GANGADHAR MEHER UNIVERSITY
AMRUTA VIHAR,SAMBALPUR,ODISHA

DEPARTMENT OF COMPUTER SCIENCE

Syllabus for
M.Sc. in Computer Science

(2-Year Programme)

Course Effective from Academic year 2019-2020

Post Graduate
Programme Structure

Year	Semesters	
First Year	Semester I	Semester II
Second Year	Semester III	Semester IV

Part-I: Semester-I

Papers		Marks		Total	Duration	Credit
Paper No	Title	Mid Term	End Term	Marks	(Hrs)	Hours
101	Discrete Mathematical Structures	20	80	100	3	4
102	Advanced Data Structures	20	80	100	3	4
103	Microprocessor and Microcontroller	20	80	100	3	4
104	Linux Programming & Scripting	20	80	100	3	4
105	Lab (UNIX, Python, Data structure)	20	80	100	3	4
Total				500		20

Part-I: Semester-II

Papers		Marks		Total	Duration	Credit
Paper No	Title	Mid Term	End Term	Marks	(Hrs)	Hours
201	Advanced JAVA	20	80	100	3	4
202	Data Communication & Computer Networks	20	80	100	3	4
203	Advanced Operating Systems	20	80	100	3	4
204	Advanced Computer Architecture	20	80	100	3	4
205	Lab (Advanced JAVA, Algorithm)	20	80	100	3	4
DSE Papers						
206 A	Mobile Computing	20	80	100	3	4
206 B	Cloud Computing	20	80	100	3	4
206 C	Natural Language Processing	20	80	100	3	4
Total				600		24

Part-II: Semester-III

Papers		Marks		Total	Duration	Credit
Paper No	Title	Mid Term	End Term	Marks	(Hrs)	Hours
301	Artificial Intelligence and Machine Learning	20	80	100	3	4
302	Compiler Construction	20	80	100	3	4
303	Algorithms	20	80	100	3	4
304	Web Technologies	20	80	100	3	4
305	Lab (Web Technologies)	20	80	100	3	4
IDSE Papers						
306A	Network and Internet Technologies	20	80	100	3	4
306B	Data Analysis using R	20	80	100	3	4
306C	Introduction to Programming Using Python	20	80	100	3	4
Total				600		24

Part-II: Semester-IV

Papers		Marks		Total	Duration	Credit
Paper No	Title	Mid Term	End Term	Marks	(Hrs)	Hours
401	Big Data Analytics	20	80	100	3	4
402	Pattern Recognition	20	80	100	3	4
403	Distributed Systems	20	80	100	3	4
404	Information Security	20	80	100	3	4
405	Project Work Report and VIVA VOCE		100	100	3	4
Total				500		20
22 Papers	**Grand Total**			**2200**		**88**

Paper-101
Discrete Mathematical Structures

UNIT-1:

Fundamentals of Logic: Propositional Logic, Propositional Equivalences, Predicate and Quantifiers, nested Quantifiers, Rules of Inference.

Set Theory: Sets, Set Operations.

Introduction to proofs: proof by Induction, proof by contradiction, proof by cases with examples.

Mathematical Induction: Introduction to Induction, strong Induction, Recursion.

Relations: Relations and their properties, n-ary Relations and their applications, Representing relations, Closures of relations, Equivalence relations, and Partial Orderings.

UNIT-II

Number Theory: The division algorithm, Remainders, greatest common divisors, The fundamental theorem of arithmetic, infinity of primes.

Graphs: Graphs, Graph models, special types of graphs, Representing graphs, Graph Isomorphism, connectivity, Euler and Hamilton paths, Planar graphs, Graph Coloring, Matching problem.

Trees: Introduction to Trees, Applications of Trees, Binary Trees, n-ary Trees, Tree Traversal, Spanning Trees.

UNIT-III

Principles of Counting: Counting using Sum Rule and Product rule. Concepts of permutations, combinations and circular permutations. Pigeonhole Principle, Occupancy Problem

Advanced Counting Techniques: Recurrence relations, solving linear recurrence relations, Generating functions, Catalan Numbers, Principle of Inclusion and Exclusion, Applications of Inclusion and Exclusion.

UNIT-IV

Basic Probability: Random experiment. Sample space. Mutually exclusive events. Empirical definition of probability. Problems based on probability. Axiomatic definition of probability. Properties based on axiomatic definition of probability. Conditional probability. Independent events.

Bayes' Theorem and Applications: Bayes' Theorem and problems based on conditional probability.

Text Book:

1. Kenneth H. Rosen, "Discrete Mathematics & Its Applications (with Combinatorics and Graph Theory)", (6th Edition), McGraw-Hill, 2007.

Reference books:

1. C.L.Liu, D.P.Mohapatra, "Elements of Discrete Mathematics" (A Computer Oriented Aproach) (3rd Edition), McGraw-Hill, 2008.
2. J.P. Tremblay, R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", McGraw-Hill, 1997.
3. Ronald L. Graham, Donald E. Knuth, Oren Patashnik, "Concrete Mathematics (A Foundation for Computer Science)" 2nd Edition, Pearson Education,2007.
4. Dougla B. West, "Introduction to Graph Theory" 2nd Edition, PHI Learning, 2009.
5. Richard A. Brualdi, "Introductory Combinatorics" 4th Edition, Pearson, 2004,

Paper-102

Advanced Data Structures

UNIT-I

Introduction to Data Structures, Arrays and Strings, Introduction to Algorithms, Algorithm development, Complexity analysis, Recursion.

Linear Data Structures: Stacks: Operations and Applications, Queues: Operations and Applications, Circular Queues: Operations and Applications

Links Lists: Operation – Creations, insertion, Deletion, Circular Lists, and Doubly Linked List.

UNIT-II

Sorting: Insertion Sort, Merge Sort, Quick Sort, Radix Sort, and Heap Sort.

Searching: Binary Search, Selection.

Dictionaries: skip-lists, hashing, analysis of collision resolution techniques.

UNIT-III

Search Trees- Binary search Trees, Threaded binary tree,AVL Trees, B Trees, Red Black trees. Searching, insertion, deletion operations of trees

Tries and pattern matching. Priority queues and binary heaps

UNIT-IV

Introduction to Graphs, Breadth first search and connected components. Depth first search in directed and undirected graphs and strongly connected components.

Spanning trees: Prim's and Kruskal's algorithm, union-find data structure.

Dijkstra's algorithm for shortest path. Shortest path tree. Shortest and longest paths in directed acyclic graphs.

Automatic List management, dynamic storage management.

Text Books:

   1. Data Structure using C and C++, by A. S. Tanenbaum
Reference books:

1.Ellis Horowitz, Dinesh Mehta, S. Sahani. Fundamentals of Data Structures in C++, Universities Press. 2007.

2.Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, PearsonEducation 2006.
3.Michael T. Goodrich, Roberto Tamassia, David Mount, Data Structures and Algorithms in C++, Wiley India Pvt. Ltd, 2004

Paper-103

Microprocessor and Microcontroller

UNIT-I

Intel 8085 Microprocessor: What is microprocessor, Microprocessor Vs Microcontroller, Block diagram of 8085 microprocessor, pin configuration of 8085, Instruction set and addressing modes of 8085, Assembly language programs for 8085.

Study of supporting chips: basic function and block diagram of 8255(PPI), 8259 (PIC), 8253(PIT), 8251(UART), Interfacing 8085 with memory and I/O devices using address decoder concept, Machine cycle and timing diagram for read and write operation.

UNIT-II

Intel 8086 microprocessor: Block diagram of 8086 microprocessor, concept of pipelining in 8086, pin configuration of 8086, Register organization of 8086, operating modes, instruction set, addressing modes of 8086.

UNIT-III

8051 microcontroller: block diagram and pin diagram of 8051, Registers and memory in 8051, interfacing 8051 with DC motor, LED and LCD, Introduction to Embedded system, general purpose computing Vs Embedded system, Harvard Vs Von-Neuman architecture, Applications of Embedded system.

UNIT-IV

Introduction to 80386 and 80486. 80386 Microprocessor: Introduction, Architecture, Pins & Signals, Memory System, Registers, Memory Management, Paging Technique, Protected Mode Operation.

Text Books:

1. Microprocessors and Microcontrollers Architecture, programming and system Design 8085,8086,8051, 8096:by Krishna Kant; PHI.

Reference books:

1. Fundamentals of Microprocessor & Microcomputer, B. Ram, Dhanpatrai
2. Ramesh S. Gaonkar, "Microprocessor Architecture , Programming and Applications with the 8085", Penram International.
3. Advanced microprocessor by A.P Mathur
4. Raj Kamal, Embedded Systems – Architecture, Programming and Design, Tata McGraw Hill Publishing Company Limited, New Delhi,
5. Kenneth J. Ayala, The 8051 Microcontroller – Architecture, Programming and Applications,2nd Edition, Thomson Delmar Learning, 2004.

Linux Programming & Scripting

UNIT-I

Linux Basics: Introduction to Linux, File System of the Linux, General usage of Linux kernel & basic commands, Linux users and group, Permissions for file, directory and users, Searching a file & directory, zipping and unzipping concepts.

Linux Networking: Introduction to Networking in Linux, Network basics & tools, File transfer protocol in Linux, Network file system, Domain Naming Services, Dynamic hosting configuration Protocol & Network information Services.

UNIT-II

Perl Scripting: Introduction to Perl Scripting, Basic I/O, Variable, and Scalar data, Arrays, Lists, and Hashes, References.

Control structures, Functions, File I/O, Regular expressions, Special Variables and Debugging.

UNIT-III

Python Scripting: Python; basic syntax, interactive shell, editing, saving, and running a script. data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions. Conditions, Boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while);

Strings and text files; manipulating files and directories, os and sys modules; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated). String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa.

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. Functions.

UNIT-IV

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 (convert to bw, greyscale, blur, etc).

Graphical user interfaces; event-driven programming paradigm; tkinter module, creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames

Text Books:

1. Learning Perl, by Schwartz, Randal L., O'reilly publication
2. UNIX CONCEPTS AND APPLICATIONS, by Sumitabha Das, TMH publication.
3. Introduction to Computer Science using Python, by Charles Dierbach

Reference Books:

1. Larry Wall, Tom Christiansen, and John Orwant, *Programming Perl*, 3rd edition, O'Reilly, 2000.
2. Unix Shell Programming, 2003, by Yashavant P. Kanetkar
3. Linux Command Line and Shell Scripting Bible, 3ed, by Richard Blum, Christine Bresnahan.
4. Introduction to Computation and Programming Using Python with Application to Understanding Data, by Guttag John V. PHI
5. Budd, *Exploring Python*. McGraw Hill, 2008.
6. Zelle, Python Programming: An Introduction to Computer Science. Franklin, Beedle & Assoc., 2010.
7. Teach Yourself Perl 5 in 21 days by David Till.
8. Red Hat Enterprise Linux 4: System Administration Guide Copyright 2005 Red Hat, Inc

Lab (UNIX, Python, Data structure)

1. Introduction to UNIX commands.
2. Introduction Shell Scripting.
3. Basic Perl Scripting programs.
4. Perl Scripting using control structures, regular expression.
5. Basic python programs, using control structures.
6. Python programs for strings and text files operations.
7. Python programs using dictionary, tuples and using imported library.
8. Implementation of stacks, queue, linked lists operations.
9. Implementation of Insertion, merge, quick, heap, radix sort.
10. Implementation of a dictionary using trie data structure.
11. Implementation of BFS and DFS on graphs.
12. Implementation of Prim's and Kruskal's algorithms for MST generation.

Paper-201

Advanced JAVA

UNIT-I

Introduction to JAVA & its various features, JAVA Virtual Machine its architecture. Installation of JDK and 'CLASSPATH' setting, A First Java Program, Compilation and Applications, The JDK Directory Structure ,Lexical issues of java Class, Object, Instance Data and Class Data, Methods, Constructors, Access Modifiers, Destroying Objects, inheritance, overriding , Dynamic method dispatch abstract class interface ,Wrapper class boxing unboxing auto boxing and auto unboxing, Package, multithreading , exception handling ., console and File I/O.

UNIT-II

GUI basic, introduction to swing difference between AWT and swing , Swing components and containers Layout managers, event handling , Applets ,life cycle of applets steps for making applet, JLabel, JButton, JCheckBox, JRadioButton, JScrollPane, JTextField, JTextArea ,JMenu, JTable ,dialog boxes.

UNIT-III

JDBC concept The JDBC Connectivity Model, JDBC drivers ,Database Programming, Connecting to Database, Working with database tables, SQLWarning Classes, Executing SQL Queries, ResultSet MetaData, PreparedStatement, Parameterized Statements, Stored Procedures and Transaction Management, Networking , Basics of Networking, Inet Address, TCP/IP Sockets ,Data Grams, Simple Client Server socket programming. Remote method invocation (RMI).

UNIT-IV

J2EE Overview, Client Tier, Middle Tier, Application Server Tier, The J2EE Platform, Servlet , life cycle of servlet steps for making servlet, deployment ,Deployment descriptor and its configuration , Session tracking The JSP Solution, JSP Syntax & Deployment, Variables and Expressions, Sessions in JSP, page and taglib Directives.

Enterprise java beans(EJB), EJB architecture ,Classification of EJB, Session Beans, Stateless and Stateful Session bean ,Bean class , Developing and running bean application, MVC (Model View Control) architecture JAR Concepts, Steps for creating simple jar files, Creating executable JAR Files.

Text Books:
1. JAVA The Complete Reference Herbert Schildt Tata McGraw-Hill
References:
1. JAVA Server Programming Balck Book Kogent Dreamtech publication
2. Programming in JAVA Sachin Malhotra Saurabh Choudhury Oxford publication
3. Introduction to Java Programming Y. Daniel Liang Person publication

Data Communication & Computer Networks

UNIT-I

Overview of Data Communications and Networking. **Physical Layer**: Analog and Digital, Analog Signals, Digital Signals, Analog versus Digital, Data Rate Limits, Transmission Impairment, More about signals. Digital Transmission: Line coding, Block coding, Sampling, Transmission mode. Analog Transmission: Modulation of Digital Data; Telephone modems, modulation of Analog signals. Multiplexing: FDM , WDM , TDM , Transmission Media: Guided Media, Unguided media (wireless) Circuit switching and Telephone Network: Circuit switching, Telephone network.

UNIT-II

Data Link Layer: Error Detection and correction: Types of Errors, Detection, Error Correction Data Link Control and Protocols: Flow and Error Control, Stop-and-wait ARQ. Go-Back-N ARQ, Selective Repeat ARQ, HDLC, Point –to- Point Protocol, Multiple Access, Random Access, Controlled Access, Channelization. Local area Network: Ethernet, Traditional Ethernet, Fast Ethernet, Gigabit Ethernet. Wireless LANs: IEEE 802.11, Bluetooth virtual circuits: Frame Relay and ATM.

UNIT-III

Network Layer: Host to Host Delivery: Internetworking, addressing, Routing. Network Layer Protocols: ARP, RARP, NAT, BOOTP, DHCP, IPV4, ICMP, IPV6, ICMPV6 and Unicast routing protocols Transport Layer: Process to Process Delivery: UDP, TCP, congestion control and Quality of service.

UNIT-IV

Application Layer: Client Server Model, Peer to peer network, Domain Name System (DNS): Electronic Mail (SMTP) and file transfer (FTP) HTTP and WWW.

Text Books:
1. B. A. Forouzan, Data Communications and Networking (4th Ed.), Tata McGraw-Hill Publishing Company Limited.

References:
1. A. S. Tanenbaum, Computer Networks (4th Ed.), PHI Learning Private Limited.
2. Computer Networking: A Top-Down Approach, 2017, by Kurose James F. and Ross Keith

Paper-203

Advanced Operating Systems

UNIT-I

Introduction: Computer-System Architecture, Operating-System Structure, Operating-System Operations, Process Management, Memory Management, Storage Management, Protection-Security, Kernel Data Structures, Computing Environments, Open-Source Operating Systems. Operating-System Structures: Operating-System Services, User Interface for Operating-System, System Calls, Types of System Calls, Operating-System Design and Implementation, Operating-System Structure, Operating- System Debugging. Process Management: Process Concept, Process Scheduling, Operations on Processes, Inter process Communication, Examples of IPC Systems, and Communication in Client–Server Systems. Threads: Overview, Multithreading Models, Threading Issues.
Process Synchronization: Concept, Critical-Section.

UNIT-II

CPU Scheduling: Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Real-Time CPU Scheduling, Algorithm Evaluation.
Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock detection, deadlock prevention, deadlock avoidance, Recovery from deadlock.

UNIT-III

Memory Management: Main Memory, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.
Virtual Memory: Demand Paging, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files.

UNIT-IV

Mass-Storage Structure: Overview, Disk Structure,
Disk scheduling, disk management, Swap-space management, RAID structure.
File Systems: File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, Protection. File- System Structure and Implementation, Directory Implementation, Allocation Methods, Free-Space Management.

Text Books:
1. Abraham Silberschatz, Galvin, Greg Gagne, Operating System Concepts (9e)

References:
1. Operating systems : a design-oriented approach by Charles Crowley
2. Andrew S. Tanenbaum, Modern Operating Systems
3. William Stallings, Operating Systems – Internals and Design Principles
4. Dhananjay M. Dhandhere, Operating Systems-A Concept Based Approach

Paper-204

Advanced Computer Architecture

UNIT-I

Fundamentals of Quantitative Design and Analysis Classes of computers, Trends in technology, Measuring and Reporting Performance, Power consumption and efficiency as the metric, Dependability, Quantitative Principles of Computer Design.

Memory: Characteristics of memory, cache memory, elements of cache design: cache mapping techniques, cache replacement algorithm, cache updation scheme, locality of references, virtual memory, memory hierarchy.

UNIT-II

Central processing unit: CPU structure and function, Micro operation (Register transfer, arithmetic logic and shift micro operations) , stack organization (Register and memory stack),control unit organization(Hardware control and micro programmed control), types of instruction formats based on number of addresses of operands, Addressing modes, Instruction set architecture (RISC and CISC).
Classifying Instruction Set Architectures, Memory Addressing, Addressing modes, Operations in the instruction set.

UNIT-III

Pipelining and parallel processing: Instruction cycle, pipeline processing, instruction pipelining, pipeline hazards, RISC pipelining, Flynn's classification of computer architecture (SISD, SIMD,MISD and MIMD), Shared memory multiprocessor, NUMA and UMA, distributed memory multiprocessor, cache coherence and MESI protocol, CC-NUMA, Multiprocessor and multicomputer system, Array processors: attached array processor, SIMD array processor, Vector computation.

UNIT-IV

Instruction level parallelism: concepts and challenges, basics of pipelining, data hazards, structural hazards, control hazards, minimizing data hazards through forwarding, overcoming branch penalties by delayed branches, static and dynamic branch prediction, dealing with exceptions in pipelining, dynamic scheduling, Tomasulo's algorithm, speculative processors, high performance instruction delivery, VLIW approach, static and dynamic superscalar processors.

Text Books:
Computer Architecture: A Quantitative Approach, by Hennessy
Reference books:

1.   Computer Organization & Architecture, W. Stallings, PHI
2.   Computer System Architecture, Morris Mano, PHI.
3.   Digital Computer Electronics, A. P. Malvino, TMH Edition

Lab (Advanced JAVA)

1. Create GUI to present a set of choices for a user to select stationary products and display the price of Product after selection from the list.
2. Create GUI to demonstrate typical Editable Table which describing Employee for a software company.
3. Create GUI to demonstrate swing components using student registration form.
4. Create a Remote Object for simple arithmetic operators. Use AWT/SWING to create user interface.
5. Write an RMI application using call back mechanism
6. Develop Servlet Question-Answer Application using HttpServletRequest and HttpServletRequest interfaces.
7. Develop Servlet application to accept ROLLNO of a student from client and display the memorandum of marks from the server
8. JSP Programs
    a. Create a JSP page that prints temperature conversion (from Celsius to Fahrenheit) chart
    b. Create a JSP page to print current date and time
    c. Create a JSP page to print number of times page is referred after the page is loaded.
9. Write a simple JSP application to demonstrate the use of implicit object (at least 5).
10. Develop a Hibernate application to Store Feedback of Website Visitors in MySQL Database.
11. Develop a JSP Application to accept Registration Details from the user and store database table.
12. Develop a JSP Application to Authenticate User Login as per the Registration Details. If Login Success then forward User to Index Page otherwise show Login failure Message.
13. Develop a web Application to add items in the inventory using JSF.
14. Write EJB applications using stateless session beans and state-full session beans.
15. Develop a Room Reservation System Application using Entity Beans.

Mini-Project

At the end of the semester, each student has to submit a mini-project using the concept of Advanced Java. Students may form a group of size not more than two for doing the project.

Mobile Computing

UNIT-I

Introduction to Mobile Communications and Computing: Mobile Computing (MC): Introduction to MC, novel applications, limitations, and architecture.
GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services.

UNIT-II

(Wireless) Medium Access Control: Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA.

UNIT-III

Mobile Network Layer: Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP).
Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

UNIT-IV

Database Issues: Hoarding techniques, caching invalidation mechanisms, client server computing with adaptation, power-aware and context-aware computing, transactional models, query processing, recovery, and quality of service issues.
Data Dissemination: Communications asymmetry, classification of new data delivery mechanisms, push-based mechanisms, pull-based mechanisms, hybrid mechanisms, selective tuning (indexing) techniques.

Text Book:
1. Mobile Computing by Raj Kamal, Oxford University Press.

Reference Books:
1. Reza Behravanfar, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML", ISBN: 0521817331, Cambridge University Press, October 2004,
2. Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden , Schwiebert, Loren, "Fundamentals of Mobile and Pervasive Computing", ISBN: 0071412379, McGraw-Hill Professional, 2005.
3. Hansmann, Merk, Nicklous, Stober, "Principles of Mobile Computing", Springer, second edition, 2003.
4. Martyn Mallick, "Mobile and Wireless Design Essentials", Wiley DreamTech, 2003

DSE-206B

Cloud Computing

UNIT-I

Introduction: Cloud Computing at a Glance, Historical Developments, Building Cloud Computing Environments, Computing Platforms and Technologies. Principles of Parallel and Distributed Computing: Eras of Computing, Parallel vs. Distributed Computing, Elements of Parallel Computing, Elements of Distributed Computing, Technologies for Distributed Computing.

UNIT-II

Virtualization: Introduction, Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples.

UNIT-III

Cloud Computing Architecture: Introduction, Cloud Reference Model, Types of Clouds, Economics of the Cloud, Open Challenges Cloud Application Platform: Anatomy of the Aneka Container, Building Aneka Clouds, Cloud Programming and Management High-Throughput Computing: Task Programming: Task Computing, Task-based Application Models, Aneka Task-Based Programming.

Data Intensive Computing: Map-Reduce Programming: What is Data-Intensive Computing? Technologies for Data-Intensive Computing. Cloud Applications: Scientific Applications, Healthcare: ECG Analysis in the Cloud, Biology: Protein Structure Prediction, Biology: Gene Expression Data Analysis for Cancer Diagnosis, Business and Consumer Applications, Multiplayer Online Gaming.

UNIT-IV

Serving the Business with SOA and Cloud Computing, Query API - User Authentication-Connecting to the Cloud - OpenSSH Keys - Tunneling / Port Forwarding - Simple Storage Service - S3, EC2 - EC2 Compute Units, Platforms and storage, EC2 pricing, EC2 customers Amazon Elastic Block Storage - EBS - Ubuntu in the Cloud - Apache Instances in EC2 – Amazon Cloud Services- Amazon Elastic Compute Cloud (Amazon EC2), Amazon SimpleDB, Amazon Simple Storage Service (Amazon S3), Amazon CloudFront, Amazon Simple Queue Service (Amazon SQS), Amazon Elastic MapReduce, Amazon Relational Database Service (Amazon RDS) , EC2 Applications - Web application design - AWS EC2 Capacity Planning – Apache Servers - Mysql Servers - Amazon Cloud Watch – Monitoring Tools.

Text Books:
1. Cloud Computing: Principles and Paradigms, by Rajkumar Buyya and James Broberg, TMH
Reference books:
1. Anothony T Velte, Toby J Velte, Robert Elsenpeter, Cloud Computing: A Practical Approach, MGH, 2010.
2. Grid and Cloud Computing by D Janakiram, TMH
3. Fundamentals of Cloud Computing Paperback – by Prasanta Kumar Pattnaik (Author), Manas Ranjan Kabat (Author), Souvik Pal, VPH.

Natural Language Processing

UNIT-I

Introduction, Why NLP hard, Empirical laws, Basic text processing. Spelling correction: Edit distance, weighted edit distance and other variations. Noisy channel method for spelling correction. N-Gram language model, evaluation of language models.

UNIT-II

Basic smoothing, Advanced smoothing models. Computational morphology, finite state method for morphology. POS tagging.

Introduction to Hidden Markov model, evaluation, learning, Viterbi decoding problem of HMM.

UNIT-III

Syntax: Introduction, Parsing, CYK, PCFGs, PCFGs-inside-outside probabilities. Dependency grammar and parsing, Transition based parsing: formulation, learning. MST based dependency parsing.
Distributional semantics, distributional models of semantics.

UNIT-IV

Lexical semantics, WordNet, word sense disambiguation, Novel word sense detection. Information extraction: Introduction, Relation extraction. Text summarization-LEXRANK, Text classification.

Text Books:

1. Daniel Jurafsky and James H. Martin. 2009. Speech and Language Processing: An Introduction to Natural Language Processing, Speech Recognition, and Computational Linguistics. Prentice-Hall.

Reference books:

1. Natural Language Processing and Information Retrieval (Oxford Higher Education) by Siddiqui ,Tanveer and U.S Tiwary.
2. Christopher D. Manning and Hinrich Schafaze. 1999. Foundations of Statistical Natural Language Processing. MIT Press.

Paper-301

Artificial Intelligence and Machine Learning

UNIT-I

Introduction : AI problems, foundation of AI and history of AI; Intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, state space, problem formulation, **Search Techniques:** Uninformed search strategies: BFS, DF**S,** Iterative deepening DFS, Bidirectional search.

UNIT-II

Informed search: Greedy best first search, A* search.
Heuristic Functions, **Local search Algorithms and Optimization problem**: Hill climbing search, Local beam search. **Game playing:** Adversial search, Games, minimax, algorithm, optimal decisions in multiplayer games, Alpha-Beta pruning, Evaluation functions, and cutting of search. Solution of constraint satisfaction problems using search.

UNIT-III

Knowledge Representation & Reasoning: logical Agents, Knowledge Based Agents, First Order Logic, propositional logic, Inference in First-order Logic, Resolution, Forward & Backward Chaining, frames.

UNIT-IV

Machine Learning: Supervised learning: kNN, Decision tree, unsupervised learning: Clustering-iterative and hierarchical,k-mean clustering, Reinforcement learning, Artificial Neural Net, perceptron model, feed-forward neural network, Back propagation

Text Books:
1. Artificial Intelligence – A Modern Approach. Second Edition, Stuart Russel, Peter Norvig, Pearson Education.

Reference books:
1. Rich, E. and Knight, K., "Artificial Intelligence", Tata McGraw-Hill, 2006.
2. Nilsson, N. J., "Artificial Intelligence: A New Synthesis", Morgan Kaufmann, 1998
3. Artificial Intelligence, Dan W Patterson, Prentice Hall of India

Paper-302

Compiler Construction

UNIT-I

Compiler: Introduction – Programs related to compilers. Analysis of source program, Phases of compiler, modules related to compiler, grouping of phases. Lexical analysis – The role of Lexical Analyser. Input Buffering. Specification of Tokens. Recognition of Tokens. The Lexical-analyser Generator Lex.

UNIT-II

Syntax Analysis – Introduction. Top-Down parsing, Brute Forcing, Recursive Descent, Predicative LL(1),Bottom-Up parsing : Shift reduce parsing, Introduction to LR Parsing, Powerful LR parsers: SLR, CLR,LALR, Parser Generators – Yacc. Error Recovery : Introduction, Error detecting and Reporting in various Phases.

UNIT-III

Syntax Directed Translation – Syntax Directed Definitions. Evaluation Orders for SDDs. Applications of Syntax Directed Translation. Symbol Table Organization - Structure of Symbol table, Symbol Table organization, Data Structures of symbol Table.

Intermediate code generation: Variants of syntax trees. Three-Address Code, Types and Declarations. Translation of Expressions. Type Checking. Control Flow. Activation record, activation tree and run time storage management.

UNIT-IV

Code Generation – Issues in the Design of a Code Generator. The Target Language. Addresses in the Target Code Basic Blocks and Flow Graphs. Optimization of Basic Blocks. Peephole Optimization. Register Allocation and Assignment. Machine Independent Optimizations – The Principal Sources of Optimizations, Introduction to data flow analysis, Foundation of data flow analysis.

Text Books:
1. Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D Ullman – Compilers: Principles, Techniques & Tools, Pearson Education 2nd Edition 2007.

Suggested References:
2. Keith D Cooper & Linda Tarezon, Engineering a Compiler, Morgan Kafman, Second edition.
3. Kenneth C Louden, Compiler Construction: Principles and Practice , Cengage Learning.
4. Lex&Yacc, John R Levine, Oreilly Publishers.

Paper-303

Algorithms

UNIT-I

Introduction to Design and analysis of algorithms, Growth of Functions (Asymptotic notations), Recurrences, Solution of Recurrences by substitution, Recursion tree method, Master Method, Analysis of Searching and Sorting Techniques: Brute Force Technique, Selection sort, Bubble sort.

UNIT-II

Divide and Conquer: Merge sort, Quick sort, Time complexity analysis for Merge and Quick sort.
Transform and Conquer: Balanced search tree, Heaps and Heap sort.
Dynamic Programming algorithms: Matrix Chain Multiplication, Elements of Dynamic Programming, Longest Common Subsequence, 0/1 Knapsack problem.

UNIT-III

Greedy Algorithms: Activity Selection Problem, Elements of Greedy Strategy, Fractional Knapsack Problem, Huffman Codes. Graph Algorithm - BFS and DFS, Minimum Spanning Trees, Kruskal algorithm, Prim's Algorithm, Single Source Shortest paths, Bellmen Ford Algorithm, Dijkstra's Algorithm.

UNIT-IV

String matching, Rabin-Karp Algorithm, KMP Algorithms.

Theory of NP-completeness: Complexity classes of P, NP, NP-Hard, NP complete. Polynomial reduction, Cook's theorem, discussion on SAT, CNF-SAT, Min vertex cover, max clique, Graph coloring.

Text Books:
1. T.H.Coreman et.al. "Introduction to Algorithms" Pearson Education

Reference Books:
1. Design and Analysis of Algorithms, by Kabat M.R, PHI
2. S. Sridhar ""Design and Analysis of Algorithms", Oxford University Press
3. E. Horowitz, S. Sahni, Fundamentals of Computer Algorithms

Paper-304

Web Technologies

UNIT-I

Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols -The World Wide Web-HTTP request message-response message-Web Clients Web Servers-Case Study.

Markup Languages: XHTML. An Introduction to HTML History-Versions-Basic XHTML Syntax and Semantics-Some Fundamental HTML Elements-Relative URLs-Lists-tables-Frames-Forms-XML Creating HTML Documents-Case Study

UNIT-II

Style Sheets: CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-StyleSheets and HTML Style Rule Cascading and Inheritance-Text Properties-Box Model-Normal Flow Box Layout-Beyond the Normal Flow-Other Properties-Case Study.

Client-Side Programming: The JavaScript Language-History and Versions Introduction to JavaScript in Perspective-Syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers.

UNIT-III

PHP: Introducing PHP, PHP Language Basics–Using variables, Understanding Data Types, Operators and Expressions, Constants. Decisions and Loops–Making Decisions, Doing Repetitive Tasks with Looping, Mixing Decisions and Looping with HTML.

Strings–Creating and Accessing Strings, Searching Strings, Replacing Text with strings, Dealing with Upper and Lowercase, Formatting Strings.
Arrays–Creating Arrays, Accessing Array Elements, Looping Through Arrays with for-each, Working with Multidimensional Arrays, Manipulating Arrays.

Functions, writing your own Functions, Working with References, Writing Recursive Functions.
Objects–Introduction OOP Concepts, Creating Classes and Objects in PHP, Creating and using Properties, Working with Methods.

UNIT-IV

PHP MySQL: Handling HTML Forms with PHP–How HTML form works, Capturing Form Data with PHP, Dealing with Multi-Value Fields, Generating Web Forms with PHP, Storing PHP Variables in Forms, Creating File Upload Forms, Redirecting After a Form Submission.
Introducing Databases and SQL–Deciding How to Store Data, Understanding Relational Databases, Setting Up MySQL, A Quick Play with MySQL, Connecting MySQL from PHP.

Retrieving Data from MySQL with PHP–Setting Up the Book Club Database, Retrieving Data with SELECT, Creating a Member Record Viewer. Manipulating MySQL Data with PHP–Inserting, Updating, and Deleting Records.

Reference books:
1. Matt Doyle, Beginning PHP 5.3 (Wrox–Wiley Publishing).
2. Jon Duckett, Beginning HTML, XTML, CSS and JavaScript
3. Joel Murach, Ray Harris, Murach's PHP and MySQL
4. Luke Welling, Laura Thomson, PHP and MySQL Web Development

Lab (Internet and Web Technologies)

1. Design pages using different HTML elements.
2. Customize the pages using CSS on HTML pages.
3. Use java scripts to create DHTML.
4. Install and run PHP scripts on system.
5. Create a database through PHP in MySQL, and create, delete and modify data on database.
6. Store the data from HTML form and using PHP and MySQL, store, and update the data. Display the database data in HTML form.

Mini-Project

A student has to design a working website using HTML, CSS, PHP, and MySQL. Students may work in a team of size not more than two.

Network and Internet Technologies

UNIT-I
Computer Networks: Introduction to computer network, data communication, components of data communication, data transmission mode, data communication measurement, LAN, MAN, WAN, wireless LAN, internet, intranet, extranet.
Network Models: Client/ server network and Peer-to-peer network, OSI, TCP/IP, layers and functionalities.

Unit II
Transmission Media: Introduction, Guided Media: Twisted pair, Coaxial cable, Optical fiber. Unguided media: Microwave, Radio frequency propagation, Satellite.

LAN Topologies: Ring, bus, star, mesh and tree topologies.

Network Devices: NIC, repeaters, hub, bridge, switch, gateway and router.

Internet Terms: Web page, Home page, website, internet browsers, URL, Hypertext, ISP, Web server, download and upload, online and offline.

Unit-III
Introduction to Web Design: Introduction to hypertext markup language (html) Document type definition, creating web pages, lists, hyperlinks, tables, web forms, inserting images, frames, hosting options and domain name registration.

UNIT-IV
Style Sheets: CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-StyleSheets and HTML Style Rule Cascading and Inheritance-Text Properties-Box Model-Normal Flow Box Layout-Beyond the Normal Flow-Other Properties-Case Study.

Client-Side Programming: The JavaScript Language-History and Versions Introduction to JavaScript in Perspective-Syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers.

Reference Books:

1. Computer networks – Tannenbaum

2. Data Communication and Networking – Forouzan – Tata McGraw Hill.

3. D.R. Brooks, An Introduction to HTML and Javascript for Scientists and Engineers, Springer W. Willard,

4. 4.HTML A Beginner's Guide, Tata McGraw-Hill Education, 2009.

5. J. A. Ramalho, Learn Advanced HTML 4.0 with DHTML, BPB Publications, 2007

Data Analysis using R

UNIT-I

Basic fundamentals, installation and use of software, data editing, use of R as a calculator, functions and assignments. Use of R as a calculator, functions and matrix operations, missing data and logical operators.
Conditional executions and loops, data management with sequences.

UNIT-II

Data management with repeats, sorting, ordering, and lists. Vector indexing, factors, Data management with strings, display and formatting. Data management with display paste, split, find and replacement, manipulations with alphabets, evaluation of strings, data frames.

UNIT-III

Data frames, import of external data in various file formats, statistical functions, compilation of data. Graphics and plots, statistical functions for central tendency, variation, skewness and kurtosis, handling of bivarite data through graphics, correlations, programming and illustration with examples.

UNIT-IV

Machine Learning Introduction: Supervised learning, Regression, and classification. Linear regression using R. Classification using kNN, using R. Dimensionality reduction using PCA, using R. Introduction to unsupervised learning: clustering, using R.

Text book:
1. Beginning R: The Statistical Programming Language by Mark Gardner
Reference Book:
1. The Art of R programming by Norman Matloff
2. An Introduction To Statistical Learning With Applications in R by Trevor Hastie and Rob Tibshirani

IDSE-Paper-306C
Introduction to Programming Using Python

UNIT-I

Introduction: what a computer does, Computational thinking, Aspects of programming languages, Basic machine architecture.
Data Representation: Number systems and character representation, binary arithmetic

Human Computer Interface: Types of software, Operating system as user interface, utility programs

Devices: Input and output devices (with connections and practical demo), keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera, monitor, printer, plotter.
Memory: Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks.

UNIT-II

Planning the Computer Program: Concept of problem solving, Problem definition, Program design, Debugging, Types of errors in programming, Documentation.
Techniques of Problem Solving: Flowcharting, decision table, algorithms, Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming.

UNIT-III

Overview of Programming: Structure of a Python Program, Elements of Python.
Introduction to Python: Python Interpreter, Using Python as calculator, Python shell, Indentation. Atoms, Identifiers and keywords, Literals, Strings, Operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator).

UNIT-IV

Creating Python Programs: Input and Output Statements, Control statements (Branching, Looping, Conditional Statement, Exit function, Difference between break, continue and pass.), Defining Functions, default arguments.

References:
1. A. Goel, Computer Fundamentals, Pearson Education, 2010.

2. P. Aksoy, L. DeNardis, Introduction to Information Technology, Cengage Learning, 2006

3. Introduction to Computation and Programming Using Python with Application to Understanding Data, by Guttag John V. PHI

Paper-401

Big Data Analytics

UNIT-I

Overview of Big Data, Stages of analytical evolution, State of the Practice in Analytics, The Data Scientist, Big Data Analytics in Industry Verticals, Data Analytics Life cycle.

Introduction – distributed file system– Big Data and its importance, Four Vs, Drivers for Big data, big data analytics, Big data applications. Algorithms using map reduce.

UNIT-II

Introduction to hadoop and hadoop architecture: Big Data – Apache Hadoop & Hadoop EcoSystem, Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce, Data Serialization. Stream Computing Challenges, Systems architecture, Main memory data management techniques, energy-efficient data processing, HDFS- Overview,

UNIT-III

NoSQL: What is it? Where It is Used Types of NoSQL databases, Why NoSQL?, Advantages of NoSQL, Use of NoSQL in Industry, SQL vs NoSQL, NewSQL.

Data Base for the Modern Web: Introduction to MongoDB key features, Core Server tools, MongoDB through the JavaScript's Shell, Creating and Querying through Indexes, Document – Oriented principles of schema design, Constructing queries on Databases, collections and Documents, MongoDB Query Language.

UNIT-IV

Social Media- Descriptions and Definitions-social media networks-introduction, rise of social media for consumer applications, applying social media to national priorities Social Media Marketing - Theory and Practice, Social Media Marketing (including Viral Marketing), Mobile Marketing, Web Analytics.
Social Media Analytics - Criteria of Effectiveness, Metrics, Techniques (e.g., Social Network Analysis, Semantic Analysis, Online Sentiment Analysis) Centrality Measures-opinion mining. Community detection, Important person identification in a social network.

Reference books:
1) Frank J. Ohlhorst, Big Data Analytics, 1st Edition, Wiley, 2012.

2) Tom White, "HADOOP: The definitive Guide", O Reilly 2012.

3) VigneshPrajapati, "Big Data Analytics with R and Hadoop", Packet Publishing 2013

4) MongoDB in Action, Kyle Banker,Piter Bakkum , Shaun Verch, Dream tech Press

5) Chris Eaton,Dirk derooset al. , "Understanding Big data ", McGraw Hill, 2012.

6) Hansen, Derek, Ben Sheiderman, Marc Smith., Analyzing Social Media Networks with NodeXL: Insights from a Connected World, Morgan Kaufmann, 2011.

Paper-402

Pattern Recognition

UNIT-I

Introduction: Feature extraction and Pattern Representation, Concept of Supervised and Unsupervised Classification, Introduction to Application Areas.

Statistical Pattern Recognition: Bayes Decision Theory, Minimum Error and Minimum Risk Classifiers, Discriminant Function and Decision Boundary, Normal Density, Discriminant Function for Discrete Features, Parameter Estimation

UNIT-II

Dimensionality Problem: Dimension and accuracy, Computational Complexity, Dimensionality Reduction, dimension reduction using PCA.

Nonparametric Pattern Classification: Nearest Neighbour Rule.

UNIT-III

Linear Discriminant Functions: Separability, Two Category and Multi Category Classification, Linear Discriminators, Perceptron Criterion.

Neural Network Classifier: Single and Multilayer Perceptron, Back Propagation Learning.

UNIT-IV

Unsupervised Classification: Clustering: Basic issues in clustering, First conceptual clustering system:Partitioning methods: k-means, expectation maximization (EM), Hierarchical methods: distance-based agglomerative and divisible clustering.

Text Books:
1. Devi V.S.; Murty, M.N. (2011) Pattern Recognition: An Introduction, Universities Press, Hyderabad.
References:
1. R.O. Duda, P.E. Hart and D.G. Stork, Pattern Classification, John Wiley, 2001.
2. C Bishop – Pattern Recognition and Machine Learning – Springer, 2006.
3. S Theodoridis and K Koutroumbas – Pattern Recognition, 4th Edition, Academic Press, 2009.

Paper-403

Distributed Systems

UNIT-I

Introduction to Distributed Systems, Basic Algorithms in Message Passing System, Leader Election in Rings, Distributed Models of Computation, Causality & Logical Time.

Logical Time: Size of Vector Clock, Matrix Clocks, Virtual Time and Physical Clock Synchronization. Global State and Snapshot Recording Algorithms, Distributed Mutual Exclusion and Non-Token based Approaches, Quorum Based Distributed Mutual Exclusion Approaches.

UNIT-II

Distributed Mutual Exclusion: Token Based Distributed Mutual Exclusion Approaches, Consensus and Agreement Algorithms, Check pointing & Rollback Recovery.

Deadlock Detection in Distributed Systems, Distributed Shared Memory, and Distributed Minimum Spanning Tree.

UNIT-III

Termination Detection in Distributed System, Message Ordering and Group Communication, Fault Tolerance and Self-Stabilization.
Distributed Randomized Algorithms, Distributed Hash Table & Peer to Peer Computing.

UNIT-IV

Case Studies: Google File System and HDFS, Distributed Execution using Map Reduce, Introduction to Spark.
Introduction to cluster, grid, and cloud computing.

Text Books:
1. Distributed Systems: Principles and Paradigms by Tanenbum/ Van Steen

Reference books:
1. Distributed Computing: Principles, Algorithms, and Systems- Ajay D. Kshemkalyani and Mukesh Singhal
2. Distributed Computing: Fundamentals, Simulations and Advanced Topics-Hagit Attiya and Jennifer Welch
3. Distributed Algorithms-Nancy Lynch

4. Distributed systems by Bipin Sinha.

Paper-404

Information Security

UNIT-I

Need for Security – Attacks, Services and Mechanisms, Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Classical encryption Techniques, Block ciphers and data encryption, standard.

UNIT-II

Advanced encryption standard, evaluation criteria of AES, Symmetric ciphers- multiple encryption and triple DES, Block cipher modes of operation, Stream ciphers and RC4, Stream ciphers – Blowfish, Modern Symmetric encryption - IDEA, Confidentiality using Symmetric Encryption, Placement of encryption function, traffic confidentiality, Random number generation.

UNIT-III

Introduction to number theory- Prime numbers, Fermat's and Euler's theorems, Chinese Remainder Theorem, Discrete logarithms, Public key cryptography - Principles of public key cryptosystems and RSA, Key management, Diffie-Hellman key exchange, Elliptic curve arithmetic, Elliptic curve cryptography, Key Distribution, Message authentication and Hash functions-Authentication functions, Security and Hash functions and MACs, HMAC, CMAC, Digital signatures and authentication protocols, Authentication protocols, Digital signature standard.

UNIT-IV

Attacks- Denial-of-service/Distributed denial-of-service attacks, Back door, Spoofing, Man-in the-middle, Replay, TCP/Hijacking, Fragmentation attacks, Weak keys, Mathematical attacks, Social engineering, Port scanning, Dumpster diving, Birthday attacks, Password guessing, Software exploitation, Inappropriate system use, Eavesdropping, War driving, TCP sequence number attacks, War dialling/demon dialling attacks.

Text Books:
1. William Stallings, Cryptography and Network Security, Pearson Education, 2006.
Reference books:
1. Cryptography and Network Security – by Atul Kahate – TMH
2. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
3. Eric Cole, Dr. Ronald Kurtz and James W. Conley, Network Security Bible, Wiley Publishers, 2009

Project Work Report and VIVA VOCE

Web-development project: Students must follow software engineering principles to make the project.
Research project: Students can take a research work, review the related literatures, then propose a method or implement an existing one.