology", C.R. Kothari, Wiley Eastern.

Reference Books:

1. "Formulation of Hypothesis", Willkinson K.P, L Bhandarkar, Hymalaya Publication, Bombay.
2. "Research in Education", John W Best and V. Kahn, PHI Publication.
3. "Research Methodology- A step by step guide for beginners", Ranjit Kumar, Pearson Education.
4. "Management Research Methodology-Integration of principles, methods and Techniques", K.N. Krishna swami and others, Pearson Education.

Discrete Structure
Code: CSEM102
Credit: 4
Contacts: 4L
Allotted Lecture: 40L

Module I: [10L]
Set Theory - Set operations, properties - power set - methods of proof - relations, graph and matrix of a relation - partial and total orders, well ordering - equivalence relations, classes and properties - functions, 1-1, onto and bijective.

Module II: [6L]
Induction and Combinatorics - Peano's axioms - Mathematical induction (simple and strong) - pigeon-hole principle - principle of inclusion and exclusion.

Module III: [10L]
Algebraic Structures - Semi-groups, monoids, groups, subgroups and their properties – cyclic groups - cosets - permutation groups - Lagrange's theorem - Cayley's theorem – normal subgroups - homomorphism of groups - quotient groups - rings and fields.

Module IV: [6L]
Recurrence Relations and Generating Functions - Homogeneous and inhomogeneous recurrences-solving recurrences - Repertoire method - Perturbation method - Convolutions - simple manipulations and tricks.

Module V: [8L]
Graph Theory - - Representation of a graph - Trees - Cycles - Paths and connectedness – Graph Isomorphism - Operations on graphs - Vertex and edge cuts.

Text Books:

1. "Discrete Mathematics", K. D. Joshi, Wiley Eastern Ltd.

Reference Books:

1. "Applied Algebra for Computer Science", Arthur Gill, Prentice Hall.
2. "A Text Book of Graph Theory", R. Balakrishnan and K.Ranganathan, Springer.
3. "Discrete Mathematical Structures", D. S. Chandrasekharaih, Prism Books, 2005.

Design and Analysis of Algorithm
Code: CSEM103
Credit: 4
Contacts: 4L
Allotted Lecture: 40L

Module I: [8L]
Time and Space Complexity. Asymptotic Notations. Recurrence For Divide And Conquer And Its Solution, The Substitution Method And Recursion-Tree Method For Solving Recurrences. The Master Method: Proof And Solving Recurrence Problems, Merge Sort, Heap Sort, Quick Sort And Their Complexity Analysis.

Module II: [8L]
Advanced Data Structure: Adt and Data Structure, Linear Vs Non-Inear Data Structure. Tree: Tree As An Adt, Definition And Terminologies, Threaded Binary Tree, Bst. Avl Tree, Balance Multi Way Search Tree: 2-3 Tree, Red- Black Tree, B Tree, B+ Tree, Tries, Spatial Data Representation Using K-D Tree, Quad Tree

Module III: [12L]
Graph: Definition, Computer Representation Of Graphs, Graph Traversals: Bfs & Dfs, Spanning Tree. Graph Colouring-Chromatic Number, Algorithm For Transitive Closure, Topological Sort, and Critical Paths.
Dynamic Programming: Matrix-Chain Multiplication, All Pair Shortest Paths, Single Source Shortest Path, Travelling Salesman Problem, 0-1 Knapsack Problem, Lcs Problem.
Greedy Method : Knapsack Problem, Job Sequencing With Deadlines, Activity – Selection, Huffman Codes, Minimum Spanning Tree By Prim's And Kruskal's Algorithms.
Disjoint Set Manipulation: Set Manipulation Algorithm Like Union-Find, Union By Rank, Path Compression. Topological Sorting.
Backtracking: Use in Solving Problem, 4 Queen And 8-Queen Problem, Subset Sum Problem
Branch and Bound: Basic Method, Applications: The 15-Puzzle Problem,

Module IV: [4L]
Computational Geometry: Robust Geometric Primitives, Convex Hull, Triangulation, Voronoi Diagrams, Nearest Neighbor Search, Range Search, Point Location, Intersection Detection, Bin Packing, and Medial-Axis Transform.

Module V: [8L]
Set and String Problems: Set Cover, Set Packing, String Matching, Approximate String
Matching, Text Compression, Cryptography, Finite State Machine Minimization, Longest Common Substring/Subsequence, Shortest Common Superstring. Advanced Areas: Notion Of Np-Completeness: P Class, Np-Hard Class, Np-Complete Class, and Circuit Satisfiability Problem. Approximation Algorithm.

Text Books:

1 "The Design And Analysis Of Algorithms", A.Aho, J.Hopcroft And J.Ullman, Pe.
2. "Introduction To Algorithms", T Cormen, C Leiserson And R Rivest, Phi.

Reference Books:

1. "Fundamentals Of Algorithms"- G.Brassard, P.Bratlay, Phi.
2. "Fundamentals Of Computer Algorithms", Horowitz Ellis, Sahani Sartaz, R. Sanguthevar.

Databases and Data Mining
Code: CSEM104
Credit: 4
Contacts: 4L
Allotted Lecture: 40L

Module I: [8L]
Database Management System (DBMS)
Database System Architectures: Centralized and Client-Server Architectures, Server System Architectures, Distributed Systems. Query Processing Algorithms – Query Optimization Techniques – Transaction Management: Transaction Processing Concepts - Concurrency Control, Deadlocks Recovery Techniques. Distributed Database – Functions – Distributed RDB design- Transparency– Distributed Transactions - Commit Protocols – Concurrency Control –Deadlocks – Recovery.

Module II: [8L]
Object Oriented Database Management System (OODBMS)
Concepts of OODBMS, Storing objects in relational database, Object oriented data models and DBMS, Issues in OODBMS, Advantages and disadvantages of OODBMS. **Spatial and Temporal Data and Mobility:** Motivations, Terms in databases, Spatial and geographic data, Multimedia database, Mobility and personal databases.

Module III: [8L]
Data Warehousing and OLAP
Introduction to data warehousing, Data ware architecture, Data flows, warehousing tools, Data marts, Data warehouse design, Online Analytical Processing (OLAP benchmarks, benefits, representation of multi-dimensional data applications of OLAP, OLAP tools, categories of OLAP tools).

Module IV: [8L]
Data Mining
Introduction, Process of data mining, Data mining goals, Tasks and techniques (Prediction modeling, Database segmentation, Link analysis, Deviation detection), Applications of data mining.

Module V: [8L]
Clustering
Introduction, Issues in clustering, Types of clustering: Hierarchal and partitioning clustering, K-means clustering applications of clustering.
Classification:
Introduction, Applications of clustering, Classification technique**:** Decision trees.

Text Books:

1. "Data Mining Techniques", K. Pujari, Universities Press, 2013.
2. "Database Concepts", H. F. Korth, A. Silberchatz, Tata McGraw Hill, 2010.

Reference Books:

1. "Data Mining", V. Pudi and P. R. Krishna ,Oxford University Press India, 2009.
2. "Database Systems: A Practical Approach to Design, Implementation and Management", B. Connolly, Pearson Education, 2007.

3. “Fundamentals of Database Systems”, R. Elmasri, S. Navathe, Pearson Education, 2007.

Software Engineering & Case Tools
Code: CSEM105
Credit: 4
Contacts: 4L
Allotted Lecture: 40L

Module I: [8L]
Principles and Motivations
Definitions And Need For Engineered Approach To Software Development; Software development Process Models From The Points Of View Of Technical Development And Project Management: Waterfall, Rapid Prototyping, Incremental Development, Spiral

Module II: [8L]
Models and Emphasis on Computer-Assisted Environments.
Introduction to Modeling Tools Basics Of Object-Oriented Approach, Object-Oriented Programming And Languages, Omt, Visual Modeling, Uml, Rational Rose Tool

Module III: [8L]
Software Development Methods
Formal, Semi-Formal And Informal Methods; Requirements Elicitation, Requirements Specification; Data, Function, And Event-Based Modeling; Some Of The Popular Methodologies Such As Yourdon’s Sad, Ssadm Etc; Case Tools-Classification, Features, Strengths And Weaknesses; Icase; Case Standards.

Module IV: [6L]
Software Project Management
Principles Of Software Projects Management; Organizational And Team Structure; Project Planning; Project Initiation And Project Termination; Technical, Quality, And Management Plans; Project Control; Cost Estimation Methods - Function Points and Cocomo.

Module V: [5L]
Object Modeling and Design
Classes, Objects, Relationships, Key Abstractions, Common Mechanisms, Diagrams, Class Diagrams, Advanced Classes, Advanced Relationships, Interfaces, Types, Roles, Packages, Instances, Object Diagrams, Interactions, Use Cases, Use Case Diagrams, Interaction Diagrams, Activity Diagrams, Events And Signals, State Machines, Processes, Threads, State Chart Diagrams, Components, Deployment, Collaborations, Patterns And Frameworks, Component Diagrams, Systems And Models, Code Generation And Reverse Engineering.

Module VI: [5L]
Software Testing
Software Testing Strategy and Environment Establishing testing policy, structured approach to testing, test factors, Economics of System Development Life Cycle (SDLC) Testing Software Testing Methodology Defects hard to find, verification and validation, functional and structural testing, workbench concept, eight considerations in developing testing methodologies, testing tactics checklist, Software Testing Techniques Black Box, Boundary value, Bottom up, Branch coverage, Cause Effect

graphing.

Text Books:

1. "Software Engineering - A Practitioner's Approach", Roger Pressman, Mcgraw Hill, New York.
2. "Software Engineering", Ian Sommerville, Addison-Wesley Publishing Company, England

Reference Books:

1. "An Integrated Approach To Software Engineering", Pankaj Jalote, Narosa Publishing House, New Delhi.
2. "The Unified Modeling Language User Guide", Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education, New York.

Web Technology
Code: CSEM106A
Credit: 3
Contacts: 3L
Allotted Lecture: 42L

Module I: [8L]
Internet Principles – basic web concepts – Client/ server model – Retrieving data from Internet – Internet Protocols and applications

Module II: [8L]
HTML forms – HTML tags emulation – Links and addressing- HTML and Images

Module III: [8L]
Streaming – Networking Principles – Sockets for Clients – Sockets for Servers – Protocol Handlers – Content Handlers – Multicast sockets – Remote method Invocation.

Module IV: [6L]
Scripts - Java Script, VB Script, DHTML, XML, CGI, Servlets.

Module V: [6L]
Server Scripts - Java Sever Pages (JSP), Active Server pages (ASP), Simple applications – Online databases – Monitoring user events – Plug-ins – Database connectivity.

Module VI: [6L]
Introduction to Semantic Web – layered approach - web documents in XML – schema - name space – querying - processing. RDF - Schema – Web Resource Description using RDF- RDF Properties – Topic Maps and RDF – axiomatic semantics of RDF and RDF schema – inference system RQL and querying. Logic and inference – monotonic rules – syntax and semantics – non-monotonic rules – examples – rule mark-up in XML. Querying with SPARQL.

Text Books:

1. "Java Network Programming", Eillotte Rusty Harold, O'Reilly Publications, 1997.
2. "Internet & World Wide Web How to Program", Harvey M. Deitel and Paul J. Deitel, 4th edition, 2008.
3. "Web Technology – A Developer's Perspective", N. P. Gopalan and J. Akilandeswari, PHIO Pvt Ltd., New Delhi-, 2007.
4. Grigoris Antoniou, Frank van Harmelen, "A Semantic Web Primer (Cooperative Information Systems)", The MIT Press, 2009

Reference Books:

1. "Java Servlets Programming", Jason Hunter and William Crawford, O'Reilly Publications, 1998.
2. "Java Script", Jeff Frantzen and Sobotka, Tata McGraw Hill, 1999.
3. "Using HTML 4, XML and Java", Eric Ladd and Jim O'donnell, Prentice Hall of India – QUE, 1999. CSE Dept. OBE Curriculum NITTUGCSE08 46.

Theory of Computation
Code: CSEM106B
Credit: 3
Contacts: 3L
Allotted Lecture: 46L

Module I: [5L]
Finite Automata
Models of computation - classification, properties and equivalences, Formal definition of a Finite Automata (FA) -Examples of FA, Designing FA, DFA and NFA, regular operations. Equivalence of NFAs and DFAs. FA with Epsilon-Transitions, Epsilon-Closures, Eliminating epsilon -Transitions. Applications of FAs. Mealy and Moore machine, Dead state, Minimization of FA, Incompletely specified machine. FA on infinite inputs.

Module II: [4L]
Regular expression and Languages
Definition of a Regular Expressions (RE), The Operators of RE – Building RE, Conversions DFA's to RE. Equivalence of RE and NFA with Epsilon-moves, - Application of REs. Equivalence of regular grammar and FA.; Properties of Regular Languages (RL), Proving Languages not to be Regular, Pumping Lemma for RLs. Applications of the Pumping Lemma. Closure Properties of RLs, Decision Properties of Rls

Module III: [4L]
Context Free Languages
Context free languages, Derivation and languages, Relationship between derivation and derivation trees, Leftmost and Rightmost Derivations. Simplification of context free grammars – Normal forms for context free grammars, CNF, and GNF. Applications of Context-Free Grammars. Non determinism vs. ambiguity in CFLs. Closure properties of CFLs. Algorithmic properties about CFLs. Pumping Lemma for CFL.

Module IV: [5L]
Push Down Automata
Definition, Acceptance by a Push Down Automata (PDA), DPDA & NPDA, example, Equivalence of PDA's and CFG's (conversion: PDA's to CFG's and reverse). Multi stack PDA. Non-determinism adds power to PDAs.

Module V: [4L]
Turing Machine
Unsolvable Problems. Definition, notation and Example of Turing Machine (TM). Programming techniques –Computable languages and functions, Church Turing hypothesis, Universal TM, Random Access TM. Multitape TM, Equivalence of One-Tape and Multitape TM's , Nondeterministic TMs. Conversion of RE to TM. Multi-stack PDA & TM.

Module VI: [6L]
Computability and Decidability

Church-Turing Thesis, Decision Problems, Decidability and undecidability, unsolvable problems; Halting Problem of Turing Machines; Problem reduction (Turing and mapping reduction), Intractability (Hierarchy Theorems). Mapping reductions. More undecidable languages. Rice theorem. Reductions using controlled executions. RE Completeness. Reductions using computation histories. Linear Bounded Automata. Unrestricted grammars.

Module VII: [8L]
Computational Complexity
Resource-constrained computation. Time Complexity- notion of complexity classes, classes P NP, NP-complete, Boolean satisfiability, NP-Completeness of CSAT and 3SAT , NP-Hard, Cook□Levin Theorem. The concept of reduction, co-NP, polynomial Hierarchy. Some natural NP-complete problems. Space Complexity-Savich's Theorem. The class PSPACE. Optimization, search, and decision problems. Approximate solutions to optimization problems.

Module VIII: [4L]
Logic: Propositional and First-order logic and their applications to theorem proving and logic programming.

Module IX: [6L]
Advanced/Emerging areas: Elementary introductions to DNA Computing, Quantum Computing, Cellular Automata, Circuit complexity, Structural Complexity, Parallel Complexity, Algorithmic Information. Course Guidelines: Large majority of the lectures would focus only on the core areas, with only elementary introduction to other remaining advanced areas.

Text Books:
1. "Introduction to Automata Theory Language and Computation", Hopcroft H.E. and Ullman J. D., Pearson Education.
2. "Theory of Computer Science ", Automata Languages and computation", Mishra and Chandrashekaran, 2nd edition, PHI.
3. "Formal Languages and Automata Theory", C.K.Nagpal, Oxford

Reference Books:
1 "Switching & Finite Automata", ZVI Kohavi, 2nd Edn., Tata McGraw Hill
2. "Introduction to Computer Theory", Daniel I.A. Cohen, John Wiley
3. "Introduction to languages and the Theory of Computation", John C Martin, TMH
4. "Elements of Theory of Computation", Lewis H.P. & Papadimitrou C.H. Pearson, PHI.

Parallel Computing
Code: CSEM106C
Credit: 3
Contacts: 3L
Allotted Lecture: 40L

Module I: [8L]
Introduction
Basic uniprocessor architecture, Parallel computer. Need of parallel computers, models of computation, Analyzing algorithms. Multiprogramming and time sharing, Pipeline computers, Multiprocessor systems, Serial versus parallel processing. Parallelism approaches – Data parallelism, Control parallelism. Hardware taxonomy–Flynn's classifications, Handler's classifications, Parallel processing applications.

Module II: [8L]
Performance Metrics
Laws governing performance measurements. Metrics - Speedups, Efficiency, Utilization,

Communication overheads, Single/multiple program performances, Bench marks.

Module III: [8L]
Parallel Computer Models
Elements of modern computers, System attributes to performance, Shared memory multiprocessors, Distributed memory multicomputers, Loosely and tightly coupled multiprocessors, Multivector computers, PRAM models, Interconnection networks.

Module IV: [8L]
Pipelining and Superscalar Techniques
Linear pipeline processors – Asynchronous and synchronous models, Clocking and timing control, Nonlinear pipeline processors, Reservation and latency analysis, Collision-Free scheduling, Pipeline schedule optimization. Instruction pipeline design - Instruction execution phases, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch handling techniques, Pipeline hazards.

Module V: [8L]
Basic Parallel Algorithmic Techniques and Programming
Pointer jumping, Divide and Conquer, Partitioning, Pipelining, Accelerated cascading, Symmetry breaking, Synchronization (Locked, Lock-free) parallel algorithms. Programming systems - Pthreads, OpenMP, MPI and global address space languages.

Text Books:

1. "Computer Architecture and Parallel Processing", F. A. Briggs, McGraw-Hill International Editions, 1984.
2. "Parallel Programming in C with MPI and OpenMP", M. J. Quinn, McGraw-Hill, 2003.
3. "Computer Systems Organization and Architecture", J. d. Carpinelli, Addison Wesley, 2001.
4. "Introduction to Parallel Computing", A. Grama, G. Karypis, V. Kumar and A. Gupta, Addison-Wesley, 2003.

Embedded Systems
Code: CSEM106D
Credit: 3
Contacts: 3L
Allotted Lecture: 45L

Module I: [9L]
Embedded Computing
Challenges of Embedded Systems – Embedded system design process. Embedded processors – 8051 Microcontroller, ARM processor – Architecture, Instruction sets and programming.

Module II: [9L]
Memory and Input / Output Management
Programming Input and Output – Memory system mechanisms – Memory and I/O devices and interfacing – Interrupts handling.

Module III: [9L]
Processes and Operating Systems
Multiple tasks and processes – Context switching – Scheduling policies – Interprocess

communication mechanisms – Performance issues.

Module IV: [9L]
Embedded Software
Programming embedded systems in assembly and C – Meeting real time constraints – Multi-state systems and function sequences. Embedded software development tools – Emulators and debuggers.

Module V: [9L]
Embedded System Development
Design issues and techniques – Case studies – Complete design of example embedded systems.

Text Books:
1. "Computers as Components: Principles of Embedded Computer System Design", Wayne Wolf, Elsevier, 2006.
2. "Embedded C", Michael J. Pont, Pearson Education , 2007.

Reference Books:
1. "Embedded System Design", Steve Heath, Elsevier, 2005.
2. "The 8051Microcontroller and Embedded Systems", Muhammed Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, Pearson Education, Second edition, 2007.

Modeling and simulation
Code: CSEM106E
Credit: 3
Contacts: 3L
Allotted Lecture: 40L

Module I: [4L]
Introduction
Modeling concepts and definitions, System models and role of simulation, Types of models, Discrete-event simulation, Steps in a simulation study, Simulation examples.

Module II: [10L]
Statistical Models in Simulation
Basics of statistical model, Discrete and continuous distribution, Poisson processes and empirical distribution, Elementary queuing theory, Queuing models involving non-exponential distribution, Queuing models involving hyper- exponential distribution, Queuing models without a poisson input, Priority discipline queuing model, Queuing networks, Application of queuing models.

Module III: [8L]
Random Number Generation
Properties of random numbers, Generation of pseudo random numbers, Random variate generation, Techniques for generation of pseudo random numbers - Mid-square random number generator, Residue method, Arithmetic congruential generator, Hypothesis testing and tests for random numbers.

Module IV: [10L]
Input Modeling and Output analysis
Data collection, Identifying the distribution of data- histograms and Quantile-Quantile plots. Parameter estimation, Goodness of fit tests applied to simulation inputs, Output analysis and measures of performance and estimation.

Module V: [8L]

Simulation Tools
Basic introduction to simulation tools - Scilab, Tortuga and Extend. Introduction to network simulators - NS2, CloudSim, Wireshark.

Text Books:

1. ”Discrete- event system and simulation”, J. Banks, J.S. Carson II, B. L. Nelson and D. M. Nicol, Prentice Hall of India, 2010.
2. “Simulation Modeling and Analysis”, A. M. Law, Tata McGraw Hill India, 2007.
3. “Discrete-event modeling and simulation: a practitioner’s approach”, G.A. Wainer, CRC Press, 2009.

Reference Books:

1. “Theory of modeling and simulation: integrating discrete event and continuous complex dynamic systems”, B.P. Zeiger, H. Praehofer and T. G. Kim, Academic Press, 2000.
2. “Modeling and simulation: theory and practice”, W. J. Karplus, G. A. Bekey and B. YakobKogan, Springer, 2003.

Soft Computing
Code: CSEM106F
Credit: 3
Contacts: 3L
Allotted Lecture: 40L

Module I: [8L]
Introduction to Soft Computing
Evolution of Computing - Soft Computing Constituents – From Conventional Artificial Intelligence to Computational Intelligence - Machine Learning Basics.

Module II: [8L]
Fuzzy Logic
Fuzzy sets and Fuzzy logic: Introduction, Fuzzy sets versus crisp sets, operations on fuzzy sets, Extension principle, Fuzzy relations and relation equations, Fuzzy numbers, Linguistic variables, Fuzzy logic, Linguistic hedges, Applications, fuzzy controllers, fuzzy pattern recognition, fuzzy image processing, fuzzy database.

Module III: [8L]
Artificial Neural Networks
Artificial Neural Network: Introduction, basic models, Hebb's learning, Adeline, Perception, Multilayer feed forward network, Back propagation, Different issues regarding convergence of Multilayer Perceptron, Competitive learning, Self-Organizing Feature Maps, Adaptive Resonance Theory, Associative Memories, Applications.

Module IV: [8L]
Genetic Algorithms
Evolutionary and Stochastic techniques: Genetic Algorithm (GA), different operators of Genetic Algorithm, Analysis of selection operations, Hypothesis of building Blocks, Schema theorem and convergence of Genetic Algorithm, Simulated annealing and Stochastic models, Boltzmann Machine, Applications. Rough Set: Introduction, Imprecise Categories Approximations and Rough Sets, Reduction of Knowledge, Decision Tables, and Applications.

Module V: [8L]
Hybrid Systems
Neural-Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Design and Learning, Fuzzy Logic controlled Genetic Algorithm. Fuzzy Logic and

Genetic Algorithm for Optimization, Applications.

Text Books:

1. "An Introduction to Genetic Algorithm", Mitchell Melanie, Prentice Hall, 1998.
2. "Genetic Algorithms in Search, Optimization and Machine Learning", David E. Goldberg, Addison Wesley, 1997.
3. "Neural Networks", S. Haykin, Pearson Education, 2ed, 2001.
4. "Neural Networks, Fuzzy logic, and Genetic Algorithms", S. Rajasekaran & G. A. V. Pai , PHI.
5. "Fuzzy Sets and Fuzzy Logic", Klir & Yuan, PHI, 1997
6. "Rough Sets", Z. Pawlak, Kluwer Academic Publisher, 1991.
7. "Neural Networks, Fuzzy logic, and Genetic Algorithms", S. Rajasekaran and G. A. V. Pai, PHI.
8. "Intelligent Hybrid Systems", D. Ruan, Kluwer Academic Publisher, 1997.

Computational Geometry
Code: CSEM106G
Credit: 3
Contacts: 3L
Allotted Lecture: 42L

Module I: [4L]
Preliminaries
Basic Euclidean geometry, Geometric Preliminaries, Data Structures for geometric problems: DCEL (Doubly Connected Edge List), Quad trees, Kd-trees and BSP (Binary Space Partition) trees.

Module II: [3L]
Grids and Hulls
Fixed-radius near neighbors, Convex Hulls, Convex Hull Algorithms in the Plane -- Graham's Scan Algorithm, Jarvi's March, Divide and Conquer Algorithm, Quick Hull Algorithm. Triangulation— Polygon Triangulation, dominance and applications.

Module III: [3L]
Linear Programming
Half-plane intersection and randomized LP, backwards analysis, applications of low-dimensional LP.

Module IV: [4L]
Intersections and Triangulation
Plane-sweep line segment intersection, triangulation of monotone subdivisions, plane-sweep triangulation of simple polygons.

Module V: [4L]
Point Location
Kirkpatrick's method, trapezoidal decompositions and analysis, history DAGs.

Module VI: [4L]
Voronoi Diagrams
Basic definitions and properties, Fortune's algorithm.

Module VII: [4L]
Geometric Data Structures
kd-trees, range trees and range searching, segment trees.

Module VIII: [4L]
Delaunay Triangulations

Point set triangulations, basic definition and properties randomize incremental algorithm and analysis.

Module IX: [4L]
Arrangements and Duality
Point/line duality, incremental construction of arrangements and the zone-theorem, applications.

Module X: [4L]
Geometric Approximation
Dudley's theorem and applications, well-separated pair decompositions and geometric spanners, VC dimension, epsilon-nets and epsilon-approximations,

Module XI: [4L]
Geometric Retrieval
kd-trees, range trees, hereditary segment trees, nearest neighbor searching.

Text Book:

1. Computational Geometry: Algorithms and Applications (2nd Edition), M. de Berg, M. van Kreveld, M. Overmars, O. Schwarzkopf, Springer-Verlag, 2000.

Algorithm Lab
Code: CSEM193
Credit: 3
Contacts: 3P
Allotted Lecture: 33P

Programming Language to be used: C

Lab 1: Divide and Conquer: Implement Binary Search using Divide and Conquer approach and analysis, Implement Merge Sort using Divide and Conquer approach,

Lab 2: Divide and Conquer: Implement Quick Sort using Divide and Conquer approach, Find Maximum and Minimum element from a array of integer using Divide and Conquer approach

Lab 3: Dynamic Programming: Find the minimum number of scalar multiplication needed for chain of matrix

Lab 4: Dynamic Programming: Implement all pair of Shortest path for a graph (Floyed- Warshall Algorithm), Implement Traveling Salesman Problem

Lab 5: Dynamic Programming: Implement Single Source shortest Path for a graph (Dijkstra , Bellman Ford Algorithm)

Lab 6: Brunch and Bound: Implement 15 Puzzle Problem

Lab 7: Backtracking: Implement 8 Queen problem

Lab 8: Backtracking (implement any one of the following problem): Graph Coloring Problem Hamiltonian Problem

Lab 9: Greedy method (implement any one of the following problem): Knapsack Problem Job sequencing with deadlines

Lab 10: Greedy method (implement any one of the following problem): Minimum Cost Spanning Tree by Prim's Algorithm Minimum Cost Spanning Tree by Kruskal's Algorithm

Lab 11: Graph Traversal Algorithm: Implement Breadth First Search (BFS),Implement Depth First Search (DFS)

Database Lab
Code: CSEM194
Credit: 3
Contacts: 3P
Allotted Lecture: 33P

Experiments

Exercises to be based on Sybase / Oracle / Postgres / VB / Power Builder / DB2 / MS Access. Applications involving vendor development systems, stores management system, finance management etc.
Creation and querying of database tables
Design of tables by normalization and dependency analysis
Writing application software with host language interface

Probability and Statistic for Engineer

Subject Code: CSEM201
Contact: 40
Credit: 4
Total Lecture Hours: 40

Module-1:
Probability: 8L
Sample Space, Axioms of Probability, Probability on Finite Sample Spaces, Conditional Probability, Bayes Theorem, and Independence of Events.

Module-2:
Random Variables: 7L
Random Variables, Probability Distribution of a Random Variable, Discrete and Continuous Random Variables, and Functions of a Random Variable.

Module-3:
Moments and Generating Functions: 5L
Moments of a Distribution Function, Generating Functions, and Some Moment Inequalities.

Module-4:
Multiple Random Variables: 5L
Multiple Random Variables, Independent Random Variables, Functions of Several Random Variables, Covariance, Correlation, Moments, Conditional Expectation, Order Statisrics and Their Distributions.

Module-5:
Limit theorems: 5L
Modes of convergence weakly, in distribution, in probability, almost sure, and their relationship, Weak law of large numbers Strong law of large numbers, Borel-Cantelli lemma, and Central limit theorem.

Module-6: Sampling distributions: 2L
Chi-Square Distribution, t-Distribution, and F-Distribution.

Module-7:
Parametric Point estimation: 5L
Methods of Finding Estimators Method of Moments, Maximum Likelihood Estimators Methods of Evaluating Estimators Mean Squared Error, Best Unbiased Estimators, Sufficiency and Unbiasedness.

Module-8:
Hypothesis Testing: 3L
Concepts of Hypothesis Testing, Neyman-Pearson lemma, Likelihood Ratio Test, and Confidence Intervals.

Text Books:

1. V. Rohatgi, A. Saleh, Introduction to Probability Theory and Statistics, Second Edition, Wiley-Interscience, 2000.
2. W. Feller, An Introduction to Probability Theory and Its Applications, Vol.1, Third Edition, Wiley, 1968.
3. G. Casella, R. L. Berger, Statistical Inference, Second Edition, Duxbury Press, 2001.
4. J. S. Rosenthal, A Fist look at Rigorous Probability Theory, Second Edition, World Scientific, 2006.

Advanced Computer Architecture
CSEM202
Contact: 4L
Credit: 4
Allotted Lecture: 42

Module–1: 4L
The evolution of modern Computer systems – from DEC PDP-11, IBM 360/370 family, CDC Cyber 6600, Intel X86 architecture, Performance measurement parameters – MIPS, MFLOPS, SPEC ratings, CPI etc.

8L
Introduction to high performance Computing – Overview, Flynn's classifications – SISD, SIMD, MISD, MIMD, Examples from Vector & Array Processors, Performance comparison of algorithms for Scalar, Vector and Array Processors, Fundamentals of UMA, NUMA, NORMA architectures, Performance measurement for parallel architectures – Flynn,s measure, Feng,s measure, Handler's measure, Amadahl's law of limitation for parallel processing, Gustafson's law.

Module –2: 12L
Pipelined processor design, Pipeline performance measurement parameters – speedup factor, efficiency, throughput of a linear pipeline, comparing performance of a N stage pipeline with a N processor architecture, Pipeline design principles – Uniform sub computations, Identical computations, Independent computations, Examples from design of Arithmetic pipelines – Floating point Adders, Multipliers, Dividers etc.,Classifications of Unification, Multifunction & Dynamic pipelines, Scheduling in a pipelines with feedback , Pipeline hazards and their solutions

Module–3: 12L

RISC architecture, characteristics of RISC instruction set & RISC pipeline, its comparisons with CISC, necessity of using optimizing compilers with RISC architecture, Examples from POWER PC and SPARC architectures, Super pipelining (MIPS architecture), Superscalar architecture , Diversified pipelines and out of order execution, VLIW architecture, Hardware multithreading (Coarse grained, fine grained & simultaneous multithreading.

Module–4: 6L

Memory hierarchy – Techniques for improving Cache memory performance parameters,(reduce cache miss rate, reduce hit time, reduce miss penalty), Main memory performance enhancement – interleaved memory, improvement of memory bandwidth, use of TLB for performance enhancement.

Text books:

1. Computer Organization & Design – Patterson & Hennessy (Morgan Kaufmann)
2. Computer Architecture: A Quantitative Approach – Patterson & Hennessy (Elsevier)
3. Computer Architecture & Parallel Processing – Hwang & Briggs(TMH)
4. Computer organization and architecture, designing for performance – Stallings (PHI)
5. Modern Processor Design – Shen & Lipasti (TMH)
6. Advanced Computer Architecture – Hwang (TMH)
7. An Introduction to Intel family of Microprocessors – Antonakos (Pearson)
8. Computer Architecture – Flynn (Narosa)
9. Structured Computer Organization – Tanenbaum (PHI)
10. Computer Architecture & Organization – J P Hayes (McGraw Hill)
11. Computer Organization – Hamacher, Vranesic, Zaky(McGraw Hill)

Advanced Operating System
CSEM203
Contact: 4L
Credit: 4
Allotted Lecture: 40

Module-1: 4L

Operating System Introduction, Structures - Simple Batch, Multi programmed, time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System components, Operating-System services, System Calls, Virtual Machines, System Design and Implementation.

5L

Process and CPU Scheduling - Process concepts and scheduling, Operation on processes, Cooperating Processes, Threads, and Interposes Communication Scheduling Criteria, Scheduling Algorithm, Multiple -Processor Scheduling, Real-Time Scheduling.

Module-2 12L

Memory Management and Virtual Memory - Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging. Demand Paging, Performance of Demanding Paging, Page Replacement, Page Replacement Algorithm, Allocation of Frames, Thrashing. File System Interface and Implementation -Access methods, Directory Structure, Protection, File System Structure, Allocation methods, Free-space Management, Directory Management, Directory Implementation, Efficiency and Performance.

Module-3 9L

Deadlocks - System Model, Dead locks Characterization, Methods for Handling Deadlocks Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock.

Process Management and Synchronization - The Critical Section Problem, Synchronization Hardware, Semaphores, and Classical Problems of Synchronization, Critical Regions, Monitors.

Module-4 5L

Operating System Security Issues- Introduction to the topic of Security in Operating Systems, Principles of Information Security, Access Control Fundamentals, Generalized Security Architectures.

Module-5 5L

Introduction to Distributed systems: Goals of distributed system, hardware and software Concepts, design issues. Elementary introduction to the terminologies within Modern Oss: Parallel, Distributed, Embedded & Real Time, Mobile, Cloud and Other Operating System Models.

Text books

1. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley
2. Distributed Operating System - Andrew. S. Tanenbaum, PHI
3. Operating System a Design Approach-Crowley, TMH.
4. Operating Systems – Internals and Design Principles Stallings, Fifth Edition–2005, Pearson Education/PHI
5. Modern Operating Systems, Andrew S Tanenbaum 2nd edition Pearson/PHI
6. Operating Systems, Dhamdhere, TMH
7. Tanenbaum, Modern Operating Systems, 2nd ed.
8. Silberschatz & Galvin, Operating System Concepts, 6th ed.
9. Saltzer & Kaashoek, Principles of Computer System Design, 2009
10. Coulouris et al., Distributed Systems: Concepts and Design, 3rd ed., - Lynch,
11. Distributed Algorithms, - Lynch et al., Atomic Transactions,
12. Casevant & Singhal, Readings in Distributed Computing Systems,
13. Ananda & Srinivasan, Distributed Computing Systems: Concepts and Structures Mullender, Distributed Systems
14. Filman & Friedman, Coordinated Computing: Tools and Techniques for Distributed Software, - Andrews, Concurrent Programming: Principles and Practice.

Advanced Computer Network & Security
CSEM204
Contact: 4L
Credit:4
Allotted Lecture:44

Module-1 6L

Introduction to internetworking: how networks differ, how networks can be connected, connectionless internetworking, tunneling, fragmentation, overview of underlying technologies (Ethernet, token ring, token bus, FDDI, PPP.

Module-2 4L

Network layer protocols: IPV4, IPV6, NAT, ARP, RARP, DHCP, ICMP, OSPF, BGP, IGMP, CIDR.

Module-3 4L

Transport layer protocols: UDP, remote procedure call, RTP, TCP, TCP Tahoe, TCP Reno, TCP new Reno, TCP Stack.

Module-4 4L

Mobile telephone systems: introduction to wireless networks and cellular technology, AMPS, D-AMPS, GSM, GPRS, CDMA, Bluetooth.

Module-5 4L

Wireless networks: WLAN: Introduction, problems and solutions, protocol stack, access methods, services, WIMAX, WIFI, and ZIGBEE.

Module-6 4L

Ad-hoc networks: Introduction, Routing challenges for ad-hoc networks, Routing protocols (AODV, DSDV, DSR,), Transport protocols (ATCP, TCP-F, TCP BUS).

Module-7 4L

Wireless Internet: MIPV4, MIPV6, TCP Performance, I-TCP, TCP SNOOP, FREEZE TCP, WWP, TCP REAL.

Module-8 4L

Congestion control: General Principles, Congestion prevention policies, Choke packet, RED, ECN, ELN, ELN-ACK. [4 L]

Module-9 4L

QOS provisioning: delay guarantees, network delay, delay jitter, and play out delay, admission control, QOS objectives, the RSVP approach.

Module-10 6L

Security: Introduction to Cryptography, Symmetric key and Public key algorithms, Diffie Hellman key exchange algorithm, Digital signatures, IPSec, firewall, VPN, VLAN, wireless security, Authentication protocols.

Text Books

1. Internetworking with TCP/IP: Principles, Protocols, and architecture – Douglas Comer.
2. Computer networks –A.S.Tannenbaum.
3. Data and Computer Communications – William Stallings
4. Wimax security & QOS-an end-to-end perspective, Wiley publication.

Distributed Systems
CSEM205A
Contact:
Credit:
Allotted Lecture:

Module-1:
Distributed Systems 9L

Computer architecture: CICS, RISC, Multi-core Computer networking: ISO/OSI Model Evolution of operating systems Introduction to distributed computing systems. DCS design goals, Transparencies, Fundamental issues.

Module- 2:
Distributed Coordination 7L

Temporal ordering of events, Lamport's logical clocks, Vector clocks; Ordering of messages, Physical clocks, Global state detection

Module-3:
Process synchronization 6L
Distributed mutual exclusion algorithms, Performance matrix.

Module-4:
Inter-process communication 6L
Message passing communication, Remote procedure call, Transaction communication, Group communication; Broadcast atomic protocols.

Module-5:
Distributed file systems 6L
Deadlocks in distributed systems and Load scheduling and balancing techniques.

Text Books:

1. Distributed Systems Concepts and Design, G. Coulouris, J. Dollimore, Addison Wesley
2. Advanced Operating Systems, M. Singhal, N.G. Shivarathri, McGraw Hill
3. Distributed Operating Systems and Algorithms, Randy Chow, T. Johnson, Addison Wesley
4. Distributed Operating Systems, A.S. Tanenbaum, Prentice Hall
5. Principles of Distributed Database Systems, M. Tamer Ozsu, Patrick Valduriez, Prentice Hall International
6. Tanenbaum, A. S. Distributed Operating Systems, Prentice Hall 1995. Tanenbaum, A. S. Modern Operating Systems, 2nd Edition, Prentice Hall 2001.
7. Bacon, J., Concurrent Systems, 2nd Edition, (ISBN 0-201-177-676), Addison Wesley 1998.
8. Silberschatz, A., Galvin, P. and Gagne, G., Applied Operating Systems Concepts, 1st Edition, Wiley 2000.
9. Coulouris, G. et al, Distributed Systems: Concepts and Design, 3rd Edition, Addison Wesley 2001.
10. Galli, D.L., Distributed Operating Systems: Concepts and Practice Prentice-Hall 2000.

Cryptography & Network Security
CSEM205B
Contact:3L
Credit:3
Allotted Lecture:45

Module-1 9L
Security trends – Attacks and services – Classical crypto systems – Different types of ciphers – LFSR sequences – Basic Number theory – Congruences – Chinese Remainder theorem – Modular exponentiation – Fermat and Euler's theorem – Legendre and Jacobi symbols – Finite fields – continued fractions.

Module-2: 9L
Simple DES – Differential cryptoanalysis – DES – Modes of operation – Triple DES – AES – RC4 – RSA – Attacks – Primality test – factoring.

Module-3 9L
Discrete Logarithms – Computing discrete logs – Diffie-Hellman key exchange – ElGamal Public key cryptosystems – Hash functions – Secure Hash – Birthday attacks - MD5 – Digital signatures – RSA – ElGamal – DSA.

Module-4 9L

Authentication applications – Kerberos, X.509, PKI – Electronic Mail security – PGP, S/MIME – IP security – Web Security – SSL, TLS, SET.

Module-5: 9L

System security – Intruders – Malicious software – viruses – Firewalls – Security Standards.

Text Books:

1. Wade Trappe, Lawrence C Washington, " Introduction to Cryptography with coding theory",
2. 2nd ed, Pearson, 2007.
3. William Stallings, "Crpyptography and Network security Principles and Practices", Pearson/PHI, 4th ed, 2006.

REFERENCES:

1. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education, Second Edition, 2007.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing Third Edition – Prentice Hall of India, 2006

Advanced Compiler Design
CSEM205C
Contact:3L
Credit:3
Allotted Lecture:40

Module – 1 8L

Introduction - Structure of a compiler - Different phases of a compiler - Finite automata and lexical analysis.

Module– 2 8L

Syntactic specification - Context-free grammars - Derivation and parse trees - Basic parsing techniques.

Module– 3 8L

LR Parsers - SLR, Canonical LR and LALR - Syntax-directed translation schemes – Various forms of intermediate code.

Module-4 8L

Translation of array references: procedure calls, declarations and case statements - Symbol tables - Run-time storage administration - Error detection and recovery.

Module-5 8L

Code Optimization - Loop optimization - DAG representation of basic blocks - Code generation from DAG's - Compiler compilers: YACC - Attributed parser generators.

Text Book

1. A. V. Aho, R. Sethi, and J. D. Ullman, "Compilers, Principles, Techniques and Tools", Pearson Education, 13th Indian Reprint, 2003

Reference Book

1. J. P. Tremblay and P. G. Sorrenson, "The Theory and Practice of Compiler Writing", McGraw Hill, 1985

Artificial Intelligence
CSEM205D
Contact:3L
Credit:3
Allotted Lecture:36

Module-1
Introduction: 2L
Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem.

Module-2 2L
Intelligent Agents
Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.

Module-3
Problem Solving 2L
Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

Module-4 4L
Search techniques
Solving problems by searching problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.

Module-5 3L
Heuristic search strategies
Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.

Module-6 3L
Adversarial search
Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

Module-6 3L
Knowledge & reasoning
Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.

Module-7 2L
Using predicate logic

Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.

Module-8 3L

Representing knowledge using rules

Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

Module-9 4L

Probabilistic reasoning

Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.

Module-10 2L

Planning

Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.

Module-11 2L

Natural Language processing

Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing.

Module-12 2L

Learning

Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.

Module 2L

Expert Systems

Representing and using domain knowledge, expert system shells, knowledge acquisition. Basic knowledge of programming language like Prolog & Lisp. [4L]

Books:

2. Artificial Intelligence, Ritch & Knight, TMH
3. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
4. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
5. Poole, Computational Intelligence, OUP
6. Logic & Prolog Programming, Saroj Kaushik, New Age International
7. Expert Systems, Giarranto, VIKAS
8. Artificial Intelligence, Russel, Pearson

VLSI Design
CSEM205E
Contact:3L
Credit:3
Allotted Lecture:40

Module-1 7L

Introduction: Overview of VLSI design Methodologies, VLSI Design flow, Design Hierarchy, Concept of Regularity, Modularity, and Locality, VLSI design styles **Fabrication of MOSFETs:**

Fabrication Process flow: basic steps, Fabrication of NMOS Transistor, the CMOS n-Well Process, Layout Design Rules , Full- Custom mask Layout design , CMOS Inverter Layout Design

Module-2 6L

MOS Transistor: The MOS Structure, Structure and operation of MOSFET, The MOS System under External Bias, The Threshold Voltage, MOSFET Current–Voltage Characteristics, Channel Length Modulation, Substrate Bias Effect, MOSFET Scaling and Small Geometry Effects, Short Channel Effects, Narrow Channel Effects, Limitation Imposed by Small Device Geometries , MOSFET Capacitances.

Module-3 5L

MOS Inverters: Static Characteristics: CMOS Inverters, Circuit operation, Voltage transfer characteristics of CMOS Inverter, Calculation of VIL, Calculation of VIH, Calculation of inverter threshold voltage, Noise Margin.

Module-4 6L

MOS Inverters: Switching Characteristics: Delay Time Definitions, Calculation of Delay Times, Inverter Design with delay constraints, Estimation of Interconnect Parasitic, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters.

Module-5 4L

Combinational MOS Logic Circuits: CMOS Logic Circuits, Layout of simple logic gates, Complex Logic Circuits, Layout of Complex Logic Gates, AOI and OAI Gates, CMOS Transmission Gates (pass gates) , Complementary Pass Transistor Logic.

Module-6 4L

Sequential MOS Logic Circuits: Behavior of Bitable element, SR Latch Circuits, Clocked Latch and Flip flop Circuits, CMOS D-Latch and Edge Triggered Flip flop , Clocked JK Latch, Master slave Flip flop.

Module-7 4L

Semiconductor Memories: Dynamic Random Access Memory, DRAM Configuration, Historical Evaluation of DRAM Cell, DRAM Cell Types, operation of one transistor DRAM Cell, DRAM Operation Modes, Static Random Access Memory, Full custom SRAM Cell, CMOS SRAM Design Strategy, Operation of SRAM, Flash Memory NOR Flash Memory Cell, NAND Flash Memory Cell, Flash Memory Circuit.

Module-8 4L

Design for Testability: Fault Types and Models, Ad Hoc Testable Design Techniques, Scan –based Techniques, Built-In Self Test Techniques.

REFERENCE BOOKS:

1. S. M. Kang and Y. Leblebici, *CMOS Digital Integrated Circuits : Analysis and Design*, Third Edition, MH, 2002.
2. W. Wolf, *Modern VLSI Design : System on Chip*, Third Edition, PH/Pearson, 2002.
3. N. Weste, K. Eshraghian and M. J. S. Smith, *Principles of CMOS VLSI Design : A Systems Perspective*, Second Edition (Expanded), AW/Pearson, 2001.
4. J. M. Rabaey, A. P. Chandrakasan and B. Nikolic, *Digital Integrated Circuits: A Design Perspective*, Second Edition, PH/Pearson, 2003.
5. D. A. Pucknell and K. Eshraghian, *Basic VLSI Design: Systems and Circuits*, Third Edition, PHI,
6. 1994.
7. J. P. Uyemura, *CMOS Logic Circuit Design*, Kluwer, 1999.

8. J. P. Uyemura, *Introduction to VLSI Circuits and System*, Wiley, 2002.
9. R. J. Baker, H. W. Li and D. E. Boyce, *CMOS Circuit Design, Layout and Simulation*, PH, 1997.

Pattern Recognition
CSEM205F
Contact:3L
Credit:3
Allotted Lecture:42

Module-1 8L

Introduction: Definitions, Data sets for pattern recognition, Different paradigms of pattern recognition, Clustering vs Classification, Supervised vs Un-supervised learning, Representations of patterns and classes, Linearly separable patterns and Non-linearly separable patterns, Applications and examples.

Module-2 10L

Clustering: Basics of clustering, Sequential algorithm, Similarity and dissimilarity measures, Clustering criteria, Hierarchical algorithms, Functional optimization-based clustering, Graph clustering, Learning clustering, Clustering high dimensional data, Subspace clustering, Cluster validity measures.

Module-3 10L

Feature Extraction and Selection: Role of feature extraction and selection in pattern recognition, Feature extraction methods, Non-transformed structural characteristics moments. Transformed signal characteristics- Discrete fourier transform, Discrete cosine and sine transform. Structural descriptors- Graph descriptors. Texture- first-order statistics features, Second-order statistics features, Laws texture energy measures. Shape based features. Feature selection methods – exhaustive search, Branch and bound algorithm, Max-min feature selection and sequential forward and sequential backward selection.

Module-4 10L

Classifiers: Role of classifier in pattern recognition, Decision tree, Linear classifier, Quadratic classifier, K-nearest neighbor, Bayesian classifier. Support vector machines (SVMs) – Non-linear SVM classifier, Different kernel functions (Radial Basis function, polynomial). Artificial neural networks (ANNs) for classification and regression, Single layer perceptron, Multi-layer Perceptron, Backpropagation ANN. training set, Test set, Standardization and normalization.

Module-5 4L

Case Study: Digit recognition, Character recognition, Pattern recognition applications in bioinformatics and medical imaging.

Recommended Books:

1. C. M .Bishop, “Pattern Recognition and Machine Learning”, Springer, 2007.
2. S. Marsland, “Machine Learning: An Algorithmic Perspective”, CRC Press, 2009.
3. D. Koller and N. Friedman, “Probabilistic Graphical Models”, MIT Press, 2009.
4. S. Theodoridis and K. Koutroumbas “Pattern Recognition”, Academic Press, 2008.

Bioinformatics
CSEM206A
Contact:3L
Credit:3
Allotted Lecture:40

Module-1
Introduction: 8L
Biology in the computer age, computing changes in biology, Bioinformatics just about building database, Meaning of informatics to biologists, challenges offered by biology to computer scientists, skills required for this field, Available information & software for this domain, use web information, understand sequence alignment data, writing programs to align two biological sequences, predict protein structure from sequence, questions bioinformatics can answer, Watson's Definition, Information Flow, Human Genome project.

Module-2
Tools for Bioinformatics: 8L
Biological Research on the web, Using search engines, finding scientific articles. Public biological databases, Searching biological databases, Depositing data into the public databases, finding software, Judging the quality of information Sequence Analysis, Pair-wise alignment& Database searching: Chemical composition of bio-molecules, Composition of DNA & RNA, Watson & Crick Solve structure of DNA, Development of DNA sequencing methods, Gene finders & feature detection in DNA, DNA translation, Pair wise sequence comparison, Sequence queries against biological databases, Multifunctional tools for sequence analysis.

Module-3
Multiple sequence Alignments, Trees & profiles: 8L
The morphological to the molecular, Multiple sequence alignment, Phylogenic analysis, Profiles & motifs. Predicting protein structure & function from sequence: Determining the structure of the proteins, Prediction the structure of proteins, from 3D to 1D, Feature detection in protein sequences, Secondary structure prediction, Predicting 3D structure.

Module-4
Tools for Genomic & Proteomics: 6L
From sequencing genes to sequencing genomes, Sequence assembly, Accessing genome information on the web, Annotating and analyzing whole genome sequences, Functional genomics new data analysis challenges, Proteomics, Biochemical pathway databases, Modeling kinetics & physiology,Visualization and Data Mining: Preparing your data, Viewing graphics, Sequence data visualization, Networks and pathway visualization, working with numerical data, Visualization: summary, Data mining & biological information.

Module-5
Building a sequence search protocol: 8L

Introduction, A practical approach, when to believe a result, Structural and Functional interpretation. Analysis packages: Introduction - What is in analysis package? Commercial Databases Comprehensive packages, Packages specializing in DNA analysis. Intranet packages, Internet packages, web addresses.

Text / Reference Books:

1. Cynthia Gibas & Per Jambeck , "Developing Bio-informatics computer skills",(O'REILLY)
2. T K Attwood D J Parry-Smith, "Introduction to Bioinformatics", (Pearson Education)
3. Bryan Bergeron M.D. , "Bioinformatics Computing", (Prentice-Hall of India)

Machine Learning
CSEM206B
Contact:3L
Credit:3
Allotted Lecture:

Module-1 **6**L
Introduction: Definition of learning systems, Goals and applications of machine learning. Aspects of developing a learning system- Training data, Concept representation, Function approximation, Issues in machine learning. Types of machine learning- Learning associations. Supervised learning - Classification and regression trees, Support vector machines. Unsupervised learning - Clustering, Instance-based learning – Knearest neighbor, Locally weighted regression, Radial basis function, Reinforcement learning.

Module-2 6L
Clustering: Introduction, Mixture densities, K-means clustering, Expectation maximization algorithm, Hierarchical clustering, choosing the number of clusters.

Module-3 6L
Decision Trees: Introduction, Univariate trees - Classification and regression. Pruning, Rule extraction from Trees, Learning rules from data, Multivariate trees, Basic decision tree learning algorithm, Issues in decision tree learning.

Module-4 6L
Artificial Neural Networks: Neurons and biological motivation, Linear threshold units, Perceptrons, Training a perceptron. Multilayer networks and back propagation, Training procedures, Tuning the network size, Bayesian view of learning, Dimensionality reduction, Learning time.

Module-5 6L
Support Vector Machines: Maximum margin linear separators, Quadratic programming solution to finding maximum margin separators, Kernels for learning non-linear functions.

Module-6 6L
Bayesian Learning and Instance Based Learning: Probability theory and bayes rule, Naive Bayes learning algorithm, Parameter smoothing, Generative vs. discriminative training, Bayes nets and markov nets for representing dependencies, K-Nearest neighbor algorithm, Case-based learning.

Module-7 6L

Hidden Markov Model: Introduction, Discrete Markov Processes, Three basic problems of HMM, Learning model parameters, Continues observations, The HMM with input, Model selection in HMM.

Recommended Books:

1. E. Alpaydin, "Introduction to Machine Learning", MIT Press, 2010.
2. T.M. Mitchell, "Machine Learning", McGraw Hill, 1997.
3. M. Mehryar, R. Afshin and T. Ameet, "Foundations of Machine Learning", MIT Press, 2012.
4. S.S. Vinod Chandra and S. Anand H, "Artificial Intelligence and Machine Learning", PHI Learning, 2014.
5. C. Bishop, "Pattern Recognition and Machine Learning", Springer-Verlag, 2006.

Natural Language Processing
SEM206C
Contact:3L
Credit:3
Allotted Lecture:42

Module-1 7L

Introduction: Need for processing of natural languages, Language processing levels, Applications of NLP, Introduction to Finite State Automata and Regular expressions, Introduction to Formal languages and Context-free grammars.

Module-2 7L

Morphological Processing: Inflectional and Derivational morphology, Morphological parsing, Finite state transducers, N-gram language models.

Module-3 7L

Part-of-Speech Tagging: Word Classes, Part-of-speech tagging, Tagsets, Rule-based, Stochastic and Transformation based POS tagging.

Module-4 7L

Parsing: Basic parsing strategies, Parsing with context-free grammars, Earley algorithm, Finite-state parsing methods, Unification of feature structures.

Module-5 7L

Semantic Analysis: Lexical Semantics, Lexemes, Relations among lexemes and their senses, WordNet, Word Sense Disambiguation.

Module-6 7L

Pragmatics: Discourse, Discourse structure. Dialogue - Acts, structure, conversational agents. Language generation, Architecture for generation.

Recommended Book:

1. D. Jurafsky and J. H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education, 2008.
2. J. Allen , "Natural Language Understanding", Addison Wesley, 2007.
3. J. Handke, "The Structure of the Lexicon: Human Versus Machine (Natural Language Processing)", Mouton de Gruyter, 1995.

Mobile Computing
CSEM206D
Contact: 3L
Credit: 3
Allotted Lecture: 36

Module-1 8L
Introduction to Wireless Networks – Applications – History – Simplified Reference Model – Wireless transmission – Frequencies – Signals – Antennas – Signal propagation – Multiplexing – Modulation – Spread spectrum – Cellular Systems.

Module-2 8L
MAC – Motivation – SDMA, FDMA, TDMA, CDMA –Telecommunication Systems – GSM – DECT – TETRA – UMTS – IMT-2000.

Module-3 8L
Wireless LAN – Infrared Vs Radio transmission – Infrastructure – Adhoc Network – 802.11 – HIPERLAN – Bluetooth – Mobile Network Layer – Mobile IP – Dynamic Host Configuration Protocol.

Module-4 8L
Adhoc Networks – Mobile Transport Layer – Traditional TCP – Indirect TCP – Snooping TCP – Mobile TCP – Fast retransmit / Fast recovery – Transmission / Time-out freezing – Selective retransmission – Transaction Oriented TCP.

Module-5 6L
Support for Mobility – File Systems – WWW – Wireless Application Protocol.

Text Book

1. Jochen Schiller, "Mobile Communications", Pearson Education, Asia Publications, 2000.

Reference Book

1. William Stallings, "Wireless Communication and Networks".

Multimedia and Graphics
CSEM206E
Contact: 3L
Credit: 3

Allotted Lecture: 40

Module-1

Introduction to computer graphics & graphics systems 6L

Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software.

Module-2

Scan conversion: 6L

Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.

Module-3

2D transformation & viewing 6L

Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines , parallel lines, intersecting lines. Viewing pipeline, Window to viewport co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse.

Module-4

3D transformation & viewing 6L

3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, viewport clipping, 3D viewing.

Module-5 3L

Curves

Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves.

Module-6

Hidden surfaces 3L

Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Painter's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry.

Module-7

Module-Color & shading models 2L

Light & color model; interpolative shading model; Texture;

Module-8 8L

Multimedia

Introduction to Multimedia: Concepts, uses of multimedia, hypertext and hypermedia; Image, video and audio standards. Audio: digital audio, MIDI, processing sound, sampling, compression. Video: MPEG compression standards, compression through spatial and temporal redundancy, inter-frame and intra-frame compression. Animation: types, techniques, key frame animation, utility, morphing. Virtual Reality concepts.

Text Books:

2. Hearn, Baker – " Computer Graphics (C version 2nd Ed.)" – Pearson education
3. Z. Xiang, R. Plastock – " Schaum's outlines Computer Graphics (2nd Ed.)" – TMH

4. D. F. Rogers, J. A. Adams – " Mathematical Elements for Computer Graphics (2nd Ed.)" – TMH
5. Mukherjee, Fundamentals of Computer graphics & Multimedia, PHI
6. Sanhker, Multimedia –A Practical Approach, Jaico
7. Buford J. K. – "Multimedia Systems" – Pearson Education
8. Andleigh & Thakrar, Multimedia, PHI
9. Mukherjee Arup, Introduction to Computer Graphics, Vikas
10. Hill,Computer Graphics using open GL, Pearson Education

Reference Books:

1. Foley, Vandam, Feiner, Hughes – "Computer Graphics principles (2nd Ed.) – Pearson Education.
2. W. M. Newman, R. F. Sproull – "Principles of Interactive computer Graphics" – TMH.
3. Elsom Cook – "Principles of Interactive Multimedia" – McGraw Hill

Cluster, Grid and Cloud Computing
CSEM206F
Contact:3L
Credit:3
Allotted Lecture: 44

Module-1
Cluster Computing 12L

A general introduction to the concept of cluster based distributed computing. Hardware technologies for cluster computing, including a survey of the possible node hardware and high-speed networking hardware and software. Software and software architectures for cluster computing, including both shared memory (OpenMP) and message passing (MPI/PVM) models

MPI-2 extension, dynamic process creation, one-sided communication, parallel I/O. Variants based on new low level protocols (MVAPICH), evaluation and tuning of system and software performance Performance evaluation tools, HINT, netperf, netpipe, ttcp, Iperf.

Module-2 16L
Grid Computing

The Grid - Past, Present, Future, A New Infrastructure for 21st Century Science - The Evolution of the Grid - Grids and Grid Technologies, Programming models - A Look at a Grid Enabled Server and Parallelization Techniques – Grid applications. The concept of virtual organizations – Grid architecture – Grid architecture and relationship to other Distributed Technologies – computational and data Grids, semantic grids

Case Study: Molecular Modeling for Drug Design and Brain Activity Analysis, Resource management and scheduling, Setting up Grid, deployment of Grid software and tools, and application execution.

Module-3
Cloud Computing 16L

Introduction to Cloud Computing, Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Deploy application over cloud, Comparison among SAAS, PAAS, IAAS

Cloud computing platforms: Infrastructure as service: Amazon EC2,Platform as Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing

Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. Issues in cloud computing, Implementing real time application over cloud platform
Issues in Intercloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment.

Text Book:

1. Cluster Computing by Rajkumar Buyya, Clemens Szyperski
2. High Performance Cluster Computing: Architectures and systems by Rajkumar Buyya
3. Grid and Cluster Computing by C.S.R Prabhu
4. Fran Bermn, Geoffrey Fox, Anthony Hey J.G., "Grid Computing: Making the Global Infrastructure a Reality", Wiley, USA, 2003
5. Joshy Joseph, Craig Fallenstein, "Grid Computing", Pearson Education, New Delhi, 2004,
6. Ian Foster, Carl Kesselman, "The Grid2: Blueprint for a New Computing Infrastructure". Morgan Kaufman, New Delhi, 2004
7. Ahmar Abbas, "Grid Computing: Practical Guide to Technology and Applications", Delmar Thomson Learning, USA, 2004,
8. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper (Wiley India Edition)
9. Enterprise Cloud Computing by Gautam Shroff,Cambridge
10. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India

Advanced Operating System Lab
CSEM293
Contact:3L
Credit:3
Allotted Lecture:

Module-1 **6P**
Preliminaries of Operating System:
Managing users, managing systems, file managements, useful commands.

Module-2 **9P**
Shell scripting
Shell syntax, executing shell scripts.

Module-3 **15P**
Process:
Creating new process, counting maximum number of processes a system can handle at a time, handling system calls; inter process communication through pipes and message passing, zombie process, orphan process.

Module-4 **6P**
Process Synchronization:
Handling threads and semaphores to achieve synchronization among processes using POSIX standard functions.

Module-5 **6P**
Signal: study of some POSIX signals (SIGINT, SIGILL, SIGFPE, SIGKILL, SIGHUP, SIGALRM, SIGABRT).

Advanced Computer Network Lab
CSEM294
Contact: 3L
Credit: 3
Allotted Lecture: 32P

Module-1 4P

Programs using TCP Sockets (like date and time server & client, echo server & Client, etc..)

Module-2 4P

Programs using UDP Sockets (like simple DNS), Programs using Raw sockets (like packet capturing and filtering),Programs using RPC,Simulation of sliding window protocols

Module-3 6P

Experiments using simulators (like OPNET)

Module-4 6P

Performance comparison of MAC protocols

Module-3 12P

Performance comparison of Routing protocols

Study of TCP/UDP performance