SCHEME OF INSTRUCTION & EXAMINATION
M.Tech – I Year (COMPUTER SCIENCE AND ENGINEERING)
With Effect from Academic Year 2014-15

SEMESTER-I

S.No	Syllabus Ref.No	SUBJECT	Scheme of Instruction		Scheme of Examination		
			Periods per Week		Duration in Hours	Maximum Marks	
			L/T	D/P		Univ. Exam	Sessionals
		THEORY					
1		Core-I	3	-	3	80	20
2		Core-II	3	-	3	80	20
3		Core-III	3	-	3	80	20
4		Core-IV	3	-	3	80	20
5		Elective-I	3	-	3	80	20
6		Elective-II	3	-	3	80	20
		PRACTICALS					
1	CS 531	Software Lab – I (Advanced Algorithms & OOSE)	-	3	3	--	50
2	CS 532	Seminar - I	-	3	3	--	50
		TOTAL	18	6	-	480	220

Core Subjects:

CS 501: Advanced Algorithms

CS 502: Advanced Operating Systems

CS 503: Artificial Intelligence

CS 504: Object Oriented Software Engineering

CS 551: Distributed Computing

CS 552: Advanced Databases

Elective – I & II:

CS 511: Mobile Computing

CS 512: Real Time Systems

CS 513: Advanced Computer Graphics

CS 514: Soft Computing

CS 515: Parallel Computer Architecture

CS 516: Multimedia Technologies

CS 517: Embedded Systems

CS 518: Data Mining

CS 519: Performance Evaluation of Computer Systems

SCHEME OF INSTRUCTION & EXAMINATION
M.Tech – I Year (COMPUTER SCIENCE AND ENGINEERING)
With Effect from Academic Year 2014-15

SEMESTER-II

S.No	Syllabus Ref.No	SUBJECT	Scheme of Instruction		Scheme of Examination		
			Periods per Week		Duration in Hours	Maximum Marks	
			L/T	D/P		Univ. Exam	Sessionals
		THEORY					
1		Core-V	3	-	3	80	20
2		Core -VI	3	-	3	80	20
3		Elective-III	3	-	3	80	20
4		Elective-IV	3	-	3	80	20
5		Elective-V	3	-	3	80	20
6		Elective-VI	3	-	3	80	20
		PRACTICALS					
1	CS 581	Software Lab – II (Distributed Computing & Advanced Databases)	-	3	3	--	50
2	CS 582	Seminar - II	-	3	3	--	50
		TOTAL	18	6	-	480	220

Elective – III & IV:

CS 561: Network Security
CS 562: Machine Learning
CS 563: Grid Computing
CS 564: Information Retrieval Systems
CS 565: Natural Language Processing
CS 566: Software Quality and Testing
CS 567: Software Engineering for RTS
CS 568: Cloud Computing
CS 569: Web Engineering
CS 570: Semantic Web

Elective – V & VI:

CS 571: Neural Networks
CS 572: Parallel Algorithms
CS 573: Simulation and Modeling
CS 574: Software Project Management
CS 575: Image Processing
CS 576: Software Reuse Techniques
CS 577: Reliability & Fault Tolerance
CS 578: Web Mining
CS 579: Human Computer Interaction

SCHEME OF INSTRUCTION & EXAMINATION
M.Tech – II Year (COMPUTER SCIENCE & ENGINEERING)
With Effect from Academic Year 2014-15

SEMESTER-III

S.No	Syllabus Ref.No	SUBJECT	Scheme of Instruction		Scheme of Examination		
			Periods per Week		Duration in Hours	Maximum Marks	
			L/T	D/P		Univ. Exam	Sessionals
1	CS	Dissertation + Project Seminar	-	6	-	-	100*

* 50 Marks to be given by the guide.
* 50 Marks to be given by viva committee which includes Head, Guide & an Examiner.

SCHEME OF INSTRUCTION & EXAMINATION
M.Tech – II Year (COMPUTER SCIENCE & ENGINEERING)
With Effect from Academic Year 2014-15

SEMESTER-IV

S.No	Syllabus Ref.No	SUBJECT	Scheme of Instruction		Scheme of Examination		
			Periods per Week		Duration in Hours	Maximum Marks	
			L/T	D/P		Univ. Exam	Sessionals
1	CS	Dissertation	-	6	-	*Grade	-

* Grade – Excellent / Very Good/ Good / Satisfactory/Unsatisfactory

With effect from the academic year 2014-15

CS-501 ADVANCED ALGORITHMS

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Algorithm Analysis: Asymptotic Notation ,Amortization.

Basic Data Structures: Stacks and Queues, Vectors, Lists and Sequences, Trees, Priority Queues, Heaps, Dictionaries and Hash Tables.

Search Trees : Ordered Dictionaries and Binary Search Trees, AVL Trees, Bounded-Depth Search Trees, Splay Trees.

UNIT-II

Fundamental Techniques: The Greedy Methods, Divide-and-conquer, Dynamic Programming.

Graphs: The Graph Abstract Data Type, Data Structures for Graphs, Graph Traversal, Directed Graphs.

UNIT-III

Weighted Graphs: Single-Source Shortest Paths, All-Pairs Shortest Paths, Minimum Spanning Trees.

Network Flow and Matching: Flows and Cuts, Maximum Bipartite Matching, Minimum-Cost Flow.

UNIT-IV

Text Processing: Strings and Pattern Matching Algorithms, Tries, Text Compression, Text Similarity Testing.

Number Theory and Cryptography: Fundamental Algorithms involving numbers, Cryptographic Computations, Information Security Algorithms and Protocols.

UNIT-V

Computational Geometry: Range Trees, Priority Search Trees, Quad trees and k-D Trees, Convex Hulls.

Suggested Reading:

1. M T Goodrich, R Tomassia. "*Algorithm Design – Foundations, Analysis, and Internet Algorithms*", John Wiley,2002.
2. E Horowitz S Salmi, S Rajasekaran, "*Fundamentals of Computer Algorithms*", Second Edition,university Press,2007.
3. Aho, A V Hopcraft, Ullman J D, "*The design and analysis of Computer Algorithms*", Pearson Education, 2007.
4. Hari Mohan Pandy, "*Design Analysis and Algorithms*", University Science Press, 2009.
5. Cormen., Lieserson, Rivest "*Introduction to Algorithm*", 2nd Edition, PHI,2003.

With effect from Academic Year 2014-2015

CS 502

ADVANCED OPERATING SYSTEMS

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Architecture of Distributed Systems. : Types, Distributed OS, Issues in Distributed Operating Systems, Theoretical Foundations : Global Clock, Lamport's Logical Clock, Vector Clocks, Global State, Termination Detection.

UNTT-II

Distributed Mutual Exclusion : Classification, requirement, performance, non-token based algorithms, Lamport's algorithm, the Richart-Agarwala algorithm, token-based algorithm-Suzuki liasamil's broadcast algorithm, Singhals heuristic algorithm.

Deadlock Detection : Resource Vs Communication deadlock, A graph - theoretic model, prevention, avoidance, detection, control organization, centralized deadlock-detection algorithm, the completely centralized algorithm, the HO-Ramamoorthy algorithm. Distributed deadlock detection algorithm - path - pushing, edge-chasing, hierarchical deadlock detection algorithm, menace-muntz and Ho-Ramamoorthy algorithm. Agreement Protocols : The system model, the Byzantine agreement, the consensus problem.

UNIT-III

Distributed File System : Mechanisms, Design Issues.

Case Studies : Sun NFS, Sprite File System, DOMAIN, Coda File System.

Distributed shared memory : Algorithms for Implementing DSM, Memory Coherence, Coherence Protocols, Design Issues.

Case Studies : IVY, Mirage, Clouds.

Distributed Scheduling : Issues in Load Distribution, Components of Algorithm, Stability Load Distributing Algorithm, Performance.

UNIT IV

Failure Recovery : Backward, Forward Error Recovery in Concurrent Systems, Consistent Set of Check Points, Synchronous and Asychronous Check Pointing and Recovery.

Fault Tolerance : Commit protocols, Non-Blocking Commit Protocols, Voting Protocols.

Protection and Security : Access Matrix, Private Key, Public key, Kerberos System.

UNIT -V

Multiprocessor Operating Systems : Motivation, Basic Multiprocessor System Architecture, Interconnection Networks for Multiprocessor Systems, Caching, Hypercube Architecture. Threads, Process Synchronization, Processor scheduling, memory management.

Database Operating System : Concurrence Control, Distributed Databases, Concurrency Control Algorithms.

Suggested Reading:

1. Singhal M, Shivaratri N.G. "Advanced concepts in operating systems"Mc-Graw-Hill Intl., 1994.
2. Pradeep K Sinha, : "Distributed Operating Systems Concepts and Design", PHI, 2002.
3 Andrew S. Tanenbaum, "Distributed Operating Systems", Pearson Education India, 2011

CS 503

ARTIFICIAL INTELLIGENCE

Instruction	3 Periods per week
Duration	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT - 1

Introduction, History Intelligent Systems, Foundations of AI, Sub areas of Al, Applications.

Problem Solving - State - Space Search and Control Strategies : Introduction General Problem Solving Characteristics of problem, Exhaustive Searches, Heuristi Search Techniques, Iterative - Deepening A*, Constraint Satisfaction.

Game Playing, Bounded Look - ahead Strategy and use of Evaluation Functions, Alpha Beta Pruning.

UNIT – II

Logic Concepts and Logic Programming : Introduction, Propositional Calculus Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Table a System in Propositional Logic, resolution Refutation in Propositional Logic, Predicate Logic, Logic Programming.

Knowledge Representation : Introduction, Approaches to knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames.

UNIT - III

Expert System and Applications : Introduction, Phases in Building Expert Systems Expert System Architecture, Expert Systems vs Traditional Systems, Truth Maintenance Systems, Application of Expert Systems, List of Shells and tools.

Uncertainty Measure - Probability Theory : Introduction, Probability Theory, Bayesian Belief Networks, Certainty Factor Theory, Dempster - Shafer Theory.

UNIT - IV

Machine - Learning Paradigms : Introduction, Machine learning System, Supervised and Unsupervised Learning, Inductive Learning, Learning Decision Trees (Suggested Reading 2)

Deductive Learning, Clustering, Support Vector Machines.

Artificial Neural Networks : Introduction Artificial Neural Networks, Single - Layer Feed Forward Networks, Multi - Layer Feed Forward Networks, Radial - Basis Function Networks, Design Issues of Artificial Neural Networks, Recurrent Networks

UNIT - V

Advanced Knowledge Representation Techniques : Case Grammars, Semantic Web.

Natural Language Processing : Introduction, Sentence Analysis Phases, Grammars and Parsers, Types of Parsers, Semantic Analysis, Universal Networking Knowledge.

Suggested Reading :

1. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 2011.

2. Russell, Norvig : Artificial Intelligence, A Modern Approach, Pearson Education, Second Edition, 2004.

3. Rich, Knight, Nair : Artificial Intelligence, Tata McGraw Hill, Third Edition 2009.

CS-504 OBJECT ORIENTED SOFTWARE ENGINEERING

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Information systems : Problems in Information systems Development, Project life cycles, Managing Information System Development, User Involvement and Methodological Approaches, Basic Concepts and Origins of Object Orientation Modeling Concepts.

UNIT-II

Requirement capture, Requirement Analysis, Refining the Requirement Models, Object Interaction.

UNIT-III

Operations, Control, Design, System Design.

UNIT-IV

Object design, Design Patterns, Human Computer Interaction, Designing Boundary Classes.

UNIT-V

Data Management Design, Implementation, Reusable Components, Managing Object Oriented Projects, System Development Methodologies.

Suggested Reading:

1. Simon Benett, Steve McRobb & Ray Farmer, " *Object Oriented System Analysis and Design using UML*", McGraw Hill, 2002.
2. Grady Booch, James Rumbaugh, Ivor Jacobson, "*The Unified Modeling language-User guide*", Addison Wesley 1999.
3. Subhash Mehta, Suresh K.Basandra " *Object Oriented Software Engineering*", Galgotia, 2004.

With effect from Academic Year 2014-2015

CS 551

DISTRIBUTED COMPUTING

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT -I

Introduction: Definition of Distributed Systems, Goals: Connecting Users and Resources, Transparency, Openness, Scalability, Hardware Concepts: Multiprocessors, Homogeneous Multicomputer systems, Heterogeneous Multicomputer systems, Software Concepts: Distributed Operating Systems, Network Operating Systems, Middleware, The client-server model: Clients and Servers, Application Layering, Client-Server Architectures.

UNIT II

Communication: Layered Protocols, Lower-Level Protocols, Transport Protocols, Higher-Level Protocols, Remote Procedure Call: Basic RPC Operation, Parameter Passing, Extended RPC Models, Remote Object Invocation: Distributed Objects, Binding a Client to an Object; Static verses Dynamic Remote Method Invocations, Parameter Passing, Message Oriented Communication: Persistence and synchronicity in Communication, Message-Oriented Transient Communication, Message-Oriented' Persistent Communication, Stream Oriented Communication: Support for Continuous Media, Streams and Quality of Service, Stream Synchronization.

UNIT -III

Process: Threads: Introduction to Threads, Threads in Distributed Systems, Clients: user Interface-:, Client-Side Software for Distribution Transparency, Servers: General Design Issues, Object Servers, Software Agents: Software Agents in Distributed Systems, Agent Technology, Naming: Naming Entities: Names, Identifiers, and Address, Name Resolution, The Implementation of a Name System, Locating Mobile Entities: Naming verses Locating Entities, Simple Solutions, Home-Based Approaches, Hierarchical Approaches.

UNIT -IV

Distributed Object based Systems : CORBA: Overview of CORBA, Communication, Processes, Naming, Synchronization, Caching and Replication, Fault Tolerance, Security, Distributed COM: Overview of DCOM, Communication, Processes, Naming, Synchronization, Replication, Fault Tolerance, Security, GLOBE: Overview of GLOBE, Communication, Process, Naming, Synchronization, Replication, Fault Tolerance, Security, Comparison of CORBA, IDCOM, and

Globe: Philosophy, Communication, Processes, Naming, Synchronization, Caching and Replication Fault Tolerance, Security, MTN

UNIT-V

Distributed Multimedia Systems: Introduction, Characteristics of Multimedia Data, Quality of Service Management: Quality of Service negotiation, Admission Control, Resource Management Resource Scheduling.

Suggested Reading:

1. Andrew S. Tanenbaum and Van Steen "Distributed Systems", Pearson Education Inc., 2002

2. Colouris G., Dollimore Jean, Kindberg Tim, "Distributed Systems Concepts and Design", 3rd Edition Pearson education 2002.

CS 552

ADVANCED DATABASES

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Object Based Databases: Overview, Complex Data Types, Structured Types and Inheritance in SQL, Table Inheritance, Array and Multiset Types in SQL, Object-Identity and Reference Types in SQL, Implementing O-R features, Persistent Programming Languages, Object-Relational Mapping, Object-Oriented versus Object-Relational.

UNIT-II

X M L : Motivation, Structure of XML data, XML Document Schema, Querying and Transformation, Application Program Interface to XML, Storage of XML data, XML applications.

UNIT-III

Query Processing : Overview, Measures of Query Cost, Selection Operation, Sorting, join Operation, Other Operations, Evaluation of Expressions.

Query Optimization : Overview, Transformation of Relational Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans, Materialized Views.

UNIT-IV

Parallel Databases: Introduction, 1/0 Parallelism, Interquery Parallelism, Intraquery Parallelism, Intraoperation Parallelism, Interoperation Parallelism, Query Optimization, Design of Parallel Systems.

Distributed Databases : Homogeneous and Heterogeneous Database, Distributed Data Storage, Distributed. Transactions, Commit Protocols, Concurrency Control in Distributed Databases, Availability, Distributed Query Processing, Heterogeneous Distributed Databases, Cloud-Based Databases, Directory Systems.

UNIT- V

Advanced Application Development : Performance Tuning, Performance Benchmarks Other Issues in Application Development, Standardization.

Spatial and Temporal Data and Mobility : Motivation, Time in Databases, Spatial and Geographic Data, Multimedia Databases, Mobility and Personal Databases.

Suggested Reading:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, "Database System Concepts". McGrawHill international Edition, Sixth Edition, 2010.
2. Elmasri Navathe, Somayajulu, Gupta , "Fundamentals of Database Systems", Pearsi Education, Fourth Edition, 2006.
3. CJ Date, A Kannan, S Swamynathan, "An Introduction to Database Systems", Pears Education, Eighth Edition, 2006.
4. Ramakrishna, Gehrke, "Database Management", International Edition, Third Edition, 200

CS-511 **With effect from the academic year 2014-2015**

MOBILE COMPUTING

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Introduction: Wireless Transmission, Frequencies for Radio Transmission, Signals, Antennas, Signal Propagation, Multiplexing, Modulations, Spread Spectrum, MAC, SOMA, FDMA, TDMA, CDMA, Cellular Wireless Networks.

UNIT-II

Telecommunication Systems: GSM, GPRS, Satellite Networks, Basics, Parameters and Configurations, Capacity Allocation, FAMA and DAMA, Broadcast Systems, DAB, DVB, CDMA and 3G.

UNIT-III

Wireless LAN: IEEE 802.11 Architecture, Services, MAC – Physical Layer, IEEE 802.11a – 802.11b standards, Bluetooth.

UNIT-IV

Routing Ad-hoc Network Routing Protocols: Ad-hoc Network Routing Protocols, Destination Sequenced Distance Vector Algorithm, Cluster Based Gateway Switch Routing, Global State Routing, Fish-eye state Routing, Dynamic Source Routing, Ad-hoc on-demand Routing, Location Aided Routing, Zonal Routing Algorithm. **Mobile IP -** Dynamic Host Configuration Protocol. **Traditional TCP -** Classical TCP Improvements – WAP, WAP 2.0.

UNIT-V

Publishing & Accessing Data in Air: Pull and Push Based Data Delivery models, Data Dissemination by Broadcast, Broadcast Disks, Directory Service in Air, Energy Efficient Indexing scheme for Push Based Data Delivery.

File System Support for Mobility: Distributed File Sharing for Mobility support, Coda and other Storage Manager for Mobility Support.

Mobile Transaction and Commerce: Models for Mobile Transaction, Kangaroo and Joey transactions, Team Transaction, Recovery Model for Mobile Transactions, Electronic Payment and Protocols for Mobile Commerce.

Suggested Reading:

1. Jochen Schiller, "*Mobile Communications*", 2nd Edition, Pearson Education, 2009.
2. Kurnkum Garg, "*Mobile Computing*", Pearson 2010
3. Asoke K Talukder, Roopa R Yavagal, "*Mobile Computing*", TMH 2008.
4. Raj Kamal, "*Mobile Computing*", Oxford, 2009.
5. "*A Survey of Mobile Transactions appeared in Distributed and Parallel databases*" 16,193-230, 2004, Kluwer Academics Publishers.
6. S. Acharya, M. Franklin and S. Zdonil, "*Balancing Push and Pull for Data Broadcast, Proceedings of the ACM SIGMOD*", Tuscon, AZ, May 1997.
7. S.Acharya, R. Alonso, M.Franklin and S.Zdonik, "*Broadcast Disks: Data Management for Assymetric Communication Environments, Proceedings of the ACM SIGMOD Conference*", San Jose, CA, May 1995.

REAL TIME SYSTEMS

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Introduction: Definition, Applications and Types of Real Time Systems, Typical Case Studies of Real Time Systems, Time Constraints.

A Reference Model for Real Time Systems: Processors and Resources, Periodic Task Model, Precedence and Data Dependency, Temporal, Foundational and Resource Parameters, Scheduling Hierarchy.

UNIT-II

Real Time Scheduling: Different Approaches- Clock Driven, Priority Driven, Scheduling of Periodic and Sporadic Jobs in Priority- Driven Systems.

UNIT-III

Resource Management: Resources and Resource Access Control, Critical Section, Priority-Ceiling Protocols, concurrent Access to Data Objects.

UNIT-IV

Implementation Aspects: Timing Services and Scheduling Mechanisms, Other Basic Operating System Functions, Processor Reserves and Resource Kernel, Open System Architecture, Capabilities of Commercial Real Time Operating Systems, Predictability of General Purpose Operating Systems.

UNIT-V

Case Studies: Vx – Works, RT Linux.

Suggested Reading:

1. Jane W.S. Liu, "*Real Time Systems*", Pearson Education, 2001.
2. C.M. Krishna and Kang G. Shin, " *Real Time Systems*", Mc-Graw Hill Companies Inc., 1997.
3. Raymond J.A. Buhr, Donald L. Bailey, "*An Introduction to Real Time Systems*", Prentice Hall International, 1999.
4. K.V.K.K. Prasad, "*Embedded Real Time Systems, Concepts, Design and Programming*", Dream Teach, 2003.

CS 513

ADVANCED COMPUTER GRAPHICS

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Raster Graphics System and its Working, Line-Drawing Algorithms (DDA and Bresenham's algorithms), Polygon Filling, 2-D Transformations.

UNIT-II

Fundamentals of 3-D graphics: Projections - Parallel projection and perspective projection, 3-DTransformations, Bezier curves and B-spline curves.

Visible-Surface Detection Methods - Painter's algorithm and Z-buffer method

UNIT-III

Animation: Design of Animation Sequences,
General Computer - Animation functions,
Raster Animations, Computer-Animation Languages, Key-Frame Systems.
Morphing, Simulating Accelerations, Motion Specification, Direct Motion Specification, Goal Directed Systems, Kinematics and Dynamics.

UNIT -TV

Fractals: Fractal-Geometry Methods, Fractal-Generation Procedures, Classification of Fractals Fractal Dimension, Geometric Construction of Deterministic Self-Similar Fractals, Geometric Construction of Statistically Self-Similar Fractals.

Affine Fractal - Construction methods, Random Midpoint - Displacement Methods. Controllin Terrain Topography, Self-squaring Fractals, Self-Inverse Fractals.

UNIT-V

Advanced Raster Graphics Architecture:

Display - Processor Systems Standard Graphics Pipeline, Introduction to multiprocessing, Pipelin Front-End Architectures, Parallel Front-End. Architectures.

Multiprocessor Rasterization Architectures, Image-Parallel Rasterization, Object-Parallel Rastcrization, Hybrid-Parallel Rasterization, Enhanced Display Capabilities.

Suggested Reading:

1. Ham Donald, Pauline Baker M., "Computer Graphics", 2nd Edition, Pearson Education 1997.
2. Foley, Vandam, Feiner, Hughes, "Computer Graphics - Principles & Practice", 2nd Edition, Addision- Wesley, 1996.
3. David F Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, McGraw-2001.

CS-514 **SOFT COMPUTING**

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Introduction to Soft Computing and Neural Networks:

Evolution of Computing Soft Computing Constituents From Conventional AI to Computational Intelligence-Machine Learning Basics.

UNIT II

Genetic Algorithms:

Introduction to Genetic Algorithms (GA) –Applications of GA in Machine Learning-Machine Learning Approach to Knowledge Acquisition.

UNIT III

Neural networks:

Machine Learning Using Neural Network, Adaptive Networks –Feed forward Networks –Supervised Learning Neural Networks–Radial Basis Function Networks-Reinforcement Learning–Unsupervised Learning Neural Networks–Adaptive Resonance architectures – Advances in Neural networks.

UNIT IV
Fuzzy Logic:

Fuzzy Sets –Operations on Fuzzy Sets –Fuzzy Relations –Membership Functions-Fuzzy Rules and Fuzzy Reasoning –Fuzzy Inference Systems –Fuzzy Expert Systems –Fuzzy Decision Making.

UNIT V

Neuro-Fuzzy Modeling:

Adaptive neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rule base Structure Identification – Neuro-Fuzzy Control – Case studies.

Suggested Reading:

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "*Neuro-Fuzzy and Soft Computing*", Prentice-Hall of India, 2003.
2. George J. Klir and Bo Yuan, "*Fuzzy Sets and Fuzzy Logic-Theory and Applications*",Prentice Hall, 1995.
3. James A. Freeman and David M. Skapura, "*Neural Networks Algorithms, Applications, and Programming Techniques*", Pearson Edn., 2003.
4. Mitchell Melanie, "*An Introduction to Genetic Algorithm*", Prentice Hall, 1998.
5. David E. Goldberg, "*Genetic Algorithms in Search, Optimization and Machine Learning*", Addison Wesley, 1997.

CS 515

PARALLEL COMPUTER ARCHITECTURE

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Parallel Computer Architecture : Trends, Convergence of Parallel Architecture, Fundamental Design Issues.

Programming for Performance : Partitioning for Performance, Data Access and Communication in a Multi memory System., Implications for Programming Models.

UNIT-II

Shared Memory Multiprocessors : Cache Coherence, Memory Consistency, Design Space for Snooping Protocols, Assessing, Assessing Protocol Design Trade-offs, Synchronization, Implications for Software.

Snoop-Based Multiprocessor Design : Correctness Requirements, Multilevel Cache Hierrarchies, Split-Transaction Bus, Extending Cache Coherence.

UNIT-III

Directory-Based Cache Coherence : Scalable Cache Coherence, Overview of Directory Based approaches, Assessing Directory Protocols and Trade-Offs, Design Challenges for Directory Protocols, Memory-Based Directory Protocols, Cache-Based Directory Protocols.

UNIT-IV

Interconnection Network Design : Basic Definitions, Basic Definitions, Basic Communication Performance, Organizational Structure, Interconnection Topologies, Evaluating Design Trade Offs in Network Topology, Routing, Switch Design, Flow Control, Case Studies.

UNIT -V

Latency Tolerance : Overview of Latency Tolerance, Latency Tolerance in Explicit Message Passing, Latency Tolerance in a Shared Address Space, Block Data Transfer in a Shared Address Space, Proceeding Past Long-Latency Events, Pre communication in a Shared Address Spact-, Multithreading in a Shared Address Space, Lockup-Free Cache Design.

Suggested Reading :

1. Id. Culler, Jaswinder Pal Singh and Anoop Gupta, "Parallel Computer Architecture Kaufmann, Elsevier Science, India, 2002.
2. Kai Hwang, "Advanced Computer Architecure", McGraw Hill, 1999.
3. John L. Hennessy & David Patterson, 'Computer Architecture A Quantitative Approach", Morgan Kaufmann Publishers, Inc 1996.

CS 516 MULTIMEDIA TECHNOLOGIES

Instruction	3 periods per week
Duration	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Media and Data Streams: Properties of multimedia systems, Data streams characteristics: Digital representation of audio, numeric instruments digital interface Bark concepts, Devices, Messages, Timing Standards Speech generation, analysis and transmission.

UNIT-II

Digital Image: Analysis, recognition, transmission.

Video: Representation, Digitalization transmission

Animations: Basic concepts, animation languages, animations control transmission

UNIT-III

Data Compression Standards: JPEG, H-261, MPEG DVI

Optical storage devices and Standards: WORHS, CDDA, CDROM, CDWO, CDMO.

Real Time Multimedia, Multimedia file System.

UNIT-IV

Multimedia Communication System: Collaborative computing session management, transport subsystem, QOS, resource management.

Multimedia Databases: Characteristics, data structures, operation, integration in a database model.

A Synchronization: Issues, presentation requirements, reference to multimedia synchronization, MHEG

UNIT-V

Multimedia Application: Media preparation, Composition, integration communication, consumption, entertainment.

Suggested Reading:

1. Ralf Steninmetz, Klara Hahrstedt, “Multimedia: Computing, communication and Applications PH-PTR Innovative Technology Series”.
2. John F.Koegel Bufford, “Multimedia System”, Addison Wesley, 1994.
3. Mark Elsom – Cook, “Principles of Interactive Multimedia “, Tata Mc-Graw Hill, 2001.
4. Judith Jefcoate, “Multimedia in Practice: Technology and Application “, PHI 1998.

CS 517

EMBEDDED SYSTEMS

Instruction	3 periods per week
Duration	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Introduction to Embedded Systems, Characteristics and quality attributes of Embedded Systems Challenges in Embedded System Design, Application and Domain specific Embedded Systems.

UNIT –II

Embedded System Architecture: Instruction Set Architecture, CISC and RISC instruction set architecture, Basic Embedded Processor/Microcontroller Architecture, C1SE Examples- Motorola (68HCI1), RISC Example- ARM, DSP Processors, Harvard Architecture Microcontroller Example - PIC.

UNIT -III

Embedded Hardware Design and Development : VLSI and Integrated Circuit Design, EDA tools, usage of ED A tools and PCB layout. Embedded firmware and Design and Development : Embedded Firmware Design Approaches and Development languages and Programming in Embedded in C.

UNIT -IV

Operating System for Embedded System: Real Time Operating Systems Based Embedded System Design, Introduction to Embedded Systems Design with Micro C/OS- II and Yx Works. Performance Issues of an Embedded System: CPU Performance, Analysis and Optimization of CPU Power Consumption, Program Execution Time, Energy and Power, Program Size. .

UNIT-V

Embedded Systems Development Environment : IDE, Cross Compilation, Disassembler, Simulators, Emulators and Debugging, Target Hardware Debugging, Boundary Scan. Product Enclosure Design and Development Tools, Embedded Product Development Life Cycle- Different phases and Approaches' of EDLC. Trends in Embedded Industry.

Suggested Reading:

1. Shibu K V "Introduction to Embedded Systems" , Tata McGraw HilI,2010.
2. Raj Kamal, "Embedded Systems Architecture, Programming & Design", Tata McGraw Hill, 2010.
3. Dr K.V.K.K. Prasad, "Embedded/Real time Systems: Concepts, Design and Programming". Dreamtech Press, 2004.

CS-518 **DATA MINING**

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Introduction : Challenges – Origins of Data Mining and Data mining Tasks

Data :Types of Data Quality – Data Preprocessing – Measures of similarity and Dissimilarity OLAP and Multidimensional Data Analysis.

UNIT-II

Classification : Preliminaries – General Approach to Solving a Classification Problem – Decision Tree Induction- Model Over fitting – Evaluating the Performance of a Classifier - Methods of Comparing Classifiers- Rule – Based Classifier.

UNIT-III

Classification : Nearest-Neighbor classifiers – Bayesian Classifiers – Artificial Neutral Networks – Support Vector Machine – Ensemble Methods – Class Imbalance Problem – Multiclass Problem.

UNIT-IV

Association Analysis : Problem Definition – Frequent Item Set Generation – Rule Generation – Compact Representation of frequent Item Sets – Alternative Methods for Generating Frequent Item Sets – FP-Growth Algorithms – Evaluation of Association patterns – Effect of Skewed Support Distribution – Handling Categorical Attributes a Handling Continuous Attributes - Handling a concept Hierarchy.

UNIT-V

Cluster Analysis : Overview – k-means –Agglomerative Hierarchical Clustering – DBSCAN Cluster evaluation on Characteristics of Data, Clusters, and Clustering Algorithms.

Suggested Reading:

1. Pang-Ning Tan Michael Steinbach, Vipin kumar, *"Introduction to Data Minings "*,Pearson Education.2008.
2. K.P. Soman, Shyam Diwakar, V.Ajay, *"Insight into Data Mining Theory and Practice* , PHI.2010.
3. Arun K Pujari, *"Data Mining Techniques "*, University Press,2nd Edn, 2009.
4. Vikram Pudi P.Radha Krishna, *"Data Minings"*,Oxford University Press, Ist edition,2009.
5. S Sumathi, S N Sivanandam. *"Introduction to Data Mining and its Applications"*,Springer.2006

CS-519 PERFORMANCE EVALUATION OF COMPUTER SYSTEMS

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Fundamentals: Need for performance evaluation - Role of performance evaluation - Performance evaluation methods - Performance metrics and Evaluation criteria - CPU and I/O architectures - Distributed and Network architectures - Secondary storage - Topologies - Computer architecture – Fundamental concepts and performance measures.

UNIT-II

Probability and Stochastic Processes: Scheduling algorithms - Workloads - Random variables – Probability distributions - Densities -Expectation - Stochastic processes - Poisson process - Birth death process - Markov process. Discrete Time Markov chains (DTMC) - Bayes theorem - Conditional probability - Total probability - Discrete and Continuous random variables - Common distributions - Probability generating functions (PGF) and Laplace Transforms (LST) numerous examples from computer networking.

UNIT-III

Queuing Theory: Queuing systems - Networks of queues - Estimating parameters and Distributions - Computational methods - Simulation process - Time control - Systems and Modeling.

UNIT-IV

Petrinets and System Performance: Petri nets - Classical petri nets - Timed petri nets - Priority-based petri nets - Colored petri nets - Generalized petri nets - Tool selection - Validation of results - Performance metrics - Evaluation - Multiple server computer system analysis.

UNIT-V

Analysis: OS components - System architecture - Workloads - Design - Simulation - Analysis - Database system performance - Computer networks components - Simulation modeling of LAN.

Suggested Reading:

1. Paul J. Fortier. Howard E. Michael, "*Computer Systems Performance Evaluation and Prediction*". Elsevier Science, 2003.
2. Thomas G. Robertazzi, "*Computer Networks and Systems Queing theory and Performance Evaluation*", 3rd edition, Springer, 2000.
3. Domenico Ferrari. Giuseppe Serazzi and Alexandra Zeijher, "*Measurement & Tuning of Computer Systems* ", Prentice Halllnc, 1983.
4. Michael F. Mories and Paul F. Roth, "*Tools and techniques Computer Performance Evaluation*", Van Nostrand. 1982.
5. K.Kant and M.M.Srinivasan. "*Introduction to computer system performance Evaluation*", McGraw Hill, 1992.
6. Herbert Hellerman and Thomas F.Conroy, "*Computer system performance*", McGraw -Hill, 1992.

CS 531

With effect from Academic Year 2014-2015

SOFTWARE LAB - I
(Advanced Algorithms and DOSE Lab)

Algorithms :

1. Shortest Path
2. Minimal Spanning Tree
3. String and Pattern matching
4. Network Flow

OOSE : A Case study using case tool supporting UML.

Note : The students have to submit a report at the end of the semester.

CS 532

SEMINAR - I

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for systematic independent study of state of the art topics in broad area of his/her specialization.

Seminar topics can be choosen by the students with the advice from the faculty members. Students are to be exposed to following aspects of seminar presentations.
Literature survey
Organization of material
Preparation of OHP slides / PC Presentation
Technical writing

Each student is required to

1. Submit one page of synopsis of the seminar talk two days before for display on notice board.
2. Give 20 minutes presentation through OHP, PC and Slide projector followed by 10 minutes discussion.
3. Submit a report on the seminar topic with a list of references and slides used within a week.

Seminars are to be scheduled from the 3rd week of the last week of the semester and any change in schedule should be discouraged.

The sessional marks will be awarded to the students by atleast 2 faculty members on the basis of an oral and a written presentation as well as their involvement in the discussion.

CS 561

NETWORK SECURITY

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Introduction: Attributes of Security, Integrity, Authenticity, Non-repudiation, Confidentiality Authorization, Anonymity, Types of Attacks, DoS, IP Spoofing, Replay, Man-in-the-Middle attacks General Threats to Computer Network, Worms, Viruses, -Trojans

UNIT-II

Secret Key Cryptography : DES, Triple DES, AES, Key distribution, Attacks

Public Key Cryptography: RSA, ECC, Key Exchange (Diffie-Hellman), Java Cryptography Extensions, Attacks

UNIT-III

Integrity, Authentication and Non-Repudiation : Hash Function (MD5, SHA5), Message Authentication Code (MAC), Digital Signature (RSA, DSA Signatures), Biometric Authentication.

UNIT-IV

PKI Interface : Digital Certificates, Certifying Authorities, PGP Key Interface, System Security using Firewalls and VPN's.

Smart Cards : Application Security using Smart Cards, Zero Knowledge Protocols and their use in Smart Cards, Attacks on Smart Cards

UNIT-V

Applications: Kerberos, Web Security Protocols (SSL), IPSec, Electronic Payments, E-cash, Secure Electronic Transaction (SET), Micro Payments, Case Studies of Enterprise Security (.NET and J2EE)

Suggested Reading:

1. William Stallings, "Cryptography and Network Security", 4th Edition. Pearson,. 2009.
2. Behrouz A Forouzan, "Cryptography and Network Security" , TMH, 2009
3. Joseph Migga Kizza, "A Guide to Computer Network Security", Springer, 2010
4. Dario Cataiano, "Contemporary Cryptology", Springer, 2010.

CS 562

MACHINE LEARNING

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Introduction: Learning, Types of Machine Learning.
Concept learning: Introduction, Version Spaces and the Candidate Elimination Algorithm. **Learning with Trees:** Constructing Decision Trees, CART. Classification Example

UNIT-II

Linear Discriminants: The Perceptron, Linear Separability, Linear Regression

Multilayer Perceptron (MLP): Going Forwards, Backwards, MLP in practices, Deriving back Propagation SUPPORT Vector Machines: Optimal Separation, Kernels

UNIT-III

Some Basic Statistics: Averages, Variance and Covariance, The Gaussian, The Bias-Variance Tradeoff Bayesian learning: Introduction, Bayes theorem. Bayes Optimal Classifier, Naive Bayes Classifier.

Graphical Models: Bayesian networks, Approximate Inference, Making Bayesian Networks, Hidden Markov Models, The Forward Algorithm.

UNIT-IV
Evolutionary Learning: Genetic Algorithms, Genetic Operators, Genetic Programming Ensemble learning: Boosting, Bagging
Dimensionality Reduction: Linear Discriminant Analysis, Principal Component Analysis

UNIT-V
Clustering: Introduction, Similarity and Distance Measures, Outliers, Hierarchical Methods, Partitional Algorithms, Clustering Large Databases, Clustering with Categorical Attributes, Comparison
Suggested Reading:

1. Tom M. Mitchell, 'Machine Learning " , MC Craw Hill, 1997
2. Stephen Marsland, "Machine Learning - An Algorithmic Perspective', CRC Press, 2009
3. Margaret H Dunham, "Data Mining". Pearson Edition., 2003.
4. Galit Shmueli, Nitin R Patel, Peter C Bruce, "Data Mining for Business Intelligence". Wiley India Edition, 2007
5. Rajjan Shinghal, "Pattern Recognition", Oxford University Press, 2006.

CS 563

GRID COMPUTING

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Introduction to Grid Computing : Grid Computing Concept, History of Distributed Computing Computational Grid Applications, Grid Computing Infrastructure Development, Grid Computing Software Interface

Job Submission : Introduction, Globus Job Submission. Transferring Files

UNIT-II

Schedulers: Scheduler Features, Scheduler Examples, Grid Computing Meta-Schedule Distributed Resource Management Application (DRMAA)

Security Concepts: Introduction, Symmetric Key Cryptography, Asymmetric Key Cryptography (Public Key Cryptography), Public Key Infrastructure. Systems/Protocols Using Security Mechanisms

Grid Security: Introduction, Grid Security Infrastructure (GSI). Delegation, Higher-Level Authorization Tools

UNIT-III

System Infrastructure I : Web Services: Service-Oriented Architecture, Web Services and Service Implementation

System Infrastructure II : Grid Computing Services: Grid Computing and Standardization Bodies Interacting Grid Computing Components, Open Grid Services Architecture (OGSA), WSRF,

User-Friendly Interfaces : Introduction Grid Computing Workflow Editors, Grid Portals

UNIT-IV

Grid-Enabling Applications: Introduction, Parameter Sweep, Using an Existing Program on Multiple Grid Computers, Writing an Application Specifically for a Grid, Using Multiple Grid Computers to Solve a Single Problem

UNIT-V

Case Studies:

Globus : Overview of Globus Toolkit 4, Installation of Globus, GT4 Configuration; Main Components and programming Model ,Using Globus

gLite : Introduction ,Internal Workings of gLite ,Logging and Bookkeeping (LB) , Security Mechanism Using gLite

Resource management using Gridway and Gridbus

Scheduling using Condor, SGE, PBS, LSF Grid scheduling with QoS.

Suggested Reading:

1. Barry Wilkinson, "Grid Computing Techniques and Applications", CRC Press, 2010.

2. Frederic Magoules, ; lie Pan, Kiat.-An Tan, Abhinit Kumar, "Introduction to Grid Computing" CRC Press 2009'.

3. Vladimir Silva, "Grid Computing for Developers", Dreamtech Press, 2006.

4. Ian Foster, carl Kesselman, "The Grid 2 :: Blueprint for a new computing Infrastructure", Elsevir Series, 2004

5. Fran Berman. Geoffrey Fox, Anthony J.G Hey. "Grid Computing: Making the Global Infrastructure a Reality", Wiley, 2003.

6. Joshey Joseph, Craig Fellenstein, "Grid computing", IBM Press, 2004.

CS 564

INFORMATION RETRIEVAL SYSTEMS

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-1

Introduction

Retrieval Strategies: Vector Space Model, Probabilistic Retrieval Strategies

Language Models: Simple Term Weights. Non Binary Independence Model

UNIT-II

Retrial Utilities: Relevance Feedback, Clustering. N-grams, Regression Analysis. Thesauri

UNIT-III

Retrieval Utilities: Semantic Networks, Parsing

Cross-language Information Retrieval: Introduction, Crossing the Language Barrier

UNIT-IV

Efficiency : Inverted Index, Query Processing, Signature Files. Duplicate Document Detection

UNIT V

Integrating Structured Data and Text: A Historical Progression, Information Retrieval as a Relational Application. Semi-Structured Search using a Relational Schema.

Distributed Information Retrieval: A Theoretical Model of Distributed Retrieval, Web Search

Suggested Reading:

1. David A. Grossman, Ophir Frieder. "Information Retrieval - Algorithms and Heuristics" Springer, 2nd Edition (Distributed by Universities Press), 2004.
2. Christopher D. Manning, Prabhakar Raghavan, Hinrich SchUtze, "An Introduction to Information Retrieval", Cambridge University Press, Cambridge, England, 2009.
3. Gerald J Kowalski, Mark T Maybury, "Information Storage and Retrieval Systems", Springer, 2000

With effect from Academic Year 2014-2015

CS 565

NATURAL LANGUAGE PROCESSING

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Introduction
Elementary Probability Theory
Essential Information Theory

UNIT-II

Linguistic Essentials Corpus-Based Work

UNIT-III

Collocations.
Statistical Inference: Bins: Forming Equivalence Classes, Reliability vs. Discrimination, n-gram models, Building ngram models, An Information Theoretic Approach.
Word Sense Disambiguation: Methodological Preliminaries, Supervised and unsupervised learning, Pseudo words. Upper and lower bounds on performance, Supervised Disambiguation, Bayesian classification.

UNIT-IV

Evaluation Measures

Markov Models: Hidden Markov Models, Use, General form of an HMM

Part-of-Speech Tagging

UNIT-V

Probabilistic Context Free Grammars: Introduction

Clustering

Information Retrieval: Background, The Vector Space Model

Suggested Reading:

1. Christopher D. Manning, Hinrich Schutze, "Foundations of Statistical Natural Language Processing", The MIT Press, 1999.

2. James Allan, "Natural Language Understanding", Pearson Education, 1994.

3. Tanveer Siddiqui, US Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

CS-566 SOFTWARE QUALITY & TESTING

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Software Quality, Quality Management, Software Quality Metrics, Product Quality Metrics, In Process Quality Maintenance, Examples.

UNIT - II

Quality tools in Software Development, Seven Basic Tools, Check List, Pareto Diagram, Histogram, Run Charts, Scatter Diagram, Control Chart, Cause and Effect Diagram, Defect Removal, Effect Removal Effectiveness, Quality Planning, Cost Effectiveness of Phase Effect Removal.

UNIT - III

Software Testing Background, Software Development Process, Realities of Software Testing, Examining the Specification, Testing the Software with Blinders on Examining the Code, Testing the Software with X-ray.

UNIT - IV

Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Website Testing, Automated Testing and Test Tools Bug Bashes and Beta Testing.

UNIT - V

Planning Your Test Effort, Writing and Tracking Test Cases, Reporting Measuring SQA.

Suggested Reading:

1. Stepen H. Khan, "*Metrics and Models in Software Quality Engineering*", Pearson Education, India,1995.
2. Ron Patton, "*Software Testing*", Sams Pubishing, 2001.
3. Boris Beizzer, "*Software Testing Techniques*", Sams Pubishing, 2001.
4. Allan Gilles, "*Software Quality Theory And Management*", Thomson International Press, 1997.

CS567 SOFTWARE ENGINEERING FOR REAL TIME SYSTEMS

Instruction	3 periods per week
Duration	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

I**ntroduction:** Review of Software Engineering Concepts, Characteristics of Real Time Systems, Importance of including Time Factor, The Real Time System Life Cycle: Requirement Specifications, State Charts.

UNIT-II

Structured Design Approaches: Event Based Model, Process-Based Structured Design, Graph-Based Theoretical Model, Petri Net Models: Stochastic Petri Net (SPN) Model Analysis, Annotated Petri Nets, Time-Augmented Petri Nets, Assessment of Petri Net Methods.

UNIT-III

Axiomatic Approaches: Weakest Precondition Analysis, Real Time Logic, Time Related History variables, State Machines and Real-Time Temporal Logic.

UNIT-IV

Language Support Restrictions: Real-Time Programming Descipline, Real-Time Programming Languages, Schedulability Analysis.

UNIT-V

Verification and Validation of Real-Time Software: Testing Real Time Properties, Simulation as Verification Tool, Testing Control and Data Flow, Proof Systems, Operational Approach.

Suggested Reading:

1. Shem – Tow Levi and Ashok K. Agarwal, “Real Time System Design”, McGraw Hill International Editions, 1999.
2. Cooling J.E. Jim Cooling, “ Software Engineering for Real Time Systems” Addison Wesly,2002

With effect from the academic year 2014-2015

CS-568 CLOUD COMPUTING

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

The Evolution of Cloud Computing: Hardware Evolution, Internet Software Evolution, Establishing a Common Protocol for Internet, Evolution of IPv6, Finding a common method to Communicate Using the Internet Protocol, Building a Common Interface to the Internet.

Cloud Formations: From One Computer to the Grid of Many, Server Virtualization, Parallel Processing, Symmetric Multiprocessing Systems, Massively Parallel Processing Systems.

UNIT II

Web services and the cloud: Communication-as-a-Service(CaaS), Infrastructure-as-a-Service(IaaS), Monitoring-as-a-Service(MaaS), Platform-as-a-Service(PaaS0,Software-NIS-a-Service(SaaS)

Building Cloud Networks: The Evolution from the MSP Model to cloud, Computing and Software-as-a-Service, The cloud Data Center, Collaboration i. Service-Oriented Architectures as a Step Toward Cloud Computing, Basic Approach to a Data Center-Based SOA

The Role of Open Source Software in Data Centers, Where Open Source Software Is Used Case Studies: Amazon web services, Google App Engine.

UNIT III

Virtualization: Introduction, types and technologies, Accomplishing Virtualization, importance of virtualization in Cloud Computing,

Case studies: Xen Virtual machine monitor-Xen API, VMware- VMware products- VMware Features, Microsoft Virtual Server-Features of Microsoft Virtual server

UNIT IV

Federation in the Cloud, Presence in the Cloud I Privacy and Its Relation to Cloud-Based Information System.

Cloud Security Challenges I Software-as-a-Service Security I Security-as-a-Service, the New MSSP.

UNIT V

Common Standards in Cloud Computing: The Open Cloud Consortium, The Distributed Management Task Force, Standards of Application Developers I Standards for messaging, Internet Messaging Access.

Protocol(IMAP) I Standards for Security.

Examples of End-User Access to Cloud Computing.

Mobile Internet Devices and the Cloud: Mobile Operating Systems for Smartphones.

Mobile Platform Virtualization I Collaboration Applications for Mobile Platforms.

Suggested Reading:

1. John W. Rittinghouse, "*Cloud Computing: Implementation, Management, and Security*", James F. Ransome, CRC Press 2009.
2. Virtualization Specialist level complete Cirtification kit-Study gude from www.theartofservice.org
3. William von Hagen, "*Proffessional Xen Virtualization*", Wrox Publications, january, 2008.
4. Chris Wolf, Erik M. Halter, "*Virtualization: From the Desktop to the Enterprise*", Apress, 2005.
5. David Marshall, Wade A. Reynolds. "*Advanced Server Virtualization: VMWare and Microsoft Platform in Virtual Data Center*", Auerbach Publications, 2006.

Web resources:

1. http://aws.amazon.com
2. http://code.google.com/appsengine

CS-569 **With effect from the academic year 2014-2015**

WEB ENGINEERING

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Web Engineering: Concepts and Reference Model

Web Engineering: Introduction and Perspectives, Web Engineering Resources Portal (WEP): A Reference Model and Guide

UNIT-II

Web Application Development: Methodologies and Techniques, Web Application Development Methodologies, Relationship Analysis: A Technique to Enhance Systems Analysis for Web Development, Engineering Location-Based Services in the Web.

UNIT-III

Web Metrics and Quality: Models and Methods.

Architectural Metrics for E-Commerce: A Balance between Rigor and Relevance, The eQual Approach to the Assessment of E-Commerce Quality: A Longitudinal Study of Internet Bookstores, Web Cost Estimation: An Introduction

UNIT-IV

Web Resource Management: Models and Techniques.

Ontology-Supported Web Content Management, Design Principles and Applications of XRML.

UNIT-V

Web Maintenance and Evolution: Techniques and Methodologies.

Program Transformations for Web Application Restructuring, The Requirements of Methodologies for Developing Web Applications. A Customer Analysis-Based Methodology for Improving Web Business Systems.

Suggested Readings:

1. Woojong Suh, "*Web Engineering Principles and Techniques"*, Idea Group Publications 2005.

WITH EFFECT FROM THE ACADEMIC YEAR 2014–2015

CS 570

SEMANTIC WEB

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessionals	20 Marks

UNIT I

The Future of the Internet: Introduction, The Syntactic Web, The Semantic Web, The working Semantic Web. **Ontology in Computer Science:** Defining the Term Ontology, Differences among Taxonomies, Thesauri, and Ontologies, Classifying Ontologies, Web Ontologies, Web Ontology Description Languages, Ontology, Categories, and Intelligence.

UNIT II

Knowledge Representation in Description Logic: Introduction, an Informal Example, the Family of Attributive Languages, Inference Problems. **RDF and RDF Schema:** Introduction, XML Essentials, RDF, RDF Schema, A Summary of the RDF/RDF Schema Vocabulary.

UNIT III

OWL: Introduction, Requirements for Web Ontology Description Languages, Header Information, Versioning, and Annotation Properties, Properties, Classes, Individuals, Data types, A Summary of the OWL Vocabulary. **Rule Languages:** Introduction, Usage Scenarios for Rule Languages, Datalog, RuleML, SWRL, TRIPLE. **Semantic Web Services:** Introduction, Web Service Essentials, OWL-S Service Ontology, An OWL-S Example.

UNIT IV

Methods for Ontology Development: Introduction, Uschold and King Ontology Development Method, Toronto Virtual Enterprise Method, Methontology, KACTUS Project Ontology Development Method, Lexicon-Based Ontology Development Method, Simplified Methods. **Ontology Sources:** Introduction, Metadata, Upper Ontologies, Other Ontologies of Interest, Ontology Libraries. **Semantic Web Software Tools:** Introduction, Metadata and Ontology Editors, Reasoners, Other tools.

UNIT V

Software Agents: Introduction, Agent Forms, Agent Architecture, Agents in the Semantic web Context. **Semantic Desktop:** Introduction, Semantic Desktop Metadata, Semantic Desktop Ontologies, Semantic Desktop Architecture, Semantic Desktop Related Applications. **Ontology Application in Art:** Introduction, Ontologies for the Description of Works of Art, Metadata Schemas for The Description of Works of Art, Semantic Annotation of Art Images.

SUGGESTED READING:

1. Semantic Web Concepts: Technologies and Applications, Karin K. Breitman, Marco Antonio Casanova and Walter Truszowski, Springer.

2. Information Sharing on the Semanting Web, Heiner Stuckenschmidt, Frank van Harmelen, Springer.

3. Semantic Web Primer, Grigoris Antoniou, Frank Van, third Edition, MIT Press.

4. Semantic Web Services: Concepts, Technologies and Applications, Rudi Studer, Stephan Grimm, Andrees Abeker, Springer.

5. Towards the Semantic Web: Ontology Driven Knowledge Management, John Davis, Dieter Fensal, Frank Van Harmelen, J. Wiley.

With effect from the academic year 2014-2015

CS 571

NEURAL NETWORKS

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT -I

Introduction: Concept of a Neural Network. Human Brain. Models of a Neuron. Neural Networks Viewed as Directed Graphs. Feedback. Neural Network Architectures. Knowledge Representation. Artificial Intelligence and Neural Networks. History of Neural Networks.

UNIT-II

Learning processes: Introduction. Error-Correction Learning. Memory-Based Learning. Hebbian Learning, Competitive Learning. Boltzmann Learning. Credit Assignment Problem. Learning with a Teacher. Learning without a Teacher.

UNIT-III

Single Layer Perceptrons: Introduction. Least-Mean-Square Algorithm. Learning Curves. Learning Rate Annealing Schedules Perceptron. Perceptron Convergence Theorem.

UNIT-IV

Multilayer Perceptrons: Introduction. Some Preliminaries. Back-Propagation Algorithm. Summary of the. Back-Propagation Algorithm. XOR Problem. Virtues and limitations of Back-Propagation learning.

UNIT -V

Neurodynamics' Introduction. Dynamical Systems. Stability of eqilibrium States. Attractors Neurodynamical Models. Manipulation of Attractors as a Recurrent Network Paradigm. Hopfield Models. Cohen-Grossberg Theorem.

Suggested Reading :

1. Simon Haykin: "Networks Networks - A Comprehensive Foundation", Pearson Education 2nd Edition, 2001.

2. Jacek M.Zurada "Introduction to Artificial Neural Systems", Jaico Publishing House.

With effect from the academic year 2014-2015

CS 572

PARALLEL ALGORITHMS

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Introduction to Parallel Algorithms and Architectures - Approaches to Design of Parallel Algorithms, Architectural Constraints and Design of Parallel Algorithms, Performance Measures of Parallel Algorithms

UNIT-II

Parallel Design Strategies - Parallel Prefix. Computations, Pointer Jumping, Matrix Operations in Parallel.

UNIT-III

Parallel Sorting - Issues in Sorting on Parallel Computers, Sorting Networks, Bubble Sort and its Variants, Quicksort, Bucket and Sample Sort.

UNIT-IV

Parallel Graph Algorithms - Definitions and Representations, Minimum Spanning Tree: Prim’s Algorithm, Single Source Shortest Path - Dijkstra's Algorithm, All pairs shortest path algorithms, Algorithms for Sparse Graphs.

UNIT-V

Search Algorithms for Discrete Optimization Problems - Definitions, Sequential search Algorithms, Search Overhead Factor, Parallel Depth first Search Parallel Breadth first Search, Speedup factors in Parallel Search Algorithms.

Suggested Reading:

I. Kenneth A. Berman and Jerome Paul "Algorithms " , Cengage Learning, 2002.

2. Ananth grama and Anshul Gupta "Introduction to Parallel Computing", Pearson Education Second Edition, 2004.

CS-573 **With effect from the academic year 2014-2015**

SIMULATION AND MODELING

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Introduction to simulation: Advantages & Dis-advantages of simulation – Areas of applications, Systems and Systems Environment, Concept of a system, Discrete & Continuous system – Models, types of models, Steps in a simulation study – Examples, Discrete – Event System simulation.

UNIT-II

Overview of Statistical Models and Queuing Systems, Programming languages for Simulation: Continuous and Discrete Simulation Languages – FORTAN, GPSS, SIMAN, SIMSCRIPT, SLAM and MODSIM.

UNIT-III

Random Numbers: Generation, Properties of Random Numbers, Generation of Pseudo Random Numbers, Tests for Random Numbers. **Random Variate:** Generation, Inverse Transformation Technique, Uniform Distribution, Exponential Distribution, Weibul's Distribution, Triangular Distribution, Empirical Continuous Distribution, Discrete Distributions, Direct Transformation for the Normal Distribution, Convolution Method of Erlang Distribution, Acceptance Rejection Techniques: Poisson Distribution, Gamma Distribution.

UNIT-IV

Input Data Analysis: Data Collection: Identify the Distribution, Parameter and Estimation.

Goodness of fit tests: Chi-Square Test – KS Test; Multivariate and time series input models, Verification and Validations of Simulation Models, Model Building, Verification and Validation: Verification of Simulation Models, Calibration and Validation of Models, face validity, Validation of Model Assumptions. Validation Input/output Transformations, Input/output Validation using Historical Input Data, Input/output Validation Sing Turning Test.

UNIT-V

Output Data Analysis, Stochastic, Nature of output data, Types of Simulation with respect to output Analysis, Measures of Performance and their Estimation, output Analysis for Terminating Simulations, Output Analysis for steady – State Simulations. **Comparison and Evaluation of Alternative System Designs:** Comparison of several system Designs, Statistical Models for Estimating the Effect of Design Alternatives

Suggested Reading:

1. Jabey Banks, John S. Cansen and Barry L. Nelson, "*Discrete – Event System Simulation*", Prentice Hall of India, 2001.
2. Nursing Deo, "*System Simulation with Digital computer*", Prentice Hall of India, 1979.
3. Anerill M. Law and W. David Kelton, "*Simulation Modelling and Analysis*", McGraw Hill. 2001.

With effect from the academic year 2014-2015

CS-574 SOFTWARE PROJECT MANAGEMENT

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Conventional Software Management, Evolution of Software Economics, Improving Software Economics, Old Way & New.

UNIT-II

Life – Cycle phases, Artifacts of the process, Model Based Software Architectures, Workflows of the Process, Checkpoints of the process.

UNIT-III

Iterative Process Planning, Project Organizations & Responsibilities, Process Automation, Project Control of Process Instrumentation, Tailoring the Process.

UNIT-IV

Modern Project profiles, Next Generation Software Economics, Modern process Transitions, Managing Contacts, Managing People & Organizing Terms.

UNIT-V

Process improvement & mapping to the CMM, ISO 12207 – an overview, programme management.

Suggested Reading:

1. Walker Royce, "*Software Project Management – A Unified frame work*", Pearson Education, Addision, 1998, .
2. Bob Hughes, Mike Cotterell "*Software Project Management*" , Tata Mc Graw Hill 3rd Edition, 2010.
3. Watt.S. Humphery, " *Managing Software Process* ", Addison - Wesley, 2008.

CS 575

IMAGE PROCESSING

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Image Formation and Description : Digital Image Representation - Elements of Visual Perception. Sampling & Quantization. Elements of Digital Image Processing Systems.

UNIT-II

Image Transforms : Digital Image Transforms - Fourier Transform, Extension to 2D, DCT, Walsh, Hadamard Transforms.

UNIT-III

Image Enhancements and Segmentation : Histogram Modification. Image Somoothing - Image Smoothing - Image Sharpening, Thresholding. Edge Detection. Segmentation. Point and Region Dependent Techniques.

UNIT-IV

Image Encoding : Fidelity Criteria. Transform Compression. K.L. Fourier, DCT, Spatial Compression. Run length Coding. Huffman Coding, Contour Coding.

UNIT-V

Restoration : Restoration Models, Inverse Filtering, Least Squares Filtering, Recursive Filtering.

Suggested Reading :

1. Gonzalez R.D., Woods R.E. "Digital Image Processing", Addison Wesley, 1992.

2. Rosenfeld A, Kak AC, "Digital Picture Processing", Vol. I & II, Acad. Press, 2nd ed. 1982.

3. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing and Analysis and Machine Vision", 2nd Edition, Thomson Learning, 1999.

CS-576 **With effect from the academic year 2014-2015**

SOFTWARE REUSE TECHNIQUES

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Software Reuse Success Factors
Reuse Driven Software Engineering Business
Object Oriented Software Engineering
Applications and Component Subsystem
Use case Components
Object Components

UNIT-II

Design Patterns: Introduction

Creational Patterns: Factory, Factory Method, Abstract Factory, Singleton, Builder Prototype.

UNIT-III

Structural Patterns: Adapter, Bridge, Composite, Decorator, Fiacade, Flyweiht, Proxy.

Behavioral Patterns: Chain of Responsibility, Command, Interpreter.

UNIT-IV

Behavioral Patterns: Iterator, Mediator, Momento, Observer, Stazte, Strategy, Template, Visitor, Other Design Pattern: Whole Part, Master-Slave, View Handler-Reciever, Client-Dispatcher-Server, Publisher-Subscriber.

UNIT-V

Architectural Patterns: Layers, Pipes and Filters, Black Board, Broker, Model View Controller.

Presentation: Abstraction-Control, Micro Kernet, Reflection.

Suggested Reading:

1. Ivar Jacobson, Martin Griss, Patrick Kohnson "*Software Resue. Architecture, Process and Organisation for Business for Business Success"*, ACM Press, 1997.
2. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides "*Design Patterns*", Addison, 1995, Pearson Education,
3. Frank Buschmann etc. – Pattern Oriented Software Architecture – Volume 1, Wiley 1996.
4. James W Cooper "*Java Design Patterns, A Tutorial*", Addison 2000, Pearson Education

With effect from academic year 2014-15

CS577 RELIABILITY AND FAULT TOLERANCE

Instruction	3 periods per week
Duration	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Introduction to Reliability Engineering:
Reliability, Repairable and Non-repairable Systems, Maintainability and Availability, Designing, Reliability, Repairable and Non-repairable Systems, MTBF MTBF, MTTF MDT, k out of in systems.

UNIT-II

Software Reliability:
Software Reliability, Software Reliability Vs Hardware Reliability, Failures and Faults, Classification of Failures, Counting, System configuration, Components and Operational Models, Concurrent Systems, Sequential Systems, Standby Redundant Systems.

Software Reliability Approaches:
Fault Avoidance, Passive Fault Detection, Active Fault Detection, Fault Tolerance, Fault Recovery, Fault Treatment.

UNIT-III

Software Reliability Modeling:
Introduction to Software Reliability Modeling, Parameter Determination and Estimation, Model Selection, Markovian Models, Finite and Infinite failure category Models, Comparison of Models, Calendar Time Modeling.

UNIT-IV

Fault Tolerant Computers: General Purpose Commercial Systems, Fault Tolerant Multiprocessor and VLSI based Communication Architecture.

Design – N – Version programming Recovery Block, Acceptance Tests, Fault Trees, Validation of Fault Tolerant Systems.

UNIT-V

Fault Types: Fault Detection and Containment, Redundancy, Data Diversity, Reversal, Reversal Checks, Obtaining Parameter Values, Reliability Models for Hardware Redundancy, Software Error Models, Checks, Fault /Tolerant Synchronization, Synchronization in Software.

Suggested Reading:

1. John D. Musa, " Software Reliability", McGraw Hill, 1995.
2. Patric D. T. O. Concor, Practical Reliability Engineering", 4th Edition, John Wesley & Sons, 2003.
3. C.M. Krishna, Kang G. Shin, " Real Time Systems", McGraw Hill, 1997.

With effect from academic year 2014-15

CS578 **WEB MINING**

Instruction	3 periods per week
Duration	3 Hours
University Examination	80 Marks
Sessional	20 Marks

UNIT-I

Crawling and Indexing, Topic Directories, Clustering and Classification. Hyperlink analysis. Resource Discovery and Vertical Portals, Structured vs Unstructured Data Mining.

Crawling the web: HTML and HTTP basics, Crawling Basics, Engineering Large Scale Crawlers, Putting Together a crawler

UNTT-II

Web Search and Information Retrieval: Boolean Queries and Inverted index, Relevance Ranking, Similarity Search

Similarity and Clustering: Foundations and Approaches, Bottom-up and Top-Down partition paradigms.

UNIT-III

Supervised learning: Introduction, Overview, of classification strategies, Nearest Neigh Learners, Feature Selection, Bayesian Learners, Discriminative classification, Hypertext classification

UNIT-IV

Expectation Maximization, Labelling Hypertext Graphs, Co-Training

Social Sciences and bibliometry, Page Rank and HITS, Coarse Grained Graph Model, Enhanced Model and Techniques, Evaluation of Topic Distillation.

UNTT-V

Collecting Important Pages, Similarity Search using Link Topology, Topical Locality and Focused Crawling, Discovering Communities.

Future of Web Mining: Information Extraction, Natural Language Processing, Question Answering, Profile, Personalization, and Collaboration.

Suggested Reading:

1. Chakrabarti Soumen, 'Mining the Web: Discovering Knowledge From Hypertext Data", Boston Elsevier, 2003.

2. Manu Konchady, "Text Mining Application Programming" Cengage Learning, 2006.

CS 579

HUMAN COMPUTER INTERACTION

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessionals	20 Marks

UNIT- I

Interaction Paradigms: Computing Environments, Analyzing Interaction Paradigms, Interaction Paradigms

Interaction Frameworks and Styles: Frameworks for Understanding Interaction, Coping with Complexity, Interaction Styles

UNIT- II

Interaction Design Process: Iterative Design, User-Centered Design, Interaction Design Models, Overview of Interaction Design Models

Discovery : Discovery Phase Framework, Collection, Interpretation , Documentation

Design : Conceptual Design, Physical Design, Evaluation, Interface Design Standards, Designing the Facets of the Interface

UNIT- III

Design Principles: Principles of Interaction Design, Comprehensibility, Learnability, Effectiveness/Usefulness, Efficiency/Usability, Grouping, Stimulus Intensity , Proportion , Screen Complexity, Resolution/Closure, Usability Goals

Interaction Design Models: Model Human Processor , Keyboard Level Model, GOMS, Modeling Structure, Modeling Dynamics, Physical Models

Usability Testing: Usability, Usability Test, Design the Test, Prepare for the Test, Perform the Test, Process the Data

UNIT- IV

Interface Components: The WIMP Interface, Other Components

Icons : Human Issues Concerning Icons, Using Icons in Interaction Design, Technical Issues Concerning Icons

Color: The Human Perceptual System, Using Color in Interaction Design, Color Concerns for Interaction Design, Technical Issues Concerning Color

UNIT- V

Text : Human Issues Concerning Text, Using Text in Interaction Design, Technical Issues Concerning Text

Speech and Hearing : The Human Perceptual System, Using Sound in Interaction Design, Technical Issues Concerning Sound

Touch and Movement: The Human Perceptual System, Using Haptics in Interaction Design, Technical Issues Concerning Haptics

Suggested reading:

1. Steven Heim, *The Resonant Interface: HCI Foundations for Interaction Design*, Addison-Wesley, 2007
2. J. Preece, Y. Rogers, and H. Sharp, *Interaction Design: Beyond Human-Computer Interaction*, Wiley & Sons, 2nd Ed., 2007
3. Ben Shneiderman , Catherine Plaisant, Designing the User Interface: Strategies for Effective Human-Computer Interaction, 5th edition, , Addison-Wesley, 2009.

With effect from Academic Year 2014-2015

CS 581

SOFTWARE LAB - II
(Distributed Computing and Advanced Databases)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

DISTRIBUTED COMPUTING :

1. Application Using RPC

2. Application Using CORBA

3. Application Using EJB

4. Application Using XML, SOAP

Advanced Databases : An application involving above technologies and database has to be developed

Note : The students have to submit a report at the end of the semester.

CS 582

SEMINAR -II

Oral presentation is an important aspects of engineering education . The objective of the seminar is to prepare the student for systematic independent study of state of the art topics in broad are his/her specialization.

Seminar topics can be chosen by the students with the advice from the faculty members.

Students are to be exposed to following aspects of seminar presentation.

Literature Survey Organization of material

Preparation of OHP Slides / PC Presentation Technical Writing.

Each Student is required to:

1. Submit one page of synopsis of the seminar talk two days before for display on notice board.
2. Give 20 minutes presentation through OHP, PC and Slide Projector followed by 10 minutes discussion.
3. Submit a report on the seminar topic with a list of references and slides used within a week

Seminar are to be scheduled from the 3rd week to the last week of the semester and any change in schedule should be discouraged.

The sessional marks will be awarded to the students by atleast 2 faculty members on the basis of an oral and a written presentation as well as their involvement in the discussion.