Information Technology & Computer Application Department
M.M.M. UNIVERSITY OF TECHNOLOGY
GORAKHPUR

Credit Structure for M.Tech. (Information Technology)

(For newly admitted students for Session 2018-2019)

Category	Semesters	I	II	III	IV	Total
Maths (M)		4	-	-	-	4
Programme Core (PC)		14	9	-	-	23
Programme Elective (PE)		-	8	8	-	16
Minor Project (MP)		-	-	4	-	4
Dissertation (D)		-	-	4	14	18
Seminar (S)		-	-	-	2	2
	Total	**18**	**17**	**16**	**16**	**67**

Curriculum M.Tech. (Information Technology)

Junior Year, Semester-I

S.N.	Category	Paper Code	Subject Name	L	T	P	Credit
1	M	MAS-213	Mathematical Foundations of Computer Science	3	1	0	4
2	PC	MCS-101A	Advanced Computer Networks	3	1	0	4
3	PC	MCS-102	Advanced Database Theory and Applications	3	1	2	5
4	PC	MCS-106	Advanced Algorithms & Data Structures	3	1	2	5
5	AC	MBA-IT6	Managing IT Enabled Services	3	1	0	-
			Total	**15**	**5**	**2**	**18**

Junior Year, Semester-II

S.N.	Category	Paper Code	Subject Name	L	T	P	Credit
1	PC	MCS-206	Information Security and Cyber Law	3	1	0	4
2	PC	MCS-108	Machine Learning Techniques	3	1	2	5
3	PE1	MCS-2**	Program Elective -1	3	1	0	4
4	PE2	MCS-2**	Program Elective -2	3	1	0	4
5	AC	MBA-109	Research Methodology	3	1	0	-
			Total	**15**	**5**	**2**	**17**

Senior Year, Semester-III

S.N.	Category	Paper Code	Subject Name	L	T	P	Credit
1	PE3	MCS-2**	Program Elective -3	3	1	0	4
2	PE4	MCS-2**	Program Elective -4	3	1	0	4
3	MP	MCS-220	Minor Project	0	0	8	4
4	D	MCS-230	Dissertation Part-I	0	0	8	4
			Total	**6**	**2**	**16**	**16**

Senior Year, Semester-IV

S.N.	Category	Paper Code	Subject Name	L	T	P	Credit
1	S	MCS-240	Seminar	0	0	4	2
2	D	MCS-250	Dissertation Part-II	0	0	28	14
			Total	**0**	**0**	**32**	**16**

Programme Core for M.Tech. (Information Technology)

S.N.	Paper Code	Subject Name	Prerequisite Subject	L	T	P	Credit
1.	MAS-213	Mathematical Foundations of Computer Science	-	3	1	0	4
2.	MCS-101A	Advanced Computer Networks	-	3	1	0	4
3.	MCS-102	Advanced Database Theory and Applications	-	3	1	2	5
4.	MCS-206	Information Security and Cyber Law	-	3	1	0	4
5.	MCS-108	Machine Learning Techniques	-	3	1	2	5
6.	MCS-106	Advanced Algorithms & Data Structures	-	3	1	2	5
7.	MCS-220	Minor Project	-	0	0	8	4
8.	MCS-230	Dissertation Part-I	-	0	0	8	4
9.	MCS-240	Seminar	-	0	0	4	2
10.	MCS-250	Dissertation Part-II	-	0	0	28	14

Programme Electives for M.Tech. (Information Technology)

S.N.	Paper Code	Subject Name	Prerequisite Subject	L	T	P	Credit
		PE1 & PE2 (II Semester)					
1.	MCS-264	Data Mining and Data Warehousing	-	3	1	0	4
2.	MCS-265	Human Computer Interaction	-	3	1	0	4
3.	MCS-208	Open Source Programming	-	3	1	0	4
4.	MCS-209	Network Programming	-	3	1	0	4
5.	MCS-211	Semantic Web	-	3	1	0	4
6.	MCS-181	Internet of Things	-	3	1	0	4
7.	MCS-210	Information Retrieval	-	3	1	0	4
8.	MCS-104	Advanced Concepts in Operating Systems	-	3	1	0	4
9.	MCS-174	Advanced Java	-	3	1	0	4
10.	MCS-160A	Cloud Computing	-	3	1	0	4
		PE3 & PE4 (III Semester)					
11.	MCS-105A	System Simulation & Modelling	-	3	1	0	4
12.	MCS-260	Software Testing & Quality Management	-	3	1	0	4
13.	MCS-173	Soft Computing	-	3	1	0	4
14.	MCS-180	Wireless Sensor Networks	-	3	1	0	4
15.	MCS-175	LINUX Networking & Administration	-	3	1	0	4
16.	MCS-256	Bio-Informatics	-	3	1	0	4
17.	MCS-207	Social Network Analysis	-	3	1	0	4
18.	MCS-211	Wireless Networks and Mobile Computing	-	3	1	0	4
19.	MCS-163	Natural Language Interface	-	3	1	0	4
20.	MCS-172	Python Programming	-	3	1	0	4

MAS-213 MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE 4 Credits (3-1-0)

Course Objectives:

1. To familiarize students with the mathematics underlying the core areas of Computer Science
2. To develop student's ability to formalize argument using mathematical proofs.

Learning Outcomes:

After successfully completing the course the student should be able to:

1. Give mathematically precise arguments for their claims
2. Apply, adapt, and design efficient algorithms to solve computational problems
3. Use Graphs to formulate and solve computational problems.
4. Apply mathematical logic to verify the correctness of various security protocols.
5. Use Group theoretic techniques to apply, adapt and design efficient coding schemes.

UNIT I: 9

Review of basic theorem proving techniques: proof by induction, by contradiction, by counterexample and proving the contrapositive.

Basic counting techniques pigeon-hole principle, recurrence relations, generating functions, principle of inclusion and exclusion, Mobius inversion, Polya's counting theorem, Hall's theorem, Sperner's theorem and Dilworth's theorem.

UNIT II: 9

Graph Theory: Introduction, Isomorphism, Sub-graphs, walks, paths and circuits, connected graphs, disconnected graphs and components, Euler graphs, Operations on graphs, more on Euler Graphs, Hamiltonian paths and circuits, The traveling salesman problem, Chromatic number, Chromatic partitioning, Chromatic polynomial, Matchings.

UNIT III: 9

Group theory: definition of groups, cosets and Lagrange's theorem, subgroups, normal subgroups, quotient groups, group action and Burnside's lemma.

Rings, Fields, Integral domains - basic definitions and properties.

UNIT IV: 9

Mathematical Logic: Propositional logic syntax and semantics, Tautologies, axiom system and deduction, Proof of soundness and completeness , First order logic syntax and semantics , Structures, models, satisfaction and validity , Axiomatization, soundness and completeness.

Books and References:

1. Peter Cameron, Combinatorics: Topics, Techniques, Algorithms, Cambridge University Press, 1995.
2. JH van Lint, RM Wilson, A Course in Combinatorics, 2nd Ed., Cambridge University Press, 2001.
3. R Graham, D Knuth, O Patashnik, Concrete Mathematics: A Foundation for Computer Science, 2nd Ed., Addison-Wesley, 1994.
4. J.A.Bondy and U.S.R.Murty: Graph Theory,Springer, 2008.
5. R.Diestel: Graph Theory,Springer(low price edition) 2000
6. IN Herstein, Abstract Algebra, 3rd Ed., Wiley, 1996.
7. DS Dummit, RM Foote, Abstract Algebra, John Wiley, 2004.
8. HD Ebbinghaus, J Flum, W Thomas, Mathematical Logic, 2nd Ed., Springer Verlag, 1994.
9. HB Enderton, A Mathematical Introduction to Logic, 2nd Ed., Academic Press, 2001.
10. RM Smullyan, First Order Logic, Dover Press, 1995.

MCS-106 ADVANCED ALGORITHMS AND DATA STRUCTURES 5 Credits (3-1-2)

Course Objectives:

1. To introduces students to several highly efficient algorithms and data structures for fundamental computational problems across a variety of areas.
2. To analyses and practice advanced algorithms and programming techniques necessary for developing sophisticated computer application programs.
3. To learn new techniques for solving specific problems more efficiently and for analysing space and time requirements.

Learning Outcomes:

1. Students are familiar with various algorithmic techniques such as brute force, greedy, and divide and conquer.
2. Application of advanced abstract data type (ADT) and data structures in solving real world problems.

3. Effectively combine fundamental data structures and algorithmic techniques in building a complete algorithmic solution to a given problem

Unit I **9**

Review of order rotation & growth of functions, recurrences, probability distributions, Average case analysis of algorithms, Basic data structures such as stacks, queues, linked lists, and applications.

Unit II **9**

Direct access tables and hash tables, hash functions and relates analysis, Binary Search trees and Operations, AVL Trees and balancing operations, R B Trees, properties, operations, B – Trees – definition – properties, operations, data structures for disjoint sets,

Unit III **9**

Graph algorithms, MST single source all pair shortest paths, BFS, DFS, topological sort, strongly connected components. More graph algorithms – maximal independent sets, coloring vertex cover, introduction to perfect graph

Unit IV **9**

Quick sort randomized version, searching in linear time, Algorithmic paradigms Greedy Strategy, Dynamic programming, Backtracking, Branch-and-Bound, Randomized algorithms.

COMPUTER PROGRAMMING LAB

1. Write programs that use both recursive and non-recursive functions for implementing the following searching methods:
    a. Linear search
    b. Binary search
2. Write programs to implement List ADT using arrays and linked lists
3. Write programs to implement the following using an array.
    a. Stack ADT
    b. Queue ADT
4. Write a program that reads an infix expression and converts the expression to postfix form.
5. Write a program to implement circular queue ADT using an array.
6. Write a program that uses both a stack and a queue to test whether the given string is a palindrome or not.
7. Write programs to implement the following using a singly linked list.
    a. Stack ADT
    b. Queue ADT
8. Write programs to implement the deque (double ended queue) ADT using
    a. Array
    b. Singly linked list
    c. Doubly linked list.
9. Write a program to implement priority queue ADT.
10. Write a program to perform the following operations:
    a. Construct a binary search tree of elements.
    b. Search for a key element in the above binary search tree.
    c. Delete an element from the above binary search tree.
11. Write a program to implement all the functions of a dictionary (ADT) using Hashing.
12. Write a program to implement Dijkstra's algorithm for Single source shortest path problem.
13. Write programs that use recursive and non-recursive functions to traverse the given binary tree in
    a. Preorder
    b. In order
    c. Post order.
14. Write programs for the implementation of BFS and DFS for a given graph.
15. Write programs for implementing the following sorting methods:
    a. Bubble sort
    b. Merge sort
    c. Binary tree sort
    d. Insertion sort
    e. Heap sort
    f. Quick sort
    g. Radix sort
16. Write a program to perform the following operations:
    a. Insertion into a B-tree
    b. Searching in a B-tree

17. Write a program that implements Kruskal's algorithm to generate minimum cost spanning tree.
18. Write a program that implements KMP algorithm for pattern matching.

Books & References:

1. Peter Brass, Advanced Data Structures, Cambridge University Press, 2008.
2. Sartaj Sahani, Data Structures, Algorithms and Applications In C++. Universities Press, 2009
3. H. S. Wilf, Algorithms and complexity, Prentice hall, 2002
4. T. H. Cormen, C. E. Leiserson, R. L. Rivest, Introduction to Algorithms, Prentice hall, 2009

MCS-107 ADVANCED COMPUTER ARCHITECTURE 4 Credits (3-1-0)

Course Objectives:

1. To understand the principles of various advanced computer architectures
2. To understand the design of parallel computer systems including modern parallel architectures
3. To assess the communication and computing possibilities of Advanced computer architecture and to predict the performance of parallel applications.

Learning Outcomes:

1. To Know the classes of computers, and new trends and developments in computer architecture.
2. To understand the pipelining, instruction set architectures, memory addressing, performance metrics of processors, memory, networks, and disks.
3. To understand the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), using dynamic scheduling, multiple issue, and speculation, multithreading by using ILP and supporting thread-level parallelism (TLP).

Unit – I **9**

Fundamentals of computer design, Amdahl's law, measuring and reporting performance, ISA Architectures, Defining Computer Architecture; Trends in Technology, Trends in Power, Trends in Cost, Dependability, Reporting and Summarizing Performance, Quantitative Principles of Computer Design, Basic and Intermediate concepts of pipelining, Pipeline Hazards, Pipelining Implementation issues.

Unit – II **9**

Instruction-Level Parallelism: Concepts and Challenges, Basic Compiler Techniques for Exposing ILP – Reducing Branch Costs with Prediction, Overcoming Data Hazards with Dynamic Scheduling, Dynamic Scheduling: Algorithm and Examples, Hardware-Based Speculation, Exploiting ILP Using Multiple Issue and Static Scheduling, Exploiting ILP Using Dynamic Scheduling, Multiple Issue and Speculation, Studies of the Limitations of ILP, Limitations on ILP for Realizable Processors, Hardware versus Software Speculation – Using ILP Support to Exploit Thread-Level Parallelism

Unit – III **9**

The Design of Memory Hierarchies, Static and Dynamic Memories, Cache design and Performance, Basic Cache Optimizations, Advanced Optimizations of Cache Performance, Memory Technology and Optimizations, Virtual Memory Design and Implementation, Memory Protection, Evaluating Memory Hierarchy Performance, RAID

Unit – IV **9**

Vector Architecture – SIMD Instruction Set Extensions for Multimedia, Graphics Processing Units (GPUs), Detecting and Enhancing Loop-Level Parallelism, Centralized Shared-Memory Architectures, Performance of Shared-Memory Multiprocessors, Distributed Shared Memory and Directory Based Coherence, Basics of Synchronization, Models of Memory Consistency.

Text & Reference Books

1. David. A. Patterson, John L. Hennessy, "Computer Architecture: A Quantitative approach", Elsevier, 5th Edition 2012.

2. K. Hwang, Naresh Jotwani, "Advanced Computer Architecture, Parallelism, Scalability, Programmability", Tata McGraw Hill, 2nd Edition 2010.
3. Hennessy, J. L. and Patterson, D. A., "Computer Architecture", 4th Ed., Morgan Kaufmann.
4. Sima, D., Fountain, T. and Kacsuk, P., "Advanced Computer Architecture: A Design Space Approach", Pearson Education.
5. Michael, J.Q., "Parallel Computing: Theory and Practice", Tata McGraw-Hill.

MCS-206 INFORMATION SECURITY & CYBER LAW 4 Credits (3-1-0)

Course Objectives:

This course will provide students the knowledge of Information security, Cyber laws, and Computer forensic.

Learning Outcomes:

On successful completion of the course, the student will be able to

1. Understand the fundamental principles of Cryptography, access control models and techniques, authentication and secure system design.
2. Have a strong understanding of different cryptographic techniques and be able to use them.
3. Apply methods for authentication, access control, IP Security, intrusion detection and prevention.
4. Identify and mitigate software security vulnerabilities in existing systems.
5. Explain the basic information on cyber security and Cyber Laws.
6. Have knowledge on copy right issues of software's.
7. Understand ethical laws of computer for different countries.
8. Understand the computer forensic, Digital Forensic Methodologies and steganography.

UNIT- I 9

Introduction to Cryptography: Attacks, Services & Mechanism, Substitution ciphers & Transposition ciphers, stream and block ciphers, Modern Block Ciphers: Block Ciphers Principles, Data Encryption Standard (DES), Strength of DES, Block Cipher Modes of Operations, Triple DES, AES, IDEA Encryption and Decryption. Introduction to Graph, Rings and Fields, Prime & Relative Prime Numbers, Modular Arithmetic, Fermat's Theorem, Euler's Theorem, Euclid's Algorithm, Chinese Remainder Theorem.

UNIT- II 9

Principle of Public Key Cryptography: RSA Algorithm, Security of RSA, Key Management, Diffie-Hellman Key Exchange Algorithm, Message Authentication and Hash Function: Authentication Requirements, Message Authentication Code, MD5 Message Digest Algorithm, Secure Hash Algorithm (SHA), Digital Signature, Authentication Protocols, Digital Signature Standard (DSS), Electronic Mail Security-Pretty Good Privacy (PGP), S/MIME

UNIT- III 9

Introduction to Cyber Security and its problem: Issues in Cyber Security: Private ordering solutions, Regulation and Jurisdiction for global Cyber security, Copy Right, Pirates, Internet Infringement, Fair Use, criminal liability, Defamation, Privacy-Common Law Privacy, Constitutional law, Federal Statutes, Electronic Contracts & Digital Signatures, Misappropriation of information, Legal Aspects of Cyber Security: Ethics, Legal Developments, Cyber security in Society, General law and Cyber Law

UNIT IV 9

Introduction to Computer Forensics: History of Forensics, Computer Forensic Flaws and Risks, Rules of Computer Forensics, Legal issues, Digital Forensic Principles, Digital Forensic Methodologies, Data Forensics: Recovering deleted files and deleted partitions, deleted file recovery tools, deleted partitioned recovery tools, Steganography: classification of steganography, categories of steganography in Forensics, Types of password cracking.

REFERENCE BOOKS:

1. William Stallings, "Cryptography and Network Security", Pearson Education,
2. Atul Kahate, "Cryptography and Network Security", McGraw Hill Education India (Pvt Ltd),2nd edition, ISBN 10: 0070151458, 2009.

3. Jonathan Rosenoer, “Cyber Law: The law of the Internet”, Springer-Verlag, 1997.
4. Mark F Grady, Fransesco Parisi, “The Law and Economics of Cyber Security”, Cambridge University Press, 2006.
5. Anthony Reyes, Jack Wiles, “Cybercrime and Digital Forensics”, Syngress Publishers, Elsevier 2007.
6. John Sammons, “The Basics of Digital Forensics”, Elsevier 2012
7. Linda Volonins, Reynalds Anzaldua, “Computer Forensics for dummies”, Wiley Publishing 2008.
8. Computer Forensics and Investigations, Bill Nelson, Amelia Philips
9. A Step-By-Step Guide to Computer Attacks and Effective Defenses, Skoudis, E., Perlman, R. Counter Hack: Prentice Hall Professional Technical Reference. 2001.
10. Incident Response & Computer Forensics,2nd Edition, Mandia, K, Prosise, C, Pepe, M Osbourne-McGraw Hill, 2003

MCS-181 INTERNET OF THINGS 4 Credits (3-1-0)

Course Objectives:

Students will be explored to the interconnection and integration of the physical world and the cyber space. They will also be able to design & develop IoT devices.

Learning Outcomes:

On successful completion of the course, the student will:

1. Understand the concepts of Internet of Things and its application areas
2. Analyze the basic protocols in wireless sensor network and cloud
3. Implement basic IoT applications on embedded platform
4. Design IoT applications in different domains and be able to analyze their performance

UNIT- I **9**

Introduction to IoT: IoT Technology & Applications, Issues & Challenges, Integration of Sensors and Actuators, Sensor Networks, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, Machine-to-Machine Communications, Difference between IoT and M2M, Software Defined Networking, SDN for IoT, Network Function Virtualization, Interoperability in IoT

UNIT- II **9**

Basics of Programming for developing IoT: Introduction to Arduino and Python programming Implementation of IoT with Raspberry Pi: Introduction to Raspberry Pi, Raspberry Architecture, Raspberry OS & Programming, Raspberry Pi I/O Interfaces, Raspberry Communication Interfaces, Sensor based IoT application development on Raspberry Pi

UNIT- III **9**

Data Management & Computing: Data Handling and Analytics, Bigdata management in IoT, Cloud Computing, IoT Network & Cloud Services, Introduction to Cloud Service Model, Sensor-Cloud, Fog Computing

UNIT- IV **9**

Case Studies: Smart Cities, Smart Homes, Surveillance applications, Vehicular networks - Connected Vehicles, Smart Lighting System, Weather Monitoring System, Smart Agriculture, Healthcare, Activity Monitoring, Industry applications, Other IoT applications

Books & References:

1. Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, Taylor & Francis Group, 2017, ISBN: 9781498761284
2. AdrianMcEwen, “Designing the Internet of Things”, Wiley Publishers, 2013, ISBN: 978-1-118-430620
3. VijayMadisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”,2014, ISBN:9780996025515
4. Daniel Kellmereit, “The Silent Intelligence: The Internet of Things”, 2013, ISBN: 0989973700
5. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", Wiley Publishers, 2010, ISBN 978-0-470-99765-9

MCS-174 **ADVANCED JAVA** **4 Credits (3-1-0)**

Course Objectives:

1. An overview of database access and details for managing information using the JDBC API.
2. Addresses how to use Remote Method Invocation.
3. Will be introduced to Java security.
4. Learn how to use Servlet and JSP and XML with JSP.
5. A presentation of Enterprise JavaBeans and how to use it.

Course Outcomes

At the end of the course the students will be able to

1. Develop Swing-based GUI
2. Develop client/server applications and TCP/IP socket programming
3. Update and retrieve the data from the databases using SQL
4. Develop distributed applications using RMI
5. Develop component-based Java software using JavaBeans
6. Develop server-side programs in the form of servlets
7. Investigate programming for Web Services

UNIT- I **9**

Introduction: Object oriented programming, Exception handling, Collections, Generics, File I/O, Serialization, Multithreading

GUI and JDBC: Event handling, AWT Controls, Window forms and controls, Layout managers, Menus, Applet, JFC, JDBC- Drivers and architecture, Connection object, Types of Statement, Stored procedures. Servlets: Introduction, Servlet life cycle, Deployment and web.xml, Servlet chaining, Session management, Cookies, Web context, Init and context parameter, Authentication and concurrent access, Servlet listeners, Creating war files.

UNIT- II **9**

Networking: Internet Addressing, Internet Address, Factory Methods, Instance Methods, TCP/IP Client Sockets, URL, URL Connection, TCP/IP Server Sockets, Datagrams.

Servlets: Servlet Overview and Architecture, Interface Servlet and the Servlet Life Cycle, Handling HTTP get Request, Handling HTTP post Request, Redirecting Requests to other Resources, Session Tracking, Cookies, Session Tracking with HTTP Session

UNIT- III **9**

EJB and Struts: Types of enterprise beans, Life cycle, Session beans, Entity beans, Message driven beans, JNDI, Hibernate, Struts architecture, Struts classes, Action mapping, Struts flow, Combining Struts and tiles, Introduction to spring framework.

UNIT- IV **9**

Java Server Pages (JSP): Introduction, Java Server Pages Overview, A First Java Server Page example, Implicit Objects, Scripting, Standard Actions, Directives, Custom Tag Libraries

Remote Method Invocation (RMI): Defining the Remote Interface, Implementing the Remote Interface, Compiling and Executing the Server and the Client.

Common Object Request Broker Architecture (CORBA): Technical/Architectural Overview, CORBA Basics, CORBA services

Books & References:

1. Herbert Schildt, Java - The Complete Reference, Tata McGraw- Hill, Seventh Edition (2008).
2. Jim Keogh, J2EE- The Complete Reference; Tata Mcgraw-Hill, Edition (2002).
3. Alur Deepak, Malks Dan and Crupi John, Core J2EE Patterns: Best Practices and Design Strategies, Prentice Hall India (2001).
4. Austin and Pawlan, Advanced Programming for JAVA 2 Platform, Pearson Education (2004).
5. Geary M. David , Core JSTL Mastering the JSP standard Tag Library, Pearson Education (2007).

MCS-105A SYSTEM SIMULATION & MODELLING 4 Credits (3-1-0)

Course Objectives:

The main objective of the course is-

1. To give introductory knowledge of Simulation and Modeling
2. To provide knowledge about manual simulation of some common problems through use of Excel.
3. To provide knowledge about various statistical used in simulation for input modeling.
4. To provide knowledge about modeling of Queuing systems in modeling.
5. To provide knowledge to validate and verify the model.

Course Outcomes:

The course outcome of the course is-

1. Student will have introductory knowledge of simulation and modeling.
2. Student will be able to simulate the common problems manually.
3. Student will be able to model various problems.
4. Student will be able to verify and validate a model.

UNIT- I **9**

Introduction to Simulation and Modeling: Simulation – introduction, appropriate and not appropriate, advantages and disadvantage, application areas, System and system environment, components of system, type of systems, model of a system, types of models and steps in simulation study, Simulation Softwares.

Manual Simulation of Systems: Simulation of Queuing Systems such as single channel and multi-channel queue, lead time demand, inventory system, reliability problem.

UNIT- II **9**

Discrete Event Formalisms: Concepts of discrete event simulation, model components, a discrete event system simulation, simulation of single channel queue, multi-channel queue, inventory system and dump truck problem using event scheduling approach.

Statistical Models in Simulation: Overview of probability and statistics, useful statistical model, discrete distribution, continuous distribution, empirical distribution and Poisson process.

Queuing Models: Characteristics of queuing systems, queuing notations, long run measures of performance of queuing systems, Steady state behavior of Markovian models (M/G/1, M/M/1, M/M/c) overview of finite capacity and finite calling population models, Network of Queues

UNIT- III **9**

Random Number Generation: Properties of random numbers, generation of true and pseudo random numbers, techniques for generating random numbers, hypothesis testing, various tests for uniformity (KS and chi-Square Test) and independence.

Random Variate Generation: Introduction, different techniques to generate random variate: - inverse transform technique, direct transformation technique, convolution method and acceptance rejection techniques.

Input Modeling: Introduction, steps to build a useful model of input data, data collection, identifying the distribution with data, parameter estimation, suggested estimators, goodness of fit tests, selection input model without data, covariance and correlation, multivariate and time series input models.

UNIT- IV **9**

Verification and Validation of Simulation Model: Introduction, model building, verification of simulation models, calibration and validation of models: - validation process, face validity, validation of model, validating input-output transformation, t-test, power of test, input output validation using historical data and Turing test.

Output Analysis: Types of simulations with respect to output analysis, stochastic nature of output data, measure of performance and their estimation, output analysis of terminating simulators, output analysis for steady state simulation.

Books & References:

1. Discrete Event System Simulation - Jerry Banks and John Carson (PHI), 4th edition, 2005
2. System Simulation-Geoffrey Gordon (PHI), 2nd edition, 2006

3. Discrete Event System Simulation - Banks J., Carson J. S., Nelson B. L. and Nicol D. M., (Pearson Education),3rd edition, 2001
4. Simulation Modeling and Analysis - Averill M. Law and W. David Kelton (McGraw Hill), 3rd edition, 2006
5. Handbook of Simulation: Principles, Methodology, Advances, Applications and Practice- Jerry Banks (Wiley), 1998

MCS-179 COMPUTER VISION AND IMAGE PROCESSING 4 Credits (3-1-0)

UNIT- I **9**

Image Formation and Coordinate Transformations-Camera Matrix, Motion/ Stereo Pin-hole model, Human eye/ cognitive aspects of colour/ 3D space; illumination; Sampling and Quantization Coordinate transformations and camera parameters, Image Processing - Noise Removal, Blurring, Edge Detection: Canny/ Gaussian/ Gabor/ Texture Edges/ Curvature/ Corner Detection.

UNIT- II **9**

Motion Estimation: Horn-Schunk Optical Flow Formulation Euler-Lagrange formulation: Calculus of variations theory. Structure Recovery from Motion [Kanade], Segmentation - Concept of Figure vs. Ground, Watershed, Change Detection, Background Subtraction, Texture Segmentation Gaussian Mixture Models - Applications in Color/Motion based Image Segmentation, Background Modeling and Shape Clustering.

UNIT- III **9**

Machine Learning techniques in Vision Bayesian Classification, Maximum Likelihood Methods, Neural Networks; Non-parametric models; Manifold estimation Support Vector Machines; Temporal sequence. Introduction to Object Tracking - Exhaustive vs. Stochastic Search Shapes, Contours, and Appearance Models. Mean-shift tracking; Contour-based models.

UNIT- IV **9**

Object Modeling and Recognition Fundamental matrix/ Epipolar geometry Adaboost approaches: Face Detection/ Recognition Large Datasets; Attention models. Applications: Surveillance, Object detection, etc., case presentations for activity modeling and recognition, cognitive aspects of vision, robot self-localization, etc.

Books & References:

1. David Forsyth and Jean Ponce, Computer Vision: A modern Approach, Prentice Hall India 2004
2. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2008
3. E.R. Davies, Machine Vision, Theory Algorithms Practicalities, Elsevier 2005
4. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis, and Machine Vision. Brooks/Cole / Thomson 1999
5. Chapter 24 (Perception) of Russell and Norvig: AI: A modern Approach, Prentice Hall 2000.
6. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Cambridge University Press 2000
7. Richard O. Duda, Peter E. Hart, and David G. Stork, Pattern Classification, 2nd ed., Wiley Asia, 2002

MCS-180 WIRELESS SENSOR NETWORKS 4 Credits (3-1-0)

Course Objectives:

Students will be able to design & develop WSN applications for the real-world problems. They will also explore the interconnection and integration of the physical world and the cyber space.

Learning Outcomes:

On successful completion of the course, the student will:

1. Understand the concepts of wireless sensor networks and its application areas
2. Analyze the basic protocols in wireless sensor network

3. Implement basic WSN applications
4. Design WSN applications in different domains and be able to analyze their performance

UNIT- I **9**

Basics of WSN: Basic components of a sensor node, Types of sensors, Constraints on the sensor nodes, WSN & its application areas, characteristics of WSN, Nature of Data in Sensor Networks, Manual vs Randomized node deployment, Event aware topology management in WSN, Issues & challenges with WSN, WSN coverage and placement, Localization and Positioning, Task driven sensing, Data Acquisition, Data Dissemination, Aggregation, Mobile WSN, Virtual Sensor Network, Operating Systems for WSN

UNIT- II **9**

MAC Protocols: Fundamentals of MAC Protocols, Design Issues, Overview of IEEE 802.15.4 and ZigBee, Contention-Free Medium Access, Contention-Based Medium Access, MAC Protocols for WSN: Contention-Free MAC Protocols, Contention-Based MAC Protocols, Hybrid MAC Protocols, Characteristics of MAC Protocols in Sensor Networks

UNIT- III **9**

Routing Protocols: Classification of routing protocols, Proactive routing vs Reactive routing, QoS routing, Flat Protocols: SPIN (Sensor Protocols for Information via Negotiation), Directed Diffusion, Hierarchical or Cluster Based Protocols: LEACH (Low Energy Adaptive Clustering Hierarchy), PEGASIS (Power-Efficient Gathering in Sensor Information Systems), Location Based Protocols: GEAR (Geographic and Energy Aware Routing), Some Other Protocols

UNIT- IV **9**

Sensor Network Applications Case Studies: Military Applications, Environmental monitoring applications, Traffic Monitoring, Weather Monitoring, Fire Detection, Underwater Monitoring, Underground Monitoring, Agricultural Applications, Habitat Monitoring, IoT related applications, other applications

Books & References:

1. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", Wiley Publishers, 2010, ISBN: 978-0-470-99765-9
2. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, “Ad Hoc and Sensor Networks: Theory and Applications”, World Scientific Publishers, 2011, ISBN: 981-256-681-3
3. Dorothea Wagner and Roger Wattenhofer, “Algorithms for Sensor and Ad Hoc Networks”, Advanced Lectures, Springer, Lecture Notes in Computer Science 4621, 2007, ISBN-13 978-3-540-74990-5

MCS-108 **MACHINE LEARNING TECHNIQUES** **5 Credits (3-1-2)**

Course Objectives

1. Be able to formulate machine learning problems corresponding to different applications.
2. Understand a range of machine learning algorithms along with their strengths and weaknesses.
3. Understand the basic theory underlying machine learning.
4. Be able to apply machine learning algorithms to solve problems of moderate complexity.
5. Be able to read current research papers and understand the issues raised by current research.

Learning Outcomes

On completion of the course students will be expected to:

1. Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
2. Have an understanding of the strengths and weaknesses of many popular machine learning approaches.
3. Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.
4. Be able to design and implement various machine learning algorithms in a range of real-world applications.

UNIT- I **9**

Introduction: Basic definitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation, Linear regression; Sum of Squares of Error; gradient descent; closed form; normal equations; features.

UNIT- II **9**

Classification problems; decision boundaries; nearest neighbor methods, Probability and classification, Bayes optimal decisions, Naive Bayes and Gaussian class-conditional distribution. Linear classifiers: Bayes' Rule and Naive Bayes Model, Logistic regression, Neural Networks, Decision tree.

UNIT- III **9**

Ensemble methods: Bagging, random forests, boosting, A more detailed discussion on Decision Tree and Boosting, Unsupervised learning: clustering, k-means, hierarchical agglomeration, Advanced discussion on clustering and EM, Latent space methods; PCA, Text representations; naive Bayes and multinomial models; clustering and latent space models.

UNIT- IV **9**

VC-dimension, structural risk minimization; margin methods and support vector machines (SVM), Support vector machines and large-margin classifiers, Time series; Markov models; autoregressive models.

List of Experiments:

1. Implement nearest neighbor algorithm.
2. Implement Linear regression algorithm.
3. Implement Naive Bayes algorithm to solve a classification problem.
4. Implement decision tree algorithm to solve a classification problem.
5. Implement Logistic regression algorithm.
6. Implement k-means algorithm to solve a clustering problem.
7. Implement hierarchical clustering algorithm to solve a problem.
8. Implement PCA algorithm on a suitable problem to reduce its dimension.
9. Implement support vector machines algorithm to solve a classification problem.
10. Implement back propagation neural network training algorithm to solve a problem.

Books & References:

1. Machine Learning, Tom Mitchell, McGraw Hill, 1997, ISBN 0-07-042807-7.
2. Pattern Recognition and Machine Learning, Christopher Bishop, Springer 2006.
3. Introduction to Statistical Learning, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 2013.
4. Pattern Classification, 2nd Ed., Richard Duda, Peter Hart, David Stork, John Wiley & Sons, 2001.

MCS-175 LINUX NETWORKING & ADMINISTRATION 4 Credits (3-1-0)

Course Objectives:

To teach the students how to administrate a LINUX system with knowledge about commands/programming for communicates with other programs across a computer network.

1. Understand the task of LINUX system administration
2. To provide an opportunity to do network programming using TCP/UDP sockets.
3. Understand the system programming like IPC, semaphore etc.

Learning Outcomes:

At the end of the course the student should be able to:

1. Administrate the LINUX server/system.
2. Get familiar with the variety of interfaces and frameworks for writing network applications.
3. Get the knowledge of Interfaces, STREAMS, sockets, and remote procedure call libraries.
4. Know the basic steps and underlying mechanisms of writing programs using the client-server model.

UNIT- I **9**

History of Unix and Linux, Architecture of Linux, Advantages of Linux Introduction to Kernel, Introduction to Linux Shell: Types of Shell, Feature and benefits of Shell, general Linux utilities/commands, shell meta characters, I/O redirection and Piping, pipes, filters, Vi text editor, operation modes and related commands/options

UNIT- II **9**

Shell Programming: Concept, Various programming constructs like while, for, if, case, until etc., Shell Script writing for different type of problems, System Call programming: system calls concept, types, process related commands & system calls, usage of process related system calls

UNIT- III **9**

General Administration Issues: Root Account, Creating User in Linux, Changing Password, Deleting User, Disabling User Account, Linux Password & Shadow File Formats System Shutdown and Restart Creating Groups, Custom Configuration and Administration Issues, Simple Commands

UNIT- IV **9**

Concept of TCP/IP Model, MAC and IP addresses, Daemons, Ports and Sockets, The Client-Server Software model, telnet: remote login, ftp, rlogin, rcp, rsh and other remote commands, socket programming

Books & References:

1. Sumitabha Das, "Unix Concepts & Applications (includes SCO Unix & Linux", Tata McGraw Hill Education
2. W. Richard Stevens, B. Fen er, A.M. Rudof , "Unix Network Programming – The Sockets Networking API", Pearson.
3. Mark Sobell, Practical Guide to Linux Programming, Pearson Education.
4. Meeta Gandhi, Shetty & Shah, "Unix-The Open-Boundless", BPB Publications.
5. Graham Glass and King Ables, "Unix for Programmers & Users", Pearson Education
6. Ellen Siever, Robert Love and Arnold Robbins, Linux in Nutshell, Fifth Edition, Oreilly Media.

MCS-172 **PYTHON PROGRAMMING** **4 Credits (3-1-0)**

Course Objectives:

The main objective of the course is-

1. To improve the problem-solving capability of student.
2. To give introductory as well as advanced concepts of python
3. To give knowledge about various python packages.

Course Outcomes:

The course outcome of the course is-

1. Student will have problem solving skill.
2. Student will be able to implement problems using python.
3. Student will have knowledge about python packages.

UNIT- I Introduction to Python **9**

Introduction- History, Features, Basic Syntax, Interacting with Python Program, Elements of Python- Data types, variables, immutable variables, Operators, expressions, Control Statements, loops, Short-Circuit (lazy) Evaluation, Functions.

UNIT- II String and Text File **9**

Strings and text files, manipulating files and directories, os and sys modules, reading/writing text file, creating and reading a formatted file (csv or tab-separated).

String manipulations: subscript operator, indexing, slicing a string

Lists, tuples, and dictionaries- basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries.

UNIT- III Simple Graphics and Image Processing **9**

Simple Graphics and Image Processing: turtle module; simple 2d drawing - colors, shapes; digital images, image file formats, image processing, Simple image manipulations with image module

UNIT- IV Advanced Python **9**

Classes and OOP: classes, objects, attributes and methods, inheritance, polymorphism, operator overloading, abstract classes, exception handling, Graphical user interfaces, Multithreading, Networks, and Client/Server Programming

Books & References:

1. Fundamentals of Python: First Programs- Kenneth Lambert, Course Technology, Cengage Learning, 2012, ISBN-13: 978-1-111-82270-5
2. Python Programming for the Absolute Beginner - Michael Dawson, Premier Press
3. Learning Python, 5th Edition- Mark Lutz, O'Reilly.

MCS-208 OPEN SOURCE PROGRAMMING 4 Credits (3-1-0)

Objective:

1. To understand Open Source Programming concepts
2. To build applications based on Open Source Softwares

Outcome

After successful completion of the course, students will be able to:

1. develop codes in open source web applications
2. understand the risks associated with the open source codes
3. write secure CGI scripts

UNIT I **9**

Introduction: Open source programming languages, their advantages, threats and vulnerabilities, brief overview of Linux shell programming, PHP Language Basics, Functions and their types, Strings, Arrays, Objects creation, Object introspection, and serialization, Web Techniques – processing forms and maintaining state.

UNIT II **9**

Web Database Applications: Three-tier architecture, Introduction to Object oriented programming with PHP 5, Database basics, MYSQL - querying web databases, writing to web databases, validation with JavaScript, Form based authentication, protecting data on the web.

UNIT III **9**

Perl, TCL, and Python: Numbers and Strings, Control Statements, Lists and Arrays, Files, Pattern matching, Hashes, Functions. Introduction to TCL/TK, Introduction to Python.

UNIT IV **9**

Security in Web Applications: Recognizing web application security threats, Code Grinder, Building functional and secure web applications, Security problems with JavaScript, vulnerable GCI scripts, Code Auditing and Reverse Engineering, types of security used in applications.

Books & References:

1. Kevin Tatroe, Peter MacIntyre, Rasmus Lerdorf, "Programming PHP", O'Reilly Media, 2012.
2. Michael Cross, "Developer's Guide to Web Application Security", Syngress Publishers, 2007.
3. Hugh E. Williams, David Lane, "Web Database applications with PHP and MYSQL", Second Edition, O'Reilly Media, 2004.
4. Tom Christiansen, Brian D Foy, Larry Wall, Jon Orwant, "Programming Perl", Fourth Edition, O'Reilly Media, 2012.
5. Mark Lutz, "Programming Python", Fourth Edition, O'Reilly Media, 2010.
6. Online Tutorials and Recent IEEE/ACM Journal Papers

MCS-173 **SOFT COMPUTING** **4 Credits (3-1-0)**

Course Objectives:

The main objective of the course is to expose the students to soft computing, various types of soft computing techniques, and applications of soft computing. Upon completion of this course, the student should be able to get an idea on:

1. Neural Networks, architecture, functions and various algorithms involved.
2. Fuzzy Logic, Various fuzzy systems and their functions.
3. Genetic algorithms, its applications and advances.

Learning Outcome:

After completing this course, you will be able to learn:

1. Fuzzy logic and its applications.
2. Artificial neural networks and its applications.
3. Solving single-objective optimization problems using GAs.
4. Solving multi-objective optimization problems using Evolutionary algorithms
5. Applications of Soft computing to solve problems in varieties of application domains.

UNIT- I **9**

Introduction to Soft Computing: Concept of computing systems, "Soft" computing versus "Hard" computing, Characteristics of Soft computing, Some applications of Soft computing techniques

UNIT- II **9**

An Introduction to Artificial Neural Network: Fundamental concepts, Evolution of NN, Basic Models of ANN, connections and learning, Terminologies such as weights, Bias, Threshold, Learning Rate etc., McCulloch-Pitts Neuron, Heb Network; Supervised Learning Network: Perceptron Network, Adaptive Linear Neuron, Multiple Adaptive Linear Neurons, Back Propagation Network, Radial Basis Function Network; Associate Memory Networks: Introduction and training algorithm for pattern association, Autoassociative Memory Network, Hetroassociative Memory Network, Bidirectional associative memory, Hopfield Network; Unsupervised Learning Network: Introduction; Fixed Weight Competitive Nets; Kohonen Self-Organizing Feature Maps; Adaptive Resonance Theory; Applications of ANN: Applications: such as recognition of characters, fabric defect identification etc.

UNIT- III **9**

Introduction to Fuzzy Logic: Classical Sets, Fuzzy Sets: operations and properties. Operations on fuzzy relations; Membership functions: Features, fuzzification, methods of membership value assignments; Defuzzification: Introduction; Lambda-Cuts for fuzzy sets and fuzzy relations; Defuzzification methods; Fuzzy Rules: Introduction; formation of rules, decomposition and aggregation of rules; fuzzy reasoning; Fuzzy inference systems (FIS) and applications: FIS methods: Mamdani and Sugeno; Applications: such as fuzzy logic control etc.

UNIT- IV **9**

Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques, Basic GA framework and different GA architectures, GA operators: Encoding, Crossover, Selection, Mutation, etc., Solving single-objective optimization problems using GAs.

Books & References:

1. Timothy J. Ross, “Fuzzy Logic with Engineering Applications,” McGraw Hill, 1995
2. Simon Haykin, “Neural Networks” Pearson Education
3. B.Yegnanarayana, “Artificial Neural Networks,” PHI, India, 2006
4. S. N. Sivanandan and S.N. Deepa, “Principles of Soft Computing”, Wiley India, 2012.
5. Limin Fu, “Neural Networks in Computer Intelligence,” McGraw Hill, 2003
6. Fakhreddine O. Karray and Clarence De Silva., “Soft Computing and Intelligent Systems Design, Theory, Tools and Applications,” Pearson Education, India, 2009
7. Simbrain and MATLAB tools for simulation of ANN and FIS
8. David E. Goldberg, Genetic Algorithm in Search Optimization and Machine learning, Pearson Education

Asia (Adisson Wesley),2000.

MCS-60A **CLOUD COMPUTING** **4 Credits (3-1-0)**

Course Objectives:

Upon successful completion of the course, students:

1. To understand the current trend and basics of cloud computing.
2. To learn cloud services from different providers.
3. To understand the data storage and its processing in Cloud.
4. To expose the various cloud security issues.

Course Outcomes:

In order to pass, the student must be able to

1. Able to collaborate the cloud services to any device.
2. Exploring the online applications of cloud services.
3. Implementing cloud computing for the corporation.
4. Design various applications by integrating the cloud services.

UNIT-I **9**

Understanding Cloud Computing

Overview of Computing Paradigm: Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing, History of Cloud Computing, Cloud Computing- Definition, Characteristics, Advantages & Disadvantages, Cloud Service Providers, Cloud Computing Architecture: Cloud Service Model-SaaS, PaaS, IaaS, Deployment Model, Cloud Storage.

UNIT-II **9**

Cloud Service Models

Infrastructure as a Service: IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM), Resource Virtualization of Server, Virtual Machine provisioning and manageability, storage as a service, Amazon EC2, Platform as a Service: PaaS definition, Service Oriented Architecture, Cloud Platform and Management: Computation, Storage, Example: Google App Engine, Microsoft Azure. Software as a Service: SaaS definition, Web 2.0, Example: Salesforce.

UNIT-III 9

Service and Data management in Cloud

Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, understanding cloud-based data storage, Storage types: SQL and NoSQL Databases, Understanding Distributed File systems, Managing Data and its Scalability, Large Scale Data Processing using Hadoop and GraphLab.

UNIT-IV **9**

Cloud Security and Simulation Tools

Infrastructure Security: Network level security, Host level security, Application level security, Data security and Storage: Data privacy and security Issues, Identity & Access Management, Access Control, Authentication in cloud computing, Case study of CloudSim.

Books & References:

1. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010.
2. Mastering Cloud Computing - Raj Kumar Buyya, Christian Vecchiola and S. Tanurai Selvi (TMH), 2012
3. Cloud Computing for Dummies - Judith Hurwitz, R. Bloor, M. Kanfman, F. Halper (Wiley India Edition)
4. Distributed and Cloud Computing - Kaittwang Geoffrey C. Fox and Jack J Dongrra (Elsevier India) 2012
5. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate - Michael Miller (Que Publishing), Online, August 2008
6. Cloud Computing – Insights into New Era Infrastructure - Kumar Saurabh (Wiley Indian Edition), 2011

7. Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs-Haley Beard (Emereo Pvt. Limited), July 2008.

MCS-101A **ADVANCED COMPUTER NETWORKS** **4 Credits (3-1-0)**

Course Objectives:

1. To study the problematic of service integration in TCP/IP networks focusing the protocol design, implementation, and performance issues.
2. To debate the current trends and leading research in the computer networking area.
3. To understand the recent advancement in networking.

Learning Outcomes:

1. To gain a through understanding of the design of modern computer networks and protocols, including the Internet.
2. To understand the workings of at least one actual TCP/IP Stack and will be able to apply this understanding in modifying it or implementing additional protocols.

UNIT-I **9**

Review of Networking concepts:

Overview of computer networks, seven layer architecture, TCP/IP suite of protocols, Review of Physical and Data link layers, MAC protocols for high speed LANs, Fast and Gigabit Ethernet, Wireless Ethernet, IP addressing and Subnetting, NAT and PAT, Variable Length Subnet, Masking, CIDR.

UNIT-II **9**

Routing and Multicast:

Structure of internet: Autonomous systems, Intra-domain routing: OSPF and RIP, Inter-domain routing: BGP. Multicasting: Group Management (IGMP), Internet scale multicasting: Reverse path broadcast, MOSPF, DVMPRP, PIM, IPv6 protocol, extensions and options, support of QoS, security etc, Mobility in networks, Mobile IP.

UNIT-III **9**

End to End protocols:

TCP connection establishment and termination, Sliding window concepts, other issues: wraparound, silly window syndrome, Nagle's algorithm, adaptive retransmission, TCP extensions. Congestion and flow control, Queuing theory, TCP flavors: Tahoe, Reno, New-Reno, TCP-SACK, TCP-RED and TCP-Vegas, Transport protocol for real time (RTP), SCTP protocol, Wireless TCP, RTP, RTCP.

UNIT-IV **9**

Network Programming:

Network Programming in Java-Network basics, TCP sockets, UDP sockets (datagram sockets), Server programs that can handle one connection at a time and multiple connections (using multithreaded server), Remote Method Invocation (Java RMI)-Basic RMI Process, Implementation details-Client-Server Application.

Books & References:

1. Computer Networks: A Systems Approach, by Peterson and Davie, 5th Ed. Morgan Kauffman, 2011.
2. Computer Networking: Top Down Approach, by Kurose and Ross, 6th Ed. Pearson, 2011.
3. Data Communications and Networking- Data Communications and Networking- Behrouz A., Forouzan, Tata Mc-Graw Hill, 4th edition 2007
4. Data Communication- W Stallings, PHI Publication.
5. TCP/IP Illustrated, Vol. 1: The protocols- W. R. Stevens (Addison Wesley), 1994.
6. An Engineering Approach to Computer Networking- S. Keshav, Pearson Publication.

7. Computer and Communication Networks- Nader F. Mir, Pearson Publication, 2007.
8. K. Fall and S. Floyd, "Simulation-based comparison of Tahoe, Reno, and SACK TCP," Computer Communication Review, vol. 26, pp. 5--21, July 1996.
9. An Introduction to Network Programming with Java, Jan Graba, Springer, 2010.
10. Java Network Programming, 3rd edition, E.R. Harold, SPD, O'Reilly.

MCS-210 INFORMATION RETRIEVAL 4 Credits (3-1-0)

Course objective:
Enable students to understand the various aspects of an Information retrieval system and its evaluation and to be able to design such a system from scratch.

Learning Outcomes:
After completing this course, you will be able:
1. To apply information retrieval principles to locate relevant information in large collections of data
2. To understand and deploy efficient techniques for the indexing of document objects that are to be retrieved
3. To implement features of retrieval systems for web-based and other search tasks
4. To analyse the performance of retrieval systems using test collection
5. To develop a complete IR system from scratch

UNIT- I **9**
Introduction to information retrieval and extraction, Conventional information retrieval systems, Boolean retrieval, The term vocabulary, and postings lists

UNIT- II **9**
Dictionaries and tolerant retrieval, Introduction to index-construction and index-compression, Scoring, term weighting and the vector space model, Computing scores in a complete search system.

UNIT- III **9**
Evaluation in information retrieval, Introduction to Relevance feedback and query expansion, Text classification, Document clustering; Link Analysis; Multimedia retrieval

UNIT- IV **9**
IR applications: Searching on the Web, Web crawling and indexes, Information extraction, Question answering, Opinion summarization etc.

Books and References:
1. Introduction to Information Retrieval, Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schutze, Cambridge University Press. 2008.
2. Hearst, M. Search User Interfaces. Cambridge University Press, 2009.
3. R. Baeza-Yates, B. Ribeiro-Neto. Modern Information Retrieval: The Concepts and Technology behind Search (2nd Edition) (ACM Press Books) 2nd Edition, ISBN: 9780321416919
4. Information Retrieval, ISSN: 1386-4564 (Print), 1573-7659 (Online), Springerl.
5. Foundations and Trends in Information Retrieval, ISSN: 1554-0669, United States.
6. International Journal of Information Retrieval Research

MCS-163 NATURAL LANGUAGE INTERFACE 4 Credits (3-1-0)

Objective:
To tag a given text with basic Language processing features, design an innovative application using NLP components, implement a rule-based system to tackle morphology/syntax of a Language, design a tag set to be used for statistical processing keeping an application in mind, design a Statistical technique for a new application, Compare and contrast use of different statistical approaches for different types of applications.

UNIT- I **9**
Introduction – Models -and Algorithms - The Turing Test -Regular Expressions Basic Regular Expression Patterns - Finite State Automata -Regular Languages and FSAs – Morphology -Inflectional Morphology - Derivational Morphology -Finite-State Morphological Parsing - Combining an FST Lexicon and Rules -Porter Stemmer

UNIT- II **9**

N-grams Models of Syntax - Counting Words - Unsmoothed N-grams – Smoothing- Backoff – Deleted Interpolation – Entropy - English Word Classes - Tagsets for English - Part of Speech Tagging -Rule-Based Part of Speech Tagging - Stochastic Part of Speech Tagging - Transformation-Based Tagging. Context Free Grammars for English Syntax-Context-Free Rules and Trees - Sentence- Level Constructions –Agreement – Sub Categorization

UNIT- III **9**

Parsing – Top-down – Earley Parsing -Feature Structures - Probabilistic Context-Free Grammars Representing Meaning - Meaning Structure of Language - First Order Predicate Calculus Representing Linguistically Relevant Concepts -Syntax-Driven Semantic Analysis

UNIT- IV **9**

Semantic Attachments - Syntax-Driven Analyzer - Robust Analysis - Lexemes and Their Senses - Internal Structure - Word Sense Disambiguation -Information Retrieval Discourse -Reference Resolution – Text Coherence Discourse Structure - Dialog and Conversational Agents - Dialog Acts – Interpretation – Coherence –Conversational Agents - Language Generation – Architecture -Surface Realizations – Discourse Planning – Machine Translation -Transfer Metaphor – Interlingua – Statistical Approaches

Books and References:

1. D. Jurafsky and J. Martin “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”,
2. C. Manning and H. Schutze, “Foundations of Statistical Natural Language Processing”,
3. James Allen. “Natural Language Understanding”, Addison Wesley, 1994.