



# **Scheme of Instruction & Syllabi**

## **of**

**M.Tech. (Computer Science & Engineering)**

**(Effective From 2016-2017)**

**Invertis Institute of Engineering & Technology**  
**INVERTIS UNIVERSITY**  
Invertis Village, Bareilly-Lucknow NH-24, Bareilly

### YEAR I, SEMESTER-I

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				SUBJECT TOTAL	Credits
						SESSIONAL EXAM.			E-SEM		
			L	T	P	CT	TA	SUB TOTAL			
1	MCS-101	Advanced Computer Architecture	3	1	0	20	10	30	70	100	4
2	MCS-102	Foundation of Computer Science	3	1	0	20	10	30	70	100	4
3	MCS-103	Advanced Computer networks	3	1	0	20	10	30	70	100	4
4	MCS-104	Distributed Systems	3	1	0	20	10	30	70	100	4
5	MCS-105	Cloud Computing	3	1	0	20	10	30	70	100	4
6	MCS-151	Colloquium & Research Review Paper-I	0	2	0		-	50	-	50	2
<b>Total</b>			15	7	0	-	-	-	-	550	22

### YEAR I, SEMESTER-II

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				SUBJECT TOTAL	Credits
						SESSIONAL EXAM.			E-SEM		
			L	T	P	CT	TA	SUB TOTAL			
1	MCS-201	Advanced Database Systems	3	1	0	20	10	30	70	100	4
2	MCS-202	Parallel Computing	3	1	0	20	10	30	70	100	4
3	MCS-203	Mobile Computing	3	1	0	20	10	30	70	100	4
4	MCS-204	Object Oriented Modeling	3	1	0	20	10	30	70	100	4
5		Elective 1	3	1	0	20	10	30	70	100	4
6	MCS-251	Colloquium & Research Review Paper-II	0	2	0		-	50	-	50	2
<b>Total</b>			15	7	0	-	-	-	-	550	22

### YEAR II, SEMESTER-III

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				SUBJECT TOTAL	Credits
						SESSIONAL EXAM.			E-SEM		
			L	T	P	CT	TA	SUB TOTAL			
1		Elective 2	3	1	0	20	10	30	70	100	4
2		Elective 3	3	1	0	20	10	30	70	100	4
3	MCS351	Colloquium & Research Review Paper-III	0	2	0	-	-	50	-	50	2
4	MCS393	Preliminary Thesis	0	8	0	-	-	200	-	200	8
<b>Total</b>			6	12	0	-	-	-	-	450	18

### YEAR II, SEMESTER-IV

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				SUBJECT TOTAL	Credits
						SESSIONAL EXAM.			E-SEM		
			L	T	P	CT	TA	SUB TOTAL			
	MCS-394	THESIS	0	16	0	-	-	100	300	400	16
<b>Total</b>			0	16	0	-	-	-	-	400	16

**ELECTIVE-I**

MCS-211 ADVANCED SOFTWARE ENGINEERING
MCS-212 WIRLESS SENSOR NETWORKS
MCS-213 NETWORK SECURITY & CRYPTOGRAPHY
MCS-214 MACHINE LEARNING
MCS-215 MULTIMEDIA SYSTEMS

**ELECTIVE -II**

MCS-321 SOFTWARE PROJECT MANAGEMENT
MCS-322 DESIGN AND ANALYSIS OF ALGORITHMS
MCS-323 INTELLECTUAL PROPERTY RIGHTS
MCS-324 UNIX NETWORK PROGRAMMING
MCS-325 COMPLIER TECHNIQUES

**ELECTIVE-III**

MCS-331 REAL TIME SYSTEMS
MCS-332 NETWORKING PROTOCOLS
MCS-333 EMERGING DATABASE TECHNOLOGIES
MCS-334 DATA WAREHOUSING & MINING

# MCS-101 – Advanced Computer Architecture

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## MODULE I

SIMD, MIMD models of parallel processing, classification of parallel computing structure,

## MODULE II

High performance memory system, pipelined computer systems, processor architecture for parallel processing, vector Processing,

## MODULE III

RISC AND CISC processors, distributed memory/shared architecture.

### References

1. Kai Hwang, "Advanced Computer Architecture," McGraw-Hill.
2. Hwang and Briggs, "Computer Architecture and Parallel Processing," McGraw Hill.

# MCS-102 – Foundation of Computer Science

(Credit-4)

L T P  
3 1 0

## MODULE I

### Regular languages

Sets, functions, Relation, Alphabet, Languages and grammars. Regular grammars, regular expressions and finite automata, deterministic and nondeterministic. Closure and decision properties of regular sets. Pumping lemma of regular sets. Minimization of finite automata.

## MODULE II

### Context free Languages

Context free grammars and pushdown automata. Chomsky and Griebach normal forms. Cook, younger and Kasami Algorithm, Ambiguity and properties of context free languages pumping lemma. Deterministic pushdown automata. Closure properties of deterministic context free languages.

## MODULE III

### Turing Machine

Turing machines and variation of Turing machine model, Halting problem, Universal turing machine, Type 0 Languages. Linear bounded automata and context sensitive languages. Turing Computable functions, Church Turing hypothesis. Recursive and recursively enumerable sets, Universal Turing machine and undecidable problems, Rice's theorems for RE sets, Undecidability of Post correspondence problem. Valid and invalid computations of Turing machines, undecidable properties of context free language problems, Basics of Recursive function theory.

### References

1. C.Papadimitrou and C.L.Lewis "Elements of Theory of Computation", PHI
2. J.E.Hopcroft and J.D.Ullman "Introduction to Automata Theory, Languages of Computations", Addison-Wesley

# MCS-103 – Advanced Computer Networks

(Credit-4)

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3 1 0

## MODULE I

IP addressing, subnetting, supernetting, variable length subnet masking (CIDR notation), ARP, RARP, ICMP, IGMP

## MODULE II

IPv6, Next Generation IP protocol, Wireless Networks, Mobility in networks, Mobile IP, Mobile TCP, TCP extensions for high speed network, SCTP,

## MODULE III

IP multicasting, Multicast routing TCP/IP programming. P2P file sharing, structure overlay network, Virtual Private N/W, Configuration of VLAN

### References

1. *Larry Peterson and Bruce Davie, "Computer Networks: A Systems Approach", Third Edition, Morgan Kaufmann, 2003, ISBN: 1-55860-832-X.*
2. *W. Richard Stevens, Bill Fenner and Andrew Rudoff, "UNIX Network Programming, Volume 1: Networking APIs - Sockets and XTI", Third Edition, Prentice Hall, 2004, ISBN: 0-13-141155-1.*
3. *Behrouz A. Forouzan "Data Communications and Networking", McGraw-Hill.*
4. *Behrouz A. Forouzan "TCP/IP" McGraw-Hill.*

## MCS-104 – Distributed Systems

(Credit -4)

L T P  
3 1 0

### MODULE I

Distributed System Concepts, Architectures, transparency Self management in Distributed system ,Thread, Virtualization, Client, server, code migration Semantics, Remote Procedure Calls, Communication, Naming, File System: Flat naming, Structure naming and Attribute based naming, Security, Concurrency control and recovery, local area network, distributed languages and communication primitives, case studies of distributed systems.

### MODULE II

Clocks and Election algorithm, Consistency Model, Consistency Protocol, Resilience, Reliable communication, Distributed Commit, recovery in Distributed systems, security in distributed systems. Deadlock in distributed systems.

### MODULE III

Distributed Operating Systems, Distributed File System, Sun NFS, and the Coda files system.NTFS, UNIX ext2 and ext3. Case studies of Distributed object based systems (CORBA) Distributed web based Systems.

#### References:

1. P. K. Sinha, "Distributed Operating Systems," PHI.
2. Tanenbaum, A. S. and Van Steen, M. "Distributed Systems Principles and Paradigms," (ISBN 0-13-088893-1), Prentice Hall 2002.
3. Bacon, J., "Concurrent Systems", 2nd Edition, (ISBN 0-201-177-676), Addison Wesley 1998.
4. Silberschatz, A., Galvin, P. and Gagne, G., "Applied Operating Systems Concepts", 1st Edition," (ISBN 0-471-36508-4), Wiley 2000..
5. Coulouris, G. et al, "Distributed Systems: Concepts and Design, 3rd Edition," (ISBN 0-201-61918-0), Addison Wesley 2001.

## MCS-201 – Advanced Database Systems

(Credit -4)

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3 1 0

### MODULE I

Transaction and schedules, Concurrent Execution of transaction, Conflict and View Serializability, Testing for Serializability, Concepts in Recoverable and Cascade-less schedules. Lock based protocols, time stamp based protocols, Multiple Granularity and Multi-version Techniques, enforcing serializability by Locks, Locking system with multiple lock modes. Distributed Transactions Management.

### MODULE II

Data Distribution, Fragmentation and Replication Techniques, Distributed Commit, Distributed Locking schemes. Issues of Recovery and atomicity in Distributed Databases, Traditional recovery techniques, Log based recovery, Recovery with Concurrent Transactions, Recovery in Message passing systems, Checkpoints, recovery line.

Distributed Query Processing, Multi-way Joins, Semi joins, Cost based query optimization for distributed database, Updating replicated data, protocols for Distributed Deadlock Detection, Eager and Lazy Replication Techniques

### MODULE III

Object-relational databases, active databases, and multi-databases. Overview of modern database technologies, such as parallel databases, multimedia databases, spatial and temporal databases, data warehousing and data mining, deductive databases.

### References

1. *Silberschatz, Korth and Sudershan, "Database System Concept", Mc Graw Hill.*
2. *Ramakrishna and Gehrke, "Database Management System", Mc Graw Hill.*
3. *Garcia-Molina, Ullman, Widom, "Database System Implementation" Pearson Education.*
4. *Ceei and Pelagatti, "Distributed Database", TMH.*
5. *Singhal and Shivratri, "Advance Concepts in Operating System" MC Graw Hill.*



## MCS-202 – Parallel Computing

(Credit-4)

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### MODULE I

Computational demands, advantages of parallel systems. Flynn's classification, controlled parallelism and scalability. Topologies: Mesh, binary tree, Hyper tree, Cube Connected cycles, shuffle-Connected Exchange; Uniform Memory Access (UMA & Non uniform Memory Access (NUMA) Multi processor System.

### MODULE II

PARAM Model of Parallel Computation, PARAM Algorithms; Parallel Reductions, Prefix sum, List Ranking, Merging of Two Sorted List.

Mapping and Scheduling; mapping of Data from Topology to other (Ring to 2-D Mesh, Binomial trees to 2-D mesh, Rings & mesh into 2-D Mesh, Ring & Mesh into Hypercubes), Load balancing, Static scheduling on UMA multi processor systems.

### MODULE III

Applications of parallel computing: Matrix Multiplication, Sorting (bitonic Merge sort, parallel quick sort, hyper quick sort), Searching a Graph (P-depth search, Breadth-Depth Search, Breath first search) , parallel Branch and bound algorithms

#### References

1. Michel J. Quinn, “ *Parallel Computing: Theory and Practice,*” McGraw-Hill.
2. Kai Hwang, “*Advanced Computer Architecture,*” McGraw-Hill.

## MCS-203 – Mobile Computing

(Credit-4)

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**3 1 0**

### **MODULE I**

Issues in Mobile Computing, Overview of wireless Telephony, IEEE 802.11 & Blue Tooth, Wireless Multiple access protocols, channel Allocation in cellular systems. Data Management Issues, data replication for mobile computers, adaptive Clustering for Mobile Wireless networks.

### **MODULE II**

Distributed location Management, pointer forwarding strategies, Energy Efficient Indexing on air, Energy Indexing for wireless broadcast data, Mobile IP, TCP Over wireless.

Mobile Agents Computing, Security and fault tolerance, transaction processing in Mobile computing environment.

### **MODULE III**

Ad hoc network, Routing Protocol, Introduction – Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks – Classifications of Routing Protocols – Table-Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV) – Wireless Routing Protocol (WRP) – Cluster Switch Gateway Routing (CSGR) – Source-Initiated On-Demand Approaches – Ad hoc On-Demand Distance Vector Routing (AODV) – Dynamic Source Routing (DSR) – Temporally Ordered Routing Algorithm (TORA) – Signal Stability Routing (SSR) – Location-Aided Routing (LAR) – Power-Aware Routing (PAR) – Zone Routing Protocol (ZRP). Introduction and application of Vehicular Communication.

### **References**

1. J. Schiller, “*Mobile Communications*”, Addison Wesley.
2. A. Mehrotra, “*GSM System Engineering : Mobile Communication Series*”, Artech House Publishers, ISBN: 0890068607.
3. M. V. D. Heijden, M. Taylor, “*Understanding WAP*”, Artech House.
4. Charles Perkins, “*Mobile IP*”, Addison Wesley.
5. Charles Perkins, “*Ad hoc Networks*”, Addison Wesley.

## MCS-211 – Advanced Software Engineering

(Credit-4)

L T P  
3 1 0

### MODULE I

Software project management, metric and management, software configuration management, software risk management, requirements engineering,

### MODULE II

Software quality assurance, software reliability models, object oriented design, Unified Modeling Language, (UML), Use case modeling

### MODULE III

Jakson method for design, case tools and technology, clean room method for software development, real time software specification and design.

### References

1. Sommerville, "Software Engg. Principles and Practices," Addison-Wesley.
2. Roger S Pressman, "Software Engg," McGraw-Hill.
3. Pankaj Jalote, "Introduction to Software Engineering," Springer.

# MCS-212 – Wireless Sensor Networks

(Credit-4)

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3 1 0

## MODULE I

Introduction and overview: Overview of the course; overview of sensor network protocols, architecture, and applications; simulation and experimental platforms; main features of WSNs; research issues and trends.

Enabling technologies : Fundamentals of 802.15.4, Bluetooth, and UWB; Physical and MAC layers.

## MODULE II

Sensor node hardware and software : Hardware: mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT. Software (OS): tinyOS, MANTIS, Contiki, and RetOS. Programming tools: C, nesC, Mate, Localization, connectivity, and topology, Sensor deployment mechanisms; coverage issues; node discovery protocols.

## MODULE III

Network layer protocols : Data dissemination and processing; multi-hop and cluster based protocols; routing.

Middleware and application layers, Data dissemination; data storage; query processing; sensorWeb; sensorGrid.

Open issues for future research, Energy preservation and efficiency; security challenges; fault-tolerance;

## References

1. H. Karl and A. Willig. "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, June 2005.
2. K. Sohrawy, D. Minoli, and T. Znati, "Wireless Sensor Networks: Technology, Protocols, and Applications", John Wiley & Sons, March 2007.
3. C. S. Raghavendra, K. M. Sivalingam, and T. Znati, "Wireless Sensor Networks", Springer Verlag, Sep. 2006.
4. E. H. Callaway, "Wireless Sensor Networks: Architectures and Protocols", Jr. AUERBACH, Aug. 2003.
5. B. Krishnamachari "Networking Wireless Sensors", Cambridge University Press, Dec. 2005.
6. F. Zhao and L. Guibas "Wireless Sensor Networks: An Information Processing Approach", Morgan Kaufmann, Jul. 2004.
7. N. P. Mahalik, "Sensor Networks and Configuration: Fundamentals, Standards, Platforms, and Applications", Springer Verlag, Nov. 2006.
8. N. Bulusu and S. Jha, "Wireless Sensor Networks: A Systems Perspective", Artech House, August 2005

## MCS-213 – Network Security & Cryptography

(Credit-4)

L T P  
3 1 0

### MODULE I

Introduction: OSI Security Architecture - Classical Encryption techniques – Cipher Principles – Data Encryption Standard – Block Cipher Design Principles and Modes of Operation Evaluation criteria for AES – AES Cipher – Triple DES – Placement of Encryption Function – Traffic Confidentiality

### MODULE II

Public Key Cryptography: Key Management - Diffie-Hellman key Exchange – Elliptic Curve Architecture and Cryptography - Introduction to Number Theory – Confidentiality using Symmetric Encryption – Public Key Cryptography and RSA. Authentication and Hash Function: Authentication requirements – Authentication functions – Message Authentication Codes – Hash Functions – Security of Hash Functions and MACs – MD5 message Digest algorithm - Secure Hash Algorithm – RIPEMD – HMAC Digital Signatures – Authentication Protocols – Digital Signature Standard

### MODULE III

Network Security Authentication Applications: Kerberos – X.509 Authentication Service – Electronic Mail Security – PGP – S/MIME - IP Security – Web Security. System Level Security Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

#### References:

1. Atul Kahate, “Cryptography and Network Security”, Tata McGraw-Hill, 2003.
2. Bruce Schneier, “Applied Cryptography”, John Wiley & Sons Inc, 2001.
3. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, Third Edition, Pearson Education, 2003.

## MCS-214 – Machine Learning

(Credit-4)

L T P  
3 1 0

### MODULE I

Algorithmic models of learning. Learning classifiers, functions, relations, grammars, probabilistic models, value functions, behaviors and programs from experience. Bayesian, maximum a posteriori, and minimum description length frameworks. Parameter estimation, sufficient statistics, decision trees, neural networks, support vector machines, Bayesian networks, bag of words classifiers,

### MODULE II

N-gram models; Markov and Hidden Markov models, probabilistic relational models, association rules, nearest neighbor classifiers, locally weighted regression, ensemble classifiers. Computational learning theory, mistake bound analysis, sample complexity analysis, VC dimension, Occam learning, accuracy and confidence boosting. Dimensionality reduction, feature selection and visualization.

### MODULE III

Clustering, mixture models, k-means clustering, hierarchical clustering, distributional clustering. Reinforcement learning; Learning from heterogeneous, distributed, data and knowledge. Selected applications in data mining, automated knowledge acquisition, pattern recognition, program synthesis, text and language processing, internet-based information systems, human-computer interaction, semantic web, and bioinformatics and computational biology.

### References

1. Bishop, C. (2006). *“Pattern Recognition and Machine Learning”*. Berlin: Springer-Verlag.

# MCS-215 Multimedia Systems

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3 1 0

## Module 1

Introduction to Multimedia, Multimedia Objects, Multimedia in business and work. Multimedia hardware, Memory & Storage devices, Communication devices, Multimedia software s, presentation tools, tools for object generations, video, sound, image capturing, authoring tools, card and page based authoring tools.

Text, Sound MIDI, Digital Audio, audio file formats, MIDI under windows environment Audio & Video Capture.

## Module 2

Huffman Coding, Shannon Fano Algorithm, Huffman Algorithms, Adaptive Coding, Arithmetic Coding Higher Order Modeling. Finite Context Modeling, Dictionary based Compression, Sliding Window Compression, LZ77, LZW compression, Compression, Compression ratio loss less & lossy compression.

Digital Audio concepts, Sampling Variables, Loss less compression of sound, loss compression & silence compression.

## Module 3

Multiple monitors, bitmaps, Vector drawing, lossy graphic compression, image file formatic animations Images standards, JPEG Compression, Zig Zag Coding.

Video representation, Colors, Video Compression, MPEG standards, MHEG Standard recent development in Multimedia.

### Books & References :

1. Tay Vaughan Multimedia, Making IT Work Osborne McGraw Hill.
2. Buford Multimedia Systems Addison Wesley.
3. Agrawal & Tiwari Multimedia Systems Excel.
4. Mark Nelson Data Compression Book BPB.
5. David Hillman Multimedia technology and Applications Galgotia Publications.
6. Rosch Multimedia Bible Sams Publishing.
7. Sleinreitz Multimedia System Addison Wesley.
8. **James E Skuman Multimedia in Action Vikas.**

# MCS-321 – Software Project Management

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## MODULE I

**Overview of Project Management**, PMI Processes, Software project phases, Organizational structures, Project charter, Statement of Work (SOW)

**Planning Phase**, Development lifecycle models, Matching lifecycles to projects, Project plans, Work Breakdown Structures (WBS)

**Estimation and Budgeting**, Estimation, Budgeting, Project, selection, NPV, ROI, Payback models

## MODULE II

**Scheduling**, Project network diagram fundamentals, PERT techniques, Gantt charts, Critical chain scheduling

**Risk and Change Management**, Mid-term review, Risk management, Change control, More MS-Project

**Development Management**, Team models, Requirements process, Configuration, management, Software metrics, Programming languages & tools, Managing conflict and motivating, MS-Project: Assigning Resources.

## MODULE III

**Project Control**, Status reporting, Project metrics, Earned value analysis, Communications Techniques, Process Improvement, MS Project: (a) Resource leveling (b) Other views

**System Test Process**, Test specifications, Black box and white box testing, Test scripts, Unit and integration testing, Acceptance test specifications, Test tools, MS Project:(a) Reporting

**Final Phases & Other Issues**, Project Recovery, Documentation, Cutover/Migration Post Project Reviews, Closing, MS Project: (a) Advanced features.

## References

1. S. McConnell, *“Software Project Survival Guide”* (1997)
2. S. Berkun, *“The Art of Project Management”*, (2005)
3. C. Larman, *“Agile and Iterative Development: A Manager's Guide”*, (2003)
4. W. Royce, *“Software Project Management: A Unified Framework”*, (1998)
5. J. Highsmith, *“Agile Project Management: Creating Innovative Products”*, (2004)
6. T. DeMarco, *“The Deadline: A Novel About Project Management”*, (1997)
7. T. DeMarco, *“Peopleware: Productive Projects and Teams”*, (1999)
8. E. Bennatan, *“On Time Within Budget: Software Project Management Practices and Techniques”*, (2000)



## MODULE I

Algorithm Analysis and Review of Data Structures: Algorithms, Psuedo code for expressing algorithms, Performance Analysis-time complexity and space complexity-notation, Omega notation and Theta notation, little o notation, Probabilistic analysis, Amortized analysis, Review of Data Structures- The List ADT, Stack ADT, Queue ADT, Implementations using template class, Hash Functions, Collision Resolution in hashing, Priority queues-Definition, Priority queues-ADT, Heaps-Definition, Insertion and Deletion, Applications-Heap sort.

## MODULE II

Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort, Strassen's Matrix Multiplication.

Greedy method: General method, applications-Job sequencing with dead lines, 0/1 knapsack problem, Minimum cost spanning trees, Single source shortest path problem. Dynamic Programming: General method, applications-Matrix chain multiplication, Optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Traveling sales person problem, Reliability design.

## MODULE III

Searching and Traversal Techniques: Efficient non-recursive Tree Traversal Algorithms, DFS, BFS of Graphs, AND/OR graphs, game trees, Search Trees-Balanced search trees-AVL trees, representation, Operations-insertion, deletion and searching, B-Trees-B-Tree of order m, Operations- insertion, deletion and searching.

Backtracking and Branch and Bound: General method (Backtracking), Applications-n-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles. General method (Branch and Bound), Applications - Traveling sales person problem, 0/1 knapsack problem-LC Branch and Bound solution.

NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP- Complete classes, Cook's theorem.

### References:

1. E. Horowitz, S.Sahani and S.Rajasekharan, "Computer Algorithms/C++", Galgotia Publishers pvt. Limited.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 2nd Edition, Pearson Education.
3. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to Algorithms", 2nd Edition, PHI Pvt.Ltd./ Pearson Education.
4. Aho, Ullman and Hopcroft, "Design and Analysis of algorithms", Pearson Education.
5. A. Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education.
6. S. Sahni, "Data structures, Algorithms and Applications in C", University press (India) pvt ltd, 2nd edition, Orient Longman pvt. ltd.
7. K. A. Berman, J. L.Paul, "Fundamentals of Sequential and Parallel Algorithms", Thomson.
8. Adam Drozdek, "Data Structures And Algorithms in C", 3rd Edition, Thomson.
9. M. T. Goodrich and R. Tomassia, "Algorithm Design: Foundations", Analysis and Internet examples, John Wiley and sons.

## MCS-323 – Intellectual Property Rights

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### MODULE I

Philosophical Aspects of Intellectual Property Laws, Basic Principles of Patent Law, Patent Application procedure, Drafting of a Patent Specification, Understanding Copyright Law,

### MODULE II

Basic Principles of Trade Mark, Basic Principles of Design Rights, International Background of Intellectual Property ,

### MODULE III

Paper H-Ownership and Enforcement of Intellectual Property Rights The thrust of study of this paper would be on the following areas

1. Patents-Objectives, Rights, Assignments, Defences in case of Infringement
2. Copyright-Objectives, Rights, Transfer of Copyright, work of employment Infringement, Defences for infringement
3. Trademarks-Objectives, Rights, Protection of goodwill, Infringement, Passing off, Defences.
4. Designs-Objectives, Rights, Assignments, Infringements, Defences of Design Infringement
5. Enforcement of Intellectual Property Rights - Civil Remedies, Criminal Remedies, Border Security measures.
6. Practical Aspects of Licensing - Benefits, Determinative factors, important clauses, licensing clauses.

Paper III-Information Technology Related Intellectual Property Rights

Focus of Study will be on the following areas.

- A. Computer Software and Intellectual Property-Objective, Copyright Protection, Reproducing, Defences, Patent Protection.
- B. Database and Data Protection-Objective, Need for Protection, UK Data Protection Act, 1998, US Safe Harbor Principle, Enforcement.
- C. Protection of Semi-conductor Chips-Objectives Justification of protection, Criteria, Subject-matter of Protection, WIPO Treaty , TRIPs, SCPA.
- D. Domain Name Protection -Objectives, domain name and Intellectual Property, Registration of domain names, disputes under Intellectual Property Rights, Jurisdictional Issues, and International Perspective.

#### References:

1. *Peter Weill , Jeanne Ross “IT Governance: How Top Performers Manage IT Decision Rights for Superior Results”*
2. *Jeanne W. Ross “Enterprise Architecture As Strategy: Creating a Foundation for Business Execution”*
3. *Peter Weill “IT Savvy: What Top Executives Must Know to Go from Pain to Gain”*
- 4.

# MCS-324– Unix Network Programming

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## MODULE I

Client/Server Model, Peer-to-Peer Model, overview of IPv4 and IPv6, TCP and UDP,

## MODULE II

Socket programming, Multiplexing I/O, Encapsulation, Unix Domain Protocols, Daemon Processes, super server, broadcasting and Multicasting,

## MODULE III

Threaded network programming, Raw Socket, HTTP Server Design.

### References:

1. W. Richard Stevens, "UNIX Network Programming," Volume 1, second edition, Prentice Hall. ISBN #0-13-490012-X.
2. Douglas Comer, "Internetworking with TCP/IP," Volume I, II & III, Prentice Hall.

# MCS-325– Compiler Techniques

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## MODULE I

Introduction: Definition , functions of Compiler in Linux / Unix / TC etc environments, other associated terms e.g. Text formatter, Text Editors, Phases and Passes, FSM & RE s and their application to Lexical Analysis, Implementation of Lexical Analyzers, Lexical- Analyzer Generator, Lex Compiler, Formal Grammar and their application to Syntax Analysis, BNF Notation, YACC.

The Syntactic specification of Languages: CFG, Derivation and Parse Trees, Capabilities of CFG.

Basic Parsing Techniques: Parsers, Shift Reduce Parsing, Operator precedence parsing, top down Parsing, Predictive Parsers.

## MODULE II

Automatic Construction of efficient Parsers: LR Parsers, the canonical collection of LR(0) items, constructing SLR Parsing Tables, Constructing canonical LR Parsing tables and LALR parsing tables , An Automatic Parser Generator, Implementation of LR parsing Tables, Constructing LALR sets of items.syntax directed translation

Symbol Tables: Data Structure for Symbol Tables, representing scope information.

## MODULE III

Run Time Administration: Implementation of simple Stack allocation scheme, storage allocation in block structured language.

Error detection and Recovery: Lexical phase errors,syntax phase errors,semantic errors Code Optimization: Loop optimization, the DAG representation of basic blocks, value numbers and Algebraic Laws, Global Data Flow Analysis.

Books and References:

1. Aho,Ullman & Sethi, Compiler Design , Addison Wesley
- 2 D.M.Dhamdhere, Compiler Construction Principles & Practice , Macmillan India Ltd.
- 3 Holub, Compiler Design in C , PHI.

## MCS-204 – Object-Oriented Modeling

### Module I

Unified Modeling Language, (UML), Use case modeling, Methodologies for object-oriented analysis and design (OOAD),

### MODULE II

Design patterns, CASE tool support for OOAD and automatic code generation, Precise modelling (using OCL-Object Constraint Language) and analysis of software models,

### MODULE III

Model-driven architecture (MDA), Modeling language design: meta-modeling, UML Profiles Advanced modeling topics: Aspect oriented modeling, Modeling non functional properties, roundtrip engineering, model-based testing, open research questions.

#### Books and References:

1. Timothy Lethbridge , Robert Laganier , “Object-Oriented Software Engineering: Practical Software Development using UML and Java”, Mcgraw-hill.
2. Lethbridge and Laganier, “Object-oriented Software Engineering”, McGraw-Hill.

# MCS-332 – Networking Protocols

## MODULE I

Networks and Services, Approaches to Network Design, The OSI Reference Model; Overview of TCP/IP Architecture, Application Protocols and TCP/IP Utilities, Internet Architecture Interconnection through IP Routers, Internet Protocol (IP), User datagram protocol (UDP).

## MODULE II

Routing Cores - peers Algorithms Autonomous Systems Exterior Gateway Protocol Multicast Address. Internet Group **Management** Protocol (IGMP) and Implementation. TCP/IP over ATM networks: ATM cell Transport , Adaptation Layer, IP Address Building in an ATM network Logical IP subnet Concept ATM-ARP packet format. Domain name **system** , Remote Login (Telnet, Rlogin) File Transfer and Access (FTP, TFTP, NFS), Electronic mail (SMTP, MIME) Internet **Management** (SNMP, SNMPV2) Internet Security and Firewall Design Post Office Protocol (POP) Network News Transfer Protocol (NNTP).

## MODULE III

TCP/IP over view- The Transport Layer: TCP and UDP. Elementary TCP Sockets. TCP Client-Server Example. I/O Multiplexing: The select and poll Functions. Socket Options. Elementary UDP Sockets. Elementary Name and Address Conversions.

The Client Server Model and Software Design, Concurrent Processing in Client-Server Software, Iterative, Connectionless Servers (UDP), Iterative, Connection-Oriented Servers (TCP), Concurrent, Connection-Oriented Servers (TCP). Single-Process, Concurrent Servers (TCP). Multiprotocol Servers (TCP, UDP), Multiservice Servers (TCP, UDP). Uniform, Efficient **Management** of server. Concurrency in clients. TCP/IP Architecture, The Internet Protocol, Limitations of IPv4 and Introduction to IPv6, User Datagram Protocol, Transmission Control Protocol, DHCP, Introduction to Internet Routing Protocols

### References:

1. A. Leon-Garcia, Indra Widjaja, "Communication Networks", Tata McGraw Hill, 2000
2. William Stallings, "Data and Computer Communications", Pearson Education, 7<sup>th</sup> Edition.
3. Andrew S. Tanenbaum, "Computer Networks", Prentice Hall India, 4<sup>th</sup> Edition, 2003
4. W.Richard Stevens: TCP/IP Illustrated vol 1: The Protocols, Pearson Edun. Asia, 2000.
5. Douglas Comer: Internetworking with TCP/IP vol.1: Principles, Protocols and Architecture, Prentice Hall, 4<sup>th</sup> edition, 2000

# MCS-333 – Emerging Database Technologies

## MODULE I

Mobile Databases: Mobile computing architecture Mobile environment characteristics  
Data management issues.

Multimedia Databases: Nature of Multimedia data and applications Data management

## MODULE II

Multimedia database applications

## MODULE III

Object Database System: Abstract data types Objects identity and reference types  
Inheritance Database design for ORDBMS ODMG data model and ODL OQL.

### References

1. *Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", McGraw Hill Publications.*
2. *Ramez Elmasri & B.Navathe, "Fundamentals of Database Systems", V Ed., Addison Wesley, 2008.*
3. *H.F. Korth and A.Silberschatz, "Database system concepts", III Ed., McGraw Hill.*
4. *Jeffrey A. Hoffer, Mary Prescott, Heikki Topi, "Modern Database Management" (9th Edition), Prentice Hall.*

# MCS-334 – Data Warehousing & Mining

## MODULE I

### Foundation

Introduction to DATA Warehousing. Client/Server Computing model & Data Warehousing. Parallel processors & Cluster Systems. Distributed DBMS implementations. Client/Server RDBMS Solutions.

### Data Warehousing

Data Warehousing Components. Building a Data Warehouse. Mapping the Data Warehousing to a Multiprocessor Architecture. DBMS Schemas for Decision Support. Data Extraction, cleanup & Transformation Tools. Metadata.

## MODULE II

### Business Analysis

Reporting & Query Tools & Applications. On line Analytical Processing (OLAP). Patterns & Models. Statistics. Artificial Intelligence.

## MODULE III

### Data Mining

Introduction to Data Mining. Decision Trees. Neural Networks. Nearest Neighbor & Clustering. Genetic Algorithms. Rule Induction. Selecting & Using the Right Technique.

Data visualization & Overall Perspective. Data Visualization. Putting it All Together. Appendices: A : Data Visualization. B : Big Data-Better Returns : Leveraging Your Hidden Data Assets to Improve ROI. C : Dr. E.F. Codd's 12 Guidelines for OLAP. D : Mistakes for Data warehousing Managers to Avoid.

### References:

1. Berson, "Data Warehousing, Data Mining & OLAP", Tata McGraw-Hill, New Delhi
2. Mallach, "Data Warehousing System", McGraw Hill.
3. Jiawei Han, Micheline Kamber "Data Mining: Concepts and Techniques", The Morgan Kaufmann Series in Data Management
4. Jim Gray, "Systems", Morgan Kaufmann Publishers, August 2000, ISBN 1-55860-489-8.



# MCS-331 – REAL TIME SYSTEMS

L T P  
3 1 0

## MODULE I

Introduction: Concept of Real Time System, Issues in real time computing, Performance measures of Real Time System, Issues in Real Time Computing, Performance measures of Real time Systems, Real Time Application. Task Assignment and Scheduling: Different task model, Scheduling hierarchy, offline vs Online Scheduling, Clock Drives.

Model of Real Time System: Processor, resources, temporal parameter, Periodic Task Model, Sporadic Task Model, Precedence Constraints and Data Dependencies, Scheduling hierarchy Scheduling of Periodic Task: Assumptions, fixed versus dynamic priority algorithms, schedulability test for fixed priority task with arbitrary deadlines.

## MODULE II

Scheduling of A periodic and Sporadic Tasks: Assumptions and approaches, deferrable, sporadic servers, slack stealing in deadline driven and fixed priority systems. Two level scheme for integrated scheduling, Scheduling for applications having flexible constrains.

## MODULE III

Resources and Resource Access Control: Assumptions on resources and their usage, resource contention, resource access control(Priority Ceiling Protocol, Priority Inheritance protocol, Slack Based Priority Ceiling Protocol, Preemption Ceiling Protocol). Multi Processor Scheduling: Model of multi processor and distributed systems, Scheduling algorithms for end to end periodic tasks in homogeneous/heterogeneous systems, Predictability and validation of dynamic multiprocessor system. Real time Communication: Model of real time Communication, Priority base service

For switched network, Weighted Round Robin Service, Medium access Control Protocol, Real Time Protocol.

### Books and References:

1. Jane .W. S. Liu Real Time Systems Pearson Education.
2. Krishna .C.M Real Time Systems Mc-Graw Hill Publication.

# MCS -105: CLOUD COMPUTING

L T P

3 1 0

## MODULE 1

Cloud Computing – History of Cloud Computing – Cloud Architecture – Cloud Storage Advantages of Cloud Computing, Disadvantages of Cloud Computing, Companies in the Cloud Today, Cloud Services, Pros and Cons of Cloud Service Development, Types of Cloud Service Development – Software as a Service – Platform as a Service – Web Services – On-Demand Computing – Discovering Cloud Services Development Services and Tools – Amazon Ec2 – Google App Engine – IBM Clouds

## MODULE 2

Overview of Cloud Networks, Network Types, LAN, gateways and Router, IP Classes and subnets, CIDR Utilities, Connection Management, Security groups, and Amazon elastic block storage EBS, Ubuntu in the cloud, Utilities, File system, Exploring Online Scheduling Applications – Exploring Online Planning and Task Management – Collaborating on Event Management, Collaborating on Databases – Storing and Sharing Files

## MODULE 3

Programming, Control structure, events based Init daemon , Configuring Apache , Directive, virtual hosts, MySQL server in cloud database, Backup and Recovery, database shading, EC2 Application, Web application design Focus on Search Engine, security, Firewall, Amazon Cloud.

### Text Books:

- Cloud Computing: Principles and Paradigms, Editors: Raj KumarBuyya, James Bromberg, Andrej M Goscinski, Wiley, 2011.
- Visible Ops private Cloud: FromVirtualization to private Cloud in 4 Practical's steps,Andi Mann, Kurt Milne, Jeanne Mcrain IT Ptocess Institute , In: first edition( April8,2011)

### Reference Book:

- Cloud Computing Explained: Implementation Handbook for Enterprises, John Rotan, Recursive Press (November 2, 2009)