INVERTIS
UNIVERSITY BAREILLY
Established by Govt. of U.P. u/s 2F of UGC Act, 1956 vide U.P. Act 22 of 2010.

Scheme of Instruction & Syllabi

of

Master of Technology
(Computer Science and Engineering)

(With effect from academic session 2023-24)

(Dr.Gaurav Agarwal)
HOD CSE

(Dr. R K Shukla)
Dean Engineering and technology

(Prof. Y D S Arya)
Vice- Chancellor

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**
Total			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**
Total			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**
Total			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**
Total			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 ANALYISIS 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	L T P 3 1 0	4 Credits

Course Objectives:

CO1	To make students know about the Parallelism concepts in Programming
CO2	To give the students an elaborate idea about the different memory systems and buses.
CO3	To introduce the advanced processor architectures to the students.
CO4	To make the students know about the importance of multiprocessor and multicomputers.
CO5	To study about data flow computer architectures

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.*

Course Outcome:

CO1	Demonstrate concepts of parallelism in hardware/software.
CO2	Discuss memory organization and mapping techniques
CO3	Describe architectural features of advanced processors.
CO4	Interpret performance of different pipelined processors.
CO5	Explain data flow in arithmetic algorithms

MCS-102	FOUNDATION OF COMPUTER SCIENCE	L T P 3 1 0	4 Credits

Course Objectives:

CO1	An ability to apply knowledge of computing and mathematics appropriate to the discipline
CO2	An ability to identify, formulate, and develop solutions to computational challenges.
CO3	An understanding of professional, ethical, legal, security, and social issues and responsibilities for the computing profession.
CO4	Recognition of the need for and ability to engage in continuing professional development
CO5	An ability to apply design and development principles in the construction of software systems of varying complexity.

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, Undecidablity 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*

Course Objectives:

CO1	Analyzing problems, and designing and implementing algorithmic solutions
CO2	Solving problems properly, achieving an implementation that is correct, effective and efficient.
CO3	Using computers at user level, including operative systems and programming environments
CO4	Knowledge of computer equipment, including both hardware and software
CO5	Identifying information needs to solve problems, recovering information and applying it to the resolution

MCS-103	ADVANCE COMPUTER NETWORKS	L T P 3 1 0	4 Credits

Course Objectives:

CO1	to study the problematic of service integration in TCP/IP networks focusing on protocol design, implementation and performance issues
CO2	to debate the current trends and leading research in the computer networking area.
CO3	to understand theoretical and practical concepts behind the design of multiconstained applications and services
CO4	to recognize the need for service integration and discuss how it can be accomplished
CO5	Design and implement a network protocol

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 Kauffmann, 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 Eddition, 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.*

Course Objectives:

CO1	to identify and discuss the concepts underlying IPv6 protocol, and their main characteristics and functionality
CO2	to understand the principles and functionality of mobile IP, explaining its concretization in IPv6; to understand the needs of optimization of the mobility mechanisms and description of some extensions that aim to reduce handover latency and requirements from terminals
CO3	to understand and explain the design issues in transport services in face of applications and services requirements
CO4	to discuss relevant management issues and devise adequate network management solutions
CO5	to identify and assess possible research opportunities and difficulties within the course scope.

MCS-104	DISTRIBUTED SYSTEMS	L T P 3 1 0	4 Credits

Course Objectives:

CO1	To introduce fundamental principles of distributed systems, technical challenges and key design issues.
CO2	To impart knowledge of the distributed computing models, algorithms and the design of distributed system
CO3	To understand the concept of deadlock
CO4	To understand the Mechanism for building distributed file systems
CO5	To understand concept of Distributed Mutual Exclusion

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.*

Course Outcomes: After the completion of the course the student will be able to:

CO1	Illustrate the mechanisms of inter process communication in distributed system
CO2	Compare the concurrency control mechanisms in distributed transactional environment
CO3	Outline the need for mutual exclusion and election algorithms in distributed systems
CO4	Can apply the concept of distributed transaction
CO5	Can apply the concept of Dynamic voting protocols

MCS-105	CLOUD COMPUTING	L T P 3 1 0	4 Credits

Course Objectives:

CO1	Basics of cloud computing.
CO2	Key concepts of virtualization.
CO3	Different Cloud Computing services
CO4	Cloud Implementation, Programming and Mobile cloud computing
CO5	Cloud Backup and solutions

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: FromVirtulization 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)

Course Objectives:

CO1	Define Cloud Computing and memorize the different Cloud service and deployment models
CO2	To Implement Different Cloud Computing services
CO3	Use and examine different cloud computing services
CO4	Analyze the components of open stack & Google Cloud platform and understand Mobile Cloud Computing
CO5	Design & develop backup strategies for cloud data based on features

MCS-201	ADVANCE DATABASE SYSTEMS	L T P 3 1 0	4 Credits

Course Objectives:

CO1	Understand the role of a database management system in an organization.
CO2	Understand basic database concepts, including the structure and operation of the relational data model.
CO3	Construct simple and moderately advanced database queries using Structured Query Language (SQL).
CO4	Understand the concept of a database transaction and related database facilities, including concurrency control, journaling, backup and recovery, and data object locking and protocols.
CO5	Design and implement a small database project using Microsoft Access

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 serializablity 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

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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.*

Course Outcome :

CO1	Describe the fundamental elements of relational database management systems
CO2	Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL
CO3	Design ER-models to represent simple database application scenarios
CO4	Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data
CO5	Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.

MCS-202	PARALLEL COMPUTING	L T P 3 1 0	4 Credits

Course Objectives:

CO1	Define terminology commonly used in parallel computing, such as efficiency and speedup
CO2	Describe different parallel architectures, inter-connect networks, programming models, and algorithms for common operations such as matrix-vector multiplication.
CO3	Given a parallel algorithm, analyze its time complexity as a function of the problem size and number of processors.
CO4	Given a parallel algorithm, an input to it, and the number of processors, show the steps performed by that algorithm on that input.
CO5	Given a parallel code, analyze its performance, determine computational bottlenecks, and optimize the performance of the code.

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.*

Course Outcome:

CO1	To develop an understanding of various basic concepts associated with parallel computing environments.
CO2	To understand the effects that issues of synchronization, latency and bandwidth have on the efficiency and effectiveness of parallel computing applications
CO3	To gain experience in a number of different parallel computing paradigms including memory passing, memory sharing, data-parallel and other approaches.
CO4	To earn experience in designing and testing parallel computing solutions to programming problems.
CO5	To develop improved communication and collaborative skills.

MCS-203	MOBILE COMPUTING	L T P 3 1 0	4 Credits

Course Objectives:

CO1	To learn about the basic concepts of Mobile Computing.
CO2	To understand about networking concepts relevant to modern wireless systems.
CO3	To introduce emerging mobile computing ideas and best practices
CO4	To gain hands-on knowledge practice with mobile computing
CO5	To understand various types of Protocols

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). Itroduction 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.*

Course Outcome:

CO1	Various wireless communication technologies.
CO2	Enables the students to visualize the various important steps in GSM communication
CO3	To acquire the knowledge of the fuzzy Neural network and Genetic Language
CO4	Enables the students to analyze the mobile IP and Transport Protocol.
CO5	To analyze various type of Protocols

MCS-204	OBJECT-ORIENTED MODELING	L T P 3 1 0	4 Credits

Course Objectives:

CO1	To understand the Object-based view of Systems
CO2	To develop robust object-based models for Systems
CO3	To inculcate necessary skills to handle complexity in software design
CO4	To Understand MDA
CO5	To understand the concept of model-based testing

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 Laganiere , "Object-Oriented Software Engineering: Practical Software Development using UML and Java", Mcgraw-hill.

2. Lethbridge and Laganiere, "Object-oriented Software Engineering", McGraw-Hill.

Course Outcome:

CO1	Ability to analyze and model software specifications.
CO2	Ability to abstract object-based views for generic software systems.
CO3	Ability to deliver robust software components.
CO4	Ability to perform roundtrip engineering
CO5	Ability to define MDA

MCS-211	ADVANCED SOFTWARE ENGINEERING	L T P 3 1 0	4 Credits

Course Objectives:

CO1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
CO2	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
CO3	an ability to use the techniques, skills, and modern engineering tools and processes necessary for software engineering practice.
CO4	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
CO5	An ability to communicate effectively with a range of audiences

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.*

Course Outcome:

CO1	Understand and adhere to professional ethical standards in the system development and modification process, especially by accepting responsibility for the consequences of design decisions and design implementations
CO2	The ability to build and configure major operating system components
CO3	The ability to analyze and implement solutions to complex problems involving computers and networks
CO4	The ability to work effectively in teams
CO5	A solid understanding to the methods of modern software engineering

MCS-212	WIRELESS SENSOR NETWORKS	L T P 3 1 0	4 Credits

Course Objectives:

CO1	To study the concepts of sensor networks.
CO2	To understand the WSN node Architecture and Newtork Architecture
CO3	To study the research issues in different layers of sensor networks
CO4	To identify the Wireless Sensor Network Platforms
CO5	To design and Develop wireless sensor node

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. Sohraby, 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*

Course Outcome:

CO1	Explain the basic concepts of wireless sensor networks, sensing, computing and communication tasks
CO2	Describe and explain radio standards and communication protocols adopted in wireless sensor networks
CO3	Describe and explain the hardware, software and communication for wireless sensor network nodes
CO4	Explain the architectures, features, and performance for wireless sensor network systems and platforms
CO5	Describe and analyze the specific requirements of applications in wireless sensor networks for energy efficiency, computing, storage and transmission

MCS-213	NETWORK SECURITY & CRYPTOGRAPHY	L T P 3 1 0	4 Credits

Course Objectives:

CO1	To understand basics of Cryptography and Network Security
CO2	To be able to secure a message over insecure channel by various means.
CO3	To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
CO4	To understand various protocols for network security to protect against the threats in the networks.
CO5	To understand various IP Securities

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.*

Course Outcome:

CO1	Provide security of the data over the network
CO2	Do research in the emerging areas of cryptography and network security
CO3	Implement various networking protocols.
CO4	Protect any network from the threats in the world.
CO5	Able to design firewall.

MCS-214	MACHINE LEARNING	L T P 3 1 0	4 Credits

Course Objectives:

CO1	To introduce students to the basic concepts and techniques of Machine Learning.
CO2	To develop skills of using recent machine learning software for solving practical problems.
CO3	To gain experience of doing independent study and research.
CO4	To Learn about Support Vector Machine concepts.
CO5	To learn about clustering

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.*

Course Outcome:

CO1	Explain Machine Learning concepts, classifications of Machine Learning and write simple programs using python.
CO2	Describe Supervised Learning concepts
CO3	Explain Support Vector Machine concepts
CO4	Describe unsupervised learning concepts and dimensionality reduction techniques
CO5	Discuss simple Machine Learning applications in a range of real-world applications using Python programming

MCS-215	MULTIMEDIA SYSTEMS	L T P 3 1 0	4 Credits

Course Objectives:

CO1	To learn and understand technical aspect of Multimedia Systems.
CO2	To understand the standards available for different audio, video and text applications
CO3	To Design and develop various Multimedia Systems applicable in real time.
CO4	To learn various multimedia authoring systems
CO5	To understand various networking aspects used for multimedia applications.

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.**

Course Outcome:

CO1	Developed understanding of technical aspect of Multimedia Systems.
CO2	Understand various file formats for audio, video and text media.
CO3	Develop various Multimedia Systems applicable in real time.
CO4	Design interactive multimedia software.
CO5	Apply various networking protocols for multimedia applications.

MCS-321	SOFTWARE PROJECT MANAGEMENT	L T P 3 1 0	4 Credits

Course Objectives:

CO1	To develop awareness regarding the theoretical and methodological issues related to software project management.
CO2	To develop software projects based on current technologies.
CO3	To make them understand the concepts of Project Management for planning to execution of projects.
CO4	To make them understand the feasibility analysis in Project Management and network analysis tools for cost and time estimation.
CO5	To enable them to comprehend the fundamentals of Contract Administration, Costing and Budgeting.

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)

Course Outcome:

CO1	Understand the process of Software Project Management.
CO2	Conduct project planning activities that accurately forecast project costs.
CO3	Handle tools like MS Project & SVN
CO4	Understand the skills required for managing projects, project teams, and stakeholders
CO5	Understand the process of Software Project Management.

MCS-322	DESIGN AND ANALYSIS OF ALGORITHMS	L T P 3 1 0	4 Credits

Course Objectives:

CO1	To understand and remember algorithms and its analysis procedure.
CO2	To introduce the concept of data structures through ADT including List, Stack, Queues. Analyze the asymptotic performance of algorithms.
CO3	To design and implement various data structures and algorithms.
CO4	Apply important algorithmic design paradigms and methods of analysis.
CO5	Synthesize efficient algorithms in common engineering design situations.

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.*

Course Outcome:

CO1	For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms .
CO2	Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
CO3	Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.
CO4	Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it
CO5	For a given model engineering problem, model it using graph and write the corresponding algorithm to solve the problems.

MCS-323	INTELLECTUAL PROPERTY RIGHTS	L T P 3 1 0	4 Credits

Course Objectives:

CO1	Understanding, defining and differentiating different types of intellectual properties (IPs) and their roles in contributing to organizational competitiveness
CO2	Understanding the Framework of Strategic Management of Intellectual Property (IP)
CO3	Appreciating and appraising different IP management (IPM) approaches and describing how pioneering firms initiate, implement and manage IPM programs
CO4	Explaining how to derive value from IP and leverage its value in new product and service development
CO5	Exposing to the Legal management of IP and understanding of real life practice of IPM

MODULE I

Philosophical Aspects of Intellectual Property Laws, Basic Principles of Patent Law, Patent Application procedure, Drafting ofa 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, De fences incase of Infringement

2. Copyright-Objectives, Rights, Transfer of Copyright, work of employment Infringement, De fences for in fiingement

3. Trademarks-Objectives, Rights, Protection ofgoodwill, Infringement, Passing off, De fences.

4. Designs-Objectives, Rights, Assignments, Infringements, De fences of Design Infringement

5. Enforcement of Intellectual Property Rights - Civil Remedies, Criminal Remedies, Border Security measures.

6. Practical Aspects of Licencing - Benefits, Determinative factors, important clauses, licensing clauses.

Paper Ill-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, De fences, Patent Protection.

B. Database and Data Protection-Objective, Need for Protection, UK Data ProtectionAct, 1998, US Safe Harbor Principle, Enforcement.

C. Protection of Semi-conductor Chips-Objectives Justification ofprotection, 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"*

Course Outcome:

CO1	Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP.
CO2	Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development
CO3	Identify activities and constitute IP infringements and the remedies available to the IP owner and describe the precautious steps to be taken to prevent infringement of proprietary rights in products and technology development.
CO4	Be familiar with the processes of Intellectual Property Management (IPM) and various approaches for IPM and conducting IP and IPM auditing and explain how IP can be managed as a strategic resource and suggest IPM strategy.
CO5	Be able to anticipate and subject to critical analysis arguments relating to the development and reform of intellectual property right institutions and their likely impact on creativity and innovation.

MCS-324	UNIX NETWORK PROGRAMMING	L T P 3 1 0	4 Credits

Course Objectives:

CO1	Able to learn about the protocols which are using in the current scenario.
CO2	To learn and understand client server relations and OSI programming Implementation of the socket and IPC
CO3	Develop skills in network programming techniques.
CO4	Implement network services that communicate through the Internet.
CO5	Apply the client-server model in networking applications.

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.*

Course Outcome:

CO1	Explain OSI Model and Standard Internet Services and Protocols
CO2	How to handle server process termination
CO3	Acquire the knowledge of Elementary TCP sockets and I/O Multiplexing and socket options
CO4	Demonstrate the concepts of fifos streams messages and Remote logins
CO5	Apply knowledge of Unix operating systems to build robust client and server software for this environment;

MCS-325	COMPILER TECHNIQUES	L T P 3 1 0	4 Credits

Course Objectives:

CO1	To discuss the techniques of scanning , parsing & semantic elaboration well enough to build or modify front end.
CO2	To expose the critical issues in modern compilers & provide them with the background to tackle those problems
CO3	Provide an understanding of the fundamental principles in compiler design
CO4	Learn the process of translating a modern high-level language to executable code required for compiler construction
CO5	Provide the skills needed for building compilers for various situations that one may encounter in a career in Computer Science.

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.

Course Outcome:

CO1	Understand the basic concepts and application of Compiler Design
CO2	Apply their basic knowledge Data Structure to design Symbol Table, Lexical Analyzer
CO3	Understand and Implement a Parser -Top Down and Bottom Up Design
CO4	Understand strength of Grammar and Programming Language
CO5	Understand the concept of Code generation

MCS-331	REAL TIME SYSTEMS	L T P 3 1 0	4 Credits

Course Objectives:

CO1	Syllabus deals with issues in real time operating systems
CO2	Importance of deadlines and concept of task scheduling
CO3	Student will be able to understand and design real time operating systems which are backbone of embedded industry
CO4	Student will be able to understand Common Approaches to Real Time Scheduling
CO5	To learn about RAC

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, Peremption 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.

Course Outcome:

CO1	To present the mathematical model of the system.
CO2	To develop real-time algorithm for task scheduling.
CO3	To understand the working of real-time operating systems and real-time database
CO4	To work on design and development of protocols related to real-time communication.
CO5	Able to implement RAC

MCS-332	NETWORKING PROTOCOLS	L T P 3 1 0	4 Credits

Course Objectives:

CO1	To understand the basic concepts of data communication, layered model, protocols and interworking between computer networks and switching components in telecommunication systems.
CO2	Discuss the nature, uses and implications of internet technology.
CO3	To understand the functioning of Frame Relay, ATM
CO4	An overview of security issues related to data communication in networks.
CO5	Know about different application layer 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 th Edition.*
3. *Andrew S. Tanenbaum, "Computer Networks", Prentice Hall India, 4th 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, 4th edition, 2000*

Course Outcome:

CO1	Describe the basis and structure of an abstract layered protocol model
CO2	Independently understand basic computer network technology.
CO3	Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
CO4	Identify the different types of network devices and their functions within a network
CO5	Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation

MCS-333	EMERGING DATABASE TECHNOLOGIES	L T P 3 1 0	4 Credits

Course Objectives:

CO1	Overview of emerging database applications and challenges
CO2	Data Management Issues in Social Networks and Network Computing Systems
CO3	Data Mining and Privacy Preserving Data Mining
CO4	RFID and Sensor Stream data management
CO5	Business Process and Workflow Management

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.*

Course Outcome:

CO1	Explain the characteristics, architecture of database approach, describe the components, major functions of a database system and give examples of their use
CO2	Compare and contrast appropriate data models, including concepts in modeling notation and how they would be used
CO3	Explain the use of integrating OO properties with relational modeling
CO4	Explain the techniques used for data fragmentation, replication, evaluate simple strategies for executing a distributed query and explain how the two-phase commit protocol is used to deal with committing a transaction that accesses databases stored on multiple nodes
CO5	Familiarize with the related areas in databases and gaining familiarity with other popular databases used in the industry

MCS-334	DATA WAREHOUSING & MINNING	L T P 3 1 0	4 Credits

Course Objectives:

CO1	To learn a basic concept of Data warehousing.
CO2	To learn various models of data warehousing
CO3	To understand the concept of data mining
CO4	To understand the concept of Data Compression. Statistical measures in large Databases
CO5	To understand basic OLAP functions

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.*

Course Outcome:

CO1	Analyze the basic functions of data warehouse and data mining.
CO2	Design data warehouse with dimensional modelling and apply different operations.
CO3	Analyze OLAP functions
CO4	Analyze appropriate data mining algorithms to solve real world problems
CO5	Evaluate different data mining techniques like classification, prediction.