MCA Curriculum & Syllabus
(2020-2022)(2021-23)

Department of Computer Application
Maharaja Sriram Chandra BhanjaDeo University
Srirama Chandra Vihar, Takatpur, Baripada, Odisha

http://nou.nic.in

Name of the Programme: Master of Computer Applications (MCA)

(a) Programme's Mission & Objectives:

Mission

To generate Competent Professionals to become Entrepreneurs or be part of the Industry, R&D organizations and Academia at the Local/National/International Levels

Vision

1. Providing strong theoretical as well as practical background across the
2. Computer Application domain to the students
3. Imparting the necessary skills to turn students into professionals
4. Inculcating Professional Behaviour, Strong Ethical values, Innovative
5. Research Capabilities and Leadership Abilities among students
6. Empowering the youth in Rural/Tribal communities with IT education
7. Extending Computer Application Research to meet Societal & Local needs

Objectives

1. Produce knowledgeable and skilled human resources which are employable in IT and ITES.
2. Impart knowledge required for planning, designing and building complex Application Software Systems as well as provide support to automated systems or application.
3. Produce entrepreneurs who can develop customized solutions for small to large Enterprises.
4. To develop academically competent and professionally motivated personnel, equipped with objective, critical thinking, right moral and ethical values that compassionately foster the scientific temper with a sense of social responsibility.
5. To develop students to become globally competent.
6. To inculcate Entrepreneurial skills among students

Programme Educational Objectives

The Master of Computer Applications Programme Educational Objectives aims to:

1. MCA graduates who will have successful careers based on their understanding of formal and practical methods of Application Development using the concepts of computer programming, software and design principles.
2. MCA graduates will demonstrate analytical and design skills including the ability to generate creative solutions and foster team-oriented, professionalism through effective communication in their careers.
3. MCA graduates who will exhibit effective work ethics and be able to adapt to the challenges of a dynamic job environment.

(b) Relevance of the Programme with HEI's Mission and Goals:

The Master of Computer Applications (MCA) programme to be offered is purely relevant and aligned with the goals and missions of the University.

(c) Nature of Prospective target groups of Learners:

After getting an MCA degree, one can enter any of the following roles :-

1. Joining IT firms Software and Web Developments

MCA has endless scopes in software. Those who with have skill and knowledge in programming and programming languages like HTML, CSS, jQuery, Ajax, PHP, MySQL, ASP, JSP, Tomcat, Python, and Perl etc. can choose an IT industry with Web development background.

2. System Analyst
A systems analyst is an information technology professional who specializes in analyzing, designing and implementing information systems. Systems analysts assess the suitability of information systems in terms of their intended outcomes.

3. Network Manager
A Network Manager Manage and maintain the network, as well as network performance monitoring, Identifying, installing and maintaining upgrades to the network

4. Data Science
After MCA learner can also make a career in Data Science. This field is emerging day by day.

5. Self Engagement
After MCA learner can also become an entrepreneur.

6. Go for Higher Studies
After MCA it is highly recommended that the learner should go for higher studies, depending upon his background and interest. After MCA the learner can opt followed degrees:

- M.Tech2 years course
- M.Phil1 year course
- Ph.D.Research course

(d) Appropriateness of the Programme to acquire specific Skills and Competence:
This program is concerned with design, development, and use of computer applications. Application implies incorporation of the operating system, a utility and a programming language. Thus, MCA graduates are able to develop and prepare documents, projects, presentations, design websites and demonstrate skills in running software programs. Besides imparting theoretical knowledge, a lot of stress is laid on hands-on training and overall development of the personality. Students graduating from this program can work gainfully in software services companies, outsourcing companies, and other allied sectors. The program has been designed to impart advanced knowledge in various areas of computer applications. It has been designed in such a way that student can complete it based on their advanced coursework. The structure of this program fosters a highly varied learning orientation in students by balancing core courses, advanced elective courses, and a substantial dissertation or project.

The University provides the opportunity to the human resource, basically to the poor and rural people to get a quality education in Computer Applications, which can fulfill the demand of the society.

MCA Syllabus (2-Years Course)
North Orissa University
2020-22

FIRST SEMESTER

PAPER ID	PAPER TITLE	FULL MARK	L-T-P	CREDIT
CA-401	Discrete Mathematics	100	3-1-0	4
CA-403	Data Structures using C	100	3-1-0	4
CA-405	Computer System Architecture	100	3-1-0	4
CA-407	Numerical Analysis	100	3-1-0	4
CA-409	Operating System	100	3-1-0	4
CA-411	Lab-1:-Data Structure Using 'C'	100	0-0-6	6
			Total Credit	**26**

SECOND SEMESTER

PAPER ID	PAPER TITLE	FULL MARK	L-T-P	CREDIT
CA-402	Theory of Computation	100	3-1-0	4
CA-404	Database Management Systems	100	3-1-0	4
CA-406	Computer Network	100	3-1-0	4
CA-408	Design and Analysis of Algorithms	100	3-1-0	4
CA-410	Lab-2:- Database Management Systems	100	3-1-0	4
OE-CA-412	Data Visualization	100	0-0-6	6
			Total Credit	**26**

THIRD SEMESTER

PAPER ID	PAPER TITLE	FULL MARK	L-T-P	CREDIT
CA-501	Object Oriented Programming using Java	100	3-1-0	4
CA-503	Software Engineering	100	3-1-0	4
CA-505	Data Warehousing and Data Mining	100	3-1-0	4
CA-507	Artificial Intelligence	100	3-1-0	4
CA-509	**Elective – 1**	100	3-1-0	4
CA-511	Lab-3:- Programming using Java	100	0-0-6	6
			Total Credit	**26**

FOURTH SEMESTER

PAPER ID	PAPER TITLE	FULL MARK	L-T-P	CREDIT
CA-502	**Elective – 2**	100	3-1-0	4
CA-504	**Elective – 3**	100	3-1-0	4
CA-506	**Elective – 4**	100	3-1-0	4
CA-508	Project/ Dissertation	300	0-0-10	10
			Total Credit	**22**

Total Mark-2400 **Total Credit-100**

Elective-1

PAPER ID	PAPER TITLE	FULL MARK	L-T-P	CREDIT
CA-509 -A	Combinatorics and Graph Theory	100	3-1-0	4
CA-509 -B	Computer Security	100	3-1-0	4
CA-509 -C	Computer Graphics	100	3-1-0	4
CA-509 -D	Internet of Things	100	3-1-0	4

Elective-2

PAPER ID	PAPER TITLE	FULL MARK	L-T-P	CREDIT
CA-502-A	Machine Learning	100	3-1-0	4
CA-502-B	Block Chain Technology	100	3-1-0	4
CA-502-C	Mobile Computing	100	3-1-0	4
CA-502-D	Data Science using Python	100	3-1-0	4

Elective-3

PAPER ID	PAPER TITLE	FULL MARK	L-T-P	CREDIT
CA-504-A	Digital Image Processing	100	3-1-0	4
CA-504-B	Cloud Computing	100	3-1-0	4
CA-504-C	Simulation and Modeling	100	3-1-0	4
CA-504-D	Compiler Design	100	3-1-0	4

Elective-4

PAPER ID	PAPER TITLE	FULL MARK	L-T-P	CREDIT
CA-506-A	Organizational Behavior	100	3-1-0	4
CA-506-B	Web and Text Mining	100	3-1-0	4
CA-506-C	Big Data Analytics	100	3-1-0	4
CA-506-D	Bioinformatics	100	3-1-0	4

CA-401 Discrete Mathematic

Course Objectives:

The objective of this course is to:

1. To learn the mathematical foundations for Computer Science.
2. Topics covered essential for understanding various courses.

Course Contents:

Unit 1

Logic: Propositions and logical Operations, Conditional statements; Predicate Calculus First order logic, universal and existential quantifiers; Proof Techniques- methods of proof, Mathematical induction. Matrices: Determinant, Matrices, Solving System of Equations-Eigen Values and Eigen Vectors-Inverse of matrix

Unit 2

Graph Theory: Directed and undirected graphs, basic terminology, paths and circuits, bipartite graph, Eulerian graph. Trees; definition and properties, rooted trees, binary trees, spanning trees, minimal spanning trees

Unit 3

Algebraic structures and application Binary operations, groups, Subgroups, Cosets, Lagrange's theorem, Normal subgroup, Homomorphism.

Unit 4

Basic properties of lattices, Distributive and complemented lattices, Boolean algebra, disjunctive and conjunctive normal forms.

Course Outcomes:

After successful completion of the course, student shall be able to:

1. Use Logical notation
2. Perform logical proofs
3. Determine equivalent logic expressions
4. Use graphs and trees
5. Apply basic and advanced principles of counting
6. Define sets and sequences
7. Easily dig into algorithms that will help employability in industry and research institutions.

Reference:

1. J.K. Mantri & T.K. Tripathy, A Modern Approach to Discrete Mathematics & structure
2. Truss, "Discrete Mathematics", Pearson
3. Rosen, " Discrete Mathematics", McGraw Hill
4. C.L. Liue, "Elements of Discrete mathematics" , Mc Graw Hill international Student edition.
5. Mott: Discrete Mathematics

CA-403 Data Structures Using C

Course Objectives:

The objective of this course is to:

1. To learn basic Programming Skills
2. To develop algorithms for performing different operations on data structures and implement in C language

Course Contents:

Unit 1

Introduction to C language: Identifiers, Keywords, Data Types, Constant and Variables, Statements, Expressions, Operators. Decision and Loop Control Statements, Arrays, Functions, Storage Class, Recursion, Structures and Unions, Pointers, Dynamic Memory Allocation.

Unit 2

Stacks: Representation & Operations, Applications of Stack: Postfix expression evaluation, Infix to Postfix Conversion. Queue: Representation and Operations, Circular Queue. Linked List. Doubly Linked List, Circularly Linked List, Linked List Operations: Insertion, Deletion, Search, Reverse, Traversal.

Unit 3

Trees: Preliminaries, Tree: Representation & Implementation. Binary Search Trees: Representation & Operations - Find, Insert, Delete. Binary Tree Traversals. AVL Trees: Single Rotation, Double Rotation. Introduction to Graph, Graph representation: Adjacency matrix, Adjacency list, Graph Traversals: DFS, BFS.

Unit 4

Search: Sequential and Binary search, Sorting Algorithms: Insertion Sort, Selection Sort, Bubble Sort, Merge Sort, Heap Sort, Quick Sort, Counting Sort. Hashing: Hash Functions, Separate Chaining, Open Addressing - Linear Probing, Quadratic Probing.

Course Outcomes:

After successful completion of the course, student shall be able to:

1. Write code for an Algorithm
2. Understand the flow of data and instructions in programming
3. Apply various data structures for problem solving
4. Find employability in software development companies, and startups.

References:

1. E. Balaguruswamy" Programming in C", Tata McGraw Hill
2. Brian W. Kernighan , Dennis M. Ritchie, "The C Programming Language (Ansi C Version)", 2nd Edition, PHI
3. H. Schildt, C The Complete Reference", Tata McGraw Hill
4. Y. Kanetkar,"Let us C", BPB Publication.
5. Peter van der Linden, "Expert C Programming: Deep C Secrets", Pearson India
6. Mark Allen Weiss, "Data Structure and Algorithm Analysis in C", 2nd Edition, Pearson Education.
7. Samir Kumar Bandyopadhyay, "Data Structures using C", 1st Edition, Pearson Education
8. Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", 2nd Edition, Cengage Learning
9. Nick Parlante, "Linked List Problems", Stanford University

CA-405 Computer System Architecture

Course Objectives:

1. Conceptualize the basics of organizational and architectural issues of a digital computer and Classify and compute the performance of machines, Machine Instructions
2. Learn about various data transfer techniques in digital computer and the I/O interfaces

Course Contents:

Unit 1
Structure of Computer Hardware: Basic function units and their Operational concepts, Single Bus Structure. Logic circuits: Logic functions, Synthesis if logic expression, Using AND, OR and NOT gates, Minimization of logic expressions using Karnaugh maps, don‘t care conditions, Synthesis using NAND and NOR gates. Computer Arithmetic: Binary Arithmetic, Addition and Subtraction of signed number, Multiplication of positive number. Signed operand multiplication, Division, Floating point number representation and arithmetic

Unit 2
Basic processing of Instruction: Instruction code, Instruction set, Instruction sequencing, Instruction cycle, Instruction format, Addressing format, Addressing modes, Micro instruction, Data path, Hardwired controlled unit, Micro programmed control unit, Design of Control Unit and ALU.

Unit 3
Memory: Memory Hierarchy, RAM, ROM, Cache memory organization, Mapping techniques, Virtual memory, Mapping technique, Associative memory, Memory Interleaving, Secondary Storage, Flash drives. Design

Unit 4
Input/Output: Accessing I/O devices. Programmed I/O. Memory mapped I/O. Interrupt Driven I/O. Standard I/O interfaces. Synchronous and Asynchronous Data Transfer, DMA Data transfer.

Learning Outcomes:

1. Explain the basics of organizational and architectural issues of a digital computer and Classify and compute the performance of machines, Machine Instructions
2. Describe various data transfer techniques in digital computer and the I/O interfaces
3. This will help them to design, develop, and implement applications better, faster, cheaper, and more efficient manner, thereby will increase their employability.

Reference:

1. M. Morris Mano , "Computer System Architecture", Pearson Education
2. William Stallings, "Computer Organization and Architecture", Pearson Education
3. V. Rajaraman and T. Radhakrishnan, "Computer Organization and Architecture", PHI
4. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", 5th Edition, Mc Graw Hill Education
5. A. S. Tanenbaum, "Structured Computer Organization", Pearson Education

CA-407 Numerical Methods

Course Objectives:

The objective of this course is to:

1. To learn various numerical techniques.
2. To be able to implement different numerical techniques using programming language.

Course Contents:

Unit 1

Number System and Errors: Introduction, Binary Number, Octal Numbers, Hexadecimal Number, Floating point representation, Approximation of numbers, Polynomial Interpolations: Existence and Uniqueness of Interpolating polynomial, Lagrange's Interpolating Formula, Error in Interpolation, Interpolation points for minimizing the error bound

Unit 2

Newton's Divided Difference Interpolating polynomial, Properties of divided Differences, Forward Difference Operator. Newton's Forward Difference Interpolating formula, Backward Difference Operator Newton's Backward Difference Interpolation formula

Unit 3

Method of bisection, Secant Method & Regular falsie Method, Newton-Raphson Method& convergence, Fixed point of a function, Fixed point iteration method, Some simple Quadrate Rules, Newton-Cotes Rules, Compound quadrate Rules, Gauss legendre-2 & 3 point

Unit 4

Numerical solution of ordinary differential equation -Euler method, Modification of Euler's method, Runge-Kutta method of order two and four

Learning Outcomes:

1. Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
2. Analyse and evaluate the accuracy of common numerical methods.
3. It is widely used for forecasting and predicting in the field of machine learning. Good grip on this subject will enable students employable in machine learning and AI projects.

Reference:

1. B.P. Acharya & R.N. Das, "A Course On Numerical Analysis", Kalyani Publishers
2. Elementary Numerical Analysis By J.K.Mantri
3. Numerical Analysis By S.S. Sastry.

CA-409 Operating System

Course Objectives:

1. To understand overall functionality of Operating System such as Process Management, Memory Management, File Management and Security Issue.
2. To Provide sufficient understanding of operating system design
3. To understand the impact of operating system on application systems design and performance.

Course Contents:

Unit 1
Introduction to Operating Systems. User View & System View of OS. Operating System Concepts, Interrupts & System Calls. Operating System Services. Processes. Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms (FCFS, SJF, Priority, Round-Robin, Multilevel Queue, Multilevel Feedback Queue).

Unit 2
Inter Process Communication. Process Synchronization: Background, The Critical-Section Problem, Semaphores, Counting Semaphores & Binary Semaphores. The Dining-Philosophers Problem. Monitors.

Unit 3
Deadlocks: Basic cause of deadlock, Conditions for deadlock, Resource-Allocation graph. Deadlock Prevention, Deadlock Avoidance with Banker's algorithm. Deadlock Detection.

Unit 4
Memory Management Strategies: Background (Address Binding, Logical vs Physical Address space), Swapping, Contiguous Memory Allocation: Dynamic Memory Allocation (First-fit, Best-fit, Worst-it), Fragmentation. Paging, Page Tables. Segmentation. Virtual Memory Management: Background (Virtual Memory & Virtual Address Space). Demand Paging, Page faults, Page replacement techniques: FIFO, Optimal, LRU. Frame allocation techniques, Thrashing.

Course Outcomes:

After successful completion of the course, student shall be able to:

1. Exhibit familiarity with the fundamental concepts of operating systems.
2. Apply a mature understanding of operating system design and how it impacts application systems design and performance.
3. Exhibit competence in recognizing operating systems features and issues.
4. It helps students to become a good programmer.
5. Operating systems are designed to give programmers a common set of commands to consistently interact with the hardware. These commands make a programmer's job easier by reducing program complexity and making it faster to write software while minimizing the possibility of errors in code.

Reference:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, “Operating System Concepts”, 8th Edition, Wiley India
2. Harvey M. Deitel, Paul J. Deitel, David R. Choffnes, “Operating Systems”, 3rd Edition, Pearson Education
3. William Stallings, “Operating Systems: Internals and Design Principles”, 6th Edition, PHI Learning / Pearson Education
4. Andrew S. Tanenbaum, “Modern Operating Systems”, 3rd Edition, PHI Learning / Pearson Education

CA-411 Lab-1:-Data Structure Using 'C'

Course Objectives:

The objective of this course is to:

1. To practice with programming skill and improve the programming logic.
2. To apply various techniques with data such storing, inserting, deleting and traversing of data.
3. Utilization of various data structures such as Linked List Structures, Stack, Queues, Trees and Graphs.

Course Contents:

1. Creating and editing simple C programs, compilation and execution.
2. Program on Expressions, Operators, Simple Arithmetic, Decision and Loop Control Statements.
3. Program demonstrating Single & Multidimensional arrays
4. Program demonstrating Functions, recursion,
5. Program demonstrating structure and union
6. Program demonstrating Pointers and dynamic memory allocation
7. Program demonstrating Array based Stacks: Postfix expression evaluation, Infix to Postfix Conversion
8. Program demonstrating Array based Queues: Queue operations, Circular queue
9. Program demonstrating Linked List, Doubly Linked List, Circularly Linked List, Linked List Operations: Insertion, Deletion, Search, Traversal.
10. Implementing Stacks & Queues using Linked List.
11. Program demonstrating Binary Search Trees: Representation & Operations - Find, Insert, Delete. Binary Tree Traversals: inOrder, preOrder, postOrder
12. Implementation of Binary search.
13. Sorting Implementations: Insertion Sort, Selection Sort, Bubble Sort, Merge Sort, Heap Sort, Quick Sort, Counting Sort.
14. Simple Hash Table implementation

Course Outcomes:

After successful completion of the course, student shall be able to:

1. Write the code for a large program after overcoming the time and space complexity.
2. Frequent use of various algorithms such as searching, sorting, traversing with data structures.
3. Define the data in an optimal way.
4. Work as a software engineer in any multinational software company.

CA-402 Theory of Computation

Course Objectives:

1. To explore the theoretical foundations of computer science from the perspective of formal languages and classify machines by their power to recognize languages.

Course Contents:

Unit 1
Introduction To Finite Automata : Alphabets and languages- Finite Representation of Languages. Deterministic Finite Automata – Non- deterministic Finite Automata – Equivalence of Deterministic and Non-Finite Automata; Conversion Problem Complexity: The Classes P and NP ; NP-Completeness; NP-Hard Problems

Unit 2
Properties of the Languages Accepted by Finite Automata – Finite Automata and Regular Expressions Context free languages: Context –Free Grammar – Regular Languages and Context-Free Grammar Pushdown Automata – Pushdown Automata and Context-Free Grammar – Properties of Context-Free Languages – Closure Properties –Deterministic Pushdown Automata and Context – Free Languages – Top- down and Bottom – Up Parsing.

Unit 3
Turing machines: The Definition of Turing Machine – Computing with Turing Machines — Types of Turing machines some ; Recursive Functions

Unit 4
Uncomputability : The Halting Problem – Turing-Enumerability, Turing – Acceptability, and Turing - Decidability – Unsolved problems about Turing machines and Recursive Functions

Course Outcomes:

1. To understand the basic properties of formal languages and grammars. differentiate regular, context-free and recursively enumerable languages. make grammars to produce strings from a specific language. including decidability and intractability
2. Student can write efficient algorithms that operate on computer devices, research and development of programming languages and in compiler design and construction that is efficient. This knowledge will help them to get job in Software Industries and R & D Sectors.

Reference :

1. Elements Of The Theory Of Computation, Harry R Lewis, Cristos h. Papadimitriou,Pearson Education / Prentice-Hall of India Private Limited.
2. Hopcroft. J.E, J.D.Ullman, "Introduction to Automata Theory, Languages, and Computation", Addison-Wesley
3. Kamala Krithivasan, Rama R., "Introduction to Formal Languages, Automata Theory and Computation", Pearson India
4. Michael Sipser, "Introduction to the Theory of Computation", Cengage Learning

CA-404 Database Management Systems

Course Objectives:

1. To learn the fundamental elements of database system.
2. To learn the basic concepts of relational database management systems.
3. To learn various SQL commands.

Course Content:

Unit 1
Database systems Architecture-data Abstraction, data independence, Codd's Rule for RDBMS, Data definitions and data manipulation Languages. Data models- Entity Relationship (ER), mapping ER Model, network, relational and Object Oriented data models, Integrity Constraints and data manipulation operations.

Unit 2
Relation Query Languages, Relational Algebra, Tuple and Domain relational calculus, SQL and QBE. Relational database Design: Domain and Data dependency, Armstrong's Axioms, Normal Forms, Dependency Preservation, Lossless design.

Unit 3
Query Processing and Optimization: Evaluation of relational algebra Expressions, Query equivalence, join strategies, Query optimization algorithms, Storage strategies: Indices, B-tree, Hashing, Transaction processing: Recovery and Concurrency control, Locking and Timestamp based schedulers, Multiversion and Optimistic Concurrency control schemes.

Unit 4
Distributed Databases: Introduction, DDBMS architectures, Homogeneous and Heterogeneous Databases, Distributed data storage, Distributed transactions, Commit protocols, Availability, Concurrency control & recovery in Distributed Databases.

Course Outcomes:

1. Defines the basics of the relational data model. Lists the database design process steps and also will be able to design and implement properly structured databases that match the standards based under realistic constraints and conditions. Develops an Entity-Relationship model based on user requirements.

2. Strong expertise in DBMS will help students to start a career as Database manager / Data analyst / Data scientist / Information security analyst /Database administrator / Data modeler / Software engineer in any Software Industry or any other organization.

Reference:

1. Elmaski & Navathe, "Fundamentals of database systems", 4th edition, Pearson education
2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", 6th Edition, Mcgraw Hill Education
3. C.J. Date, "An introduction to database systems", Pearson Education.
4. Bipin Desai, "An introduction to database system", Galgotia Publications
5. Raghu Ramkrishnan, Johannes Gehrke, "Database Management Systems", 2nd Edition, McGraw Hill International

CA-406 Computer Network

Course Objectives:

1. Describe the general principles of data communication.
2. Describe how computer networks are organized with the concept of layered approach.
3. Describe how signals are used to transfer data between nodes.
4. Implement a simple LAN with hubs, bridges and switches.

Course Content:

Unit 1
Introduction: Data Communication, Networks, Protocols and standards. Point to Point and Multipoint Line Configuration, Network Topologies: Mesh, star Tree Bus, Ring, Transmission Modes: Simplex, half Duplex, Full Duplex, Networks: LAN, WAN, MAN, The OSI model: Function of the layers.

Encoding and Modulating: digital-to-digital conversion: Unipolar, Polar, Bipolar, Analog to digital conversion: PAM, PCM, Digital to analog conversion: ASK, FSK, PSK, QAM and analog-to-analog conversion: AM, FM, PM, Transmission of Digital Data: Parallel and serial transmission, Modems, Guided and unguided transmission media, Transmission impairment.

Unit 2

Multiplexing: Frequency division, Wave division and time division multiplexing, Error Detection and Correction: Type of errors, Redundancy Checks (VRC, LRC, CRC), Data Link Control: Line Discipline, Flow Control, Error Control. Local Area Networks: IEEE 802 standards, Ethernet, Token Bus, Token Ring. Switching: Circuit Switching, Packet Switching, Message Switching.

Unit 3
Integrated Services Digital Network (ISDN): Services, History Subscriber access to ISDN, The ISDN Layers. Frame Relay: Introduction, Frame Relay Operation, Frame Relay Layers, Congestion Control, Leaky Bucket Algorithm, and Traffic Control.

Unit 4
Networking and Internetworking Devices: Repeaters, Bridges, Routers, Gateways. Application Layer: Client-Server Model, FTP, HTTP, World Wide Web.

Learning Outcomes:

1. Describe the basis and structure of an abstract layered protocol model
2. Independently understand basic computer network technology.
3. Identify the different types of network topologies and protocols.
4. Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
5. Identify the different types of network devices and their functions within a network
6. Understand and building the skills of subnetting and routing mechanisms.
7. Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.
8. After completing the course, student having expertise in Computer network can work as a Computer and Information Systems Manager / Computer Network Architect /Computer Systems Analyst /Computer Network Support Specialist in any multinational or national Software Company or any Government organizations.

References:

1. Forouzan B.A. , “Data Communication and Networking”, 4th Edition, McGraw Hill Education (India)
2. Black, U., “Computer Networks-Protocols, Standards and interfaces”. 2nd Edition, Prentice Hall

CA-408 Design and Analysis of Algorithms

Course Objectives:

1. To Write rigorous correctness proofs for algorithms. Demonstrate a familiarity with major algorithms and data structures.
2. Apply important algorithmic design paradigms and methods of analysis. Synthesize efficient algorithms in common engineering design situations.

Course Content:

Unit 1
Introduction to analysis and design of algorithm, Growth of functions, Asymptotic notations, Recurrences, Solution of recurrences by substitution, Recurrence tree and the master method. Divide and conquer algorithms (Worst case analysis of merge sort, quick sort and heap sort algorithms), Priority queue, Data structure for disjoint sets (Disjoint set operations, linked list representation, disjoint set forests)

Unit 2
Dynamic programming approach: Matrix chain multiplication, longest common subsequence. Greedy method: Activity solution problem, Greedy verses dynamic programming, Huffman codes. Concept of backtracking, branch & bound design techniques

Unit 3
Graph algorithms: Minimal spanning tree (Kruskal and Prim's algorithms), Single source shortest paths (Bellman-Ford and Dijkstra's algorithm), Floyd's algorithm, Flow Network, Ford-Fulkerson method, Fast Fourier Transform

Unit 4
Rabin-Karp string matching algorithm, NP-Completeness, Polynomial time solvability, Verification and Reducibility, NP complete problems (without proof), Approximation algorithm for the traveling salesman problem

Course Outcomes:

1. An ability to apply design and development principles in the construction of software systems of varying complexity.
2. An ability to function effectively as a member of a team in order to accomplish a common goal.
3. Recognition of the need for and an ability to engage in continuing professional development.
4. An ability to use current techniques, skills, and tools necessary for computing practice
5. Students having expertise in this subject could able to get job as Data Analyst /Data Scientist / Machine Learning Engineer/ Business Intelligence Analyst /Logistics Analyst / Data Architect in Government and Private sectors, also can peruse higher studies in National / International Universities.

Reference:

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest and L.Stein, "Introduction to Algorithms" , Second Edition, PHI Learning
2. E. Horowitz, S. Sahani, S. Rajsekharan, "Fundamentals of Computer Algorithms", Second Edition, Universities Press, 2007
3. Mark Allen Weiss, "Data Structure and Algorithm Analysis in C", 2nd Edition, Pearson Education.
4. J. Kleinbers, E.Tardos, Algorithm design, Pearson Education Inc., New Delhi , 2006
5. R. Johnsonbaugh, M. Schaefer, "Algorithms", Pearson Education Inc., New Delhi , 2004
6. Michael T. Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, analysis, and Internet Examples", 2nd Edition, Wiley India Pvt. Ltd., New Delhi

CA-410 Lab-2:- Database Management Systems

1. Database Schema for a employee scenario Consider the following tables namely “Departments” ,”Employees” and “Salary”
Departments (DEPTNO , DEPTNAME , DEPTLOC);
Employees (EMPNO, EMPNAME , JOB,DEPTNO,DOJ);

Salary(EMPNO,MONTH/YEAR,SAL)
For the above schema, perform the following:

1. Create all above tables.
2. Rename Employee table as Employee_Master
3. Add column Date_of_Birth to Employee_Master
4. Delete Date_of_Birth for Employee_Master
5. Modify EMPNAME field to accept 100 characters.
6. Insert around 10 records in each of the tables
7. List all the employees with their EMPNO.
8. List all the employee numbers whose salary is above 20000 .
9. List all the employees who have joined in the year 2002.
10. List all the department numbers where department location is Odisha.
11. Truncate the Employee_Master table.

2. Database Schema for a Student Library scenario
Student(Stud_no : integer, Stud_name: string)
Membership(Mem_no: integer, Stud_no: integer)
Book(book_no: integer, book_name:string, author: string)
Iss_rec(iss_no:integer, iss_date: date, Mem_no: integer, book_no: integer)

For the above schema, perform the following:

1. Create the all above tables .
2. Insert around 10 records in each of the tables
3. Add column S_Address to student
4. List all the student names with their student numbers.
5. List all the issues for the current date with Book number.
6. List the book names whose author is CJ DATE.
7. Give number student with book no. 5.
8. Truncate the table Iss_rec.

3. Considering Database Schema for a employee scenario
Departments (DEPTNO , DEPTNAME , DEPTLOC);
Employees (EMPNO, EMPNAME , JOB,DEPTNO,DOJ);
Salary(EMPNO,MONTH/YEAR,SAL)
For the above schema, perform the following:

1. Create the table with all the required constraints.
2. Display all the details of the records whose employee name starts with “A”
3. Display all the details of the records whose employee name does not start with “A”
4. Display the rows whose salary ranges from 15000 to 30000.
5. Calculate the total and average salary amount of the salary table.
6. Count the total records in the emp table.
7. Determine the max and min salary and rename the column as max_salary and min_salary.
8. Display the last day of that month in ¯05-Oct-09 .
9. Find how many job titles are available in the employee table.
10. What is the difference between maximum and minimum salaries of employees in the organization?
11. Display the maximum salary of a group by month_year.

Course Outcomes:
After successful completion of the course, student shall be able to:

1. Work as a software engineer in any multinational software company.

OE-CA-412 Data Visualization

Course Objectives:

The objective of this course is to:

1. Statistical tools most commonly used to process, analyze, and visualize data.
2. Understanding how to use and interpret and visualize results.

Course Contents:

Unit-1

Statistics: meaning and role as a decision making science, Data-types and scales of measurement. Descriptive Statistics - measures of central tendency, positional averages, measures of dispersion, skewness and kurtosis - Definition and properties. Presentation tables, diagrammatic and graphical methods. Exploratory Data Analysis using descriptive measures and graphical tools.

Unit-2

Correlation: bivariate data, correlation, scatterplot, correlation coefficient and its properties, testing for correlation coefficient, rank correlation. Regression: linear relationship, linear regression model, simple linear regression, fitting the regression model, coefficient of determination, standard error of the estimated model. Testing regression coefficients.

Unit-3

Visualizing Data: Mapping Data onto Aesthetics, Aesthetics and Types of Data, Scales Map Data Values onto Aesthetics. Coordinate Systems and Axes: Cartesian Coordinates, Nonlinear Axes, Coordinate Systems with Curved Axes. Understanding Visualizations: Amounts, Distributions, Proportions, x–y relationships, Geospatial Data, Uncertainty. Visualizing Amounts: Bar Plots, Grouped and Stacked Bars, Dot Plots and Heatmaps. Visualizing Distributions: Visualizing a Single Distribution, Visualizing Multiple Distributions at the Same Time, Empirical Cumulative Distribution Functions, Highly Skewed Distributions, Quantile-Quantile Plots. Visualizing Many Distributions at Once: Visualizing Distributions Along the Vertical Axis, Visualizing Distributions Along the Horizontal Axis.

Unit-4

Visualizing Proportions: Pie Charts, Side-by-Side Bars, Stacked Bars and Stacked Densities. Visualizing Associations Among Two or More Quantitative Variables: Scatterplots, Correlograms, Dimension Reduction, Paired Data. Visualizing Time Series: Individual Time Series, Multiple Time Series and Dose–Response Curves, Time Series of Two or More Response Variables. Visualizing Trends: Smoothing, Showing Trends with a Defined Functional Form, Detrending and Time-Series, Decomposition. Visualizing Geospatial Data: Projections, Layers, Choropleth Mapping, Cartograms.

Learning Outcomes:

After successful completion of the course, student shall be able to:

1. Appreciate the science of statistics and the scope of its potential applications
2. Summarize and present data in meaningful ways
3. Select the appropriate statistical analysis depending on the research question at hand
4. Form testable hypotheses that can be evaluated using common statistical analyses
5. Understand and verify the underlying assumptions of a particular analysis
6. Effectively and clearly communicate results from analyses performed to others
7. Conduct, present, and interpret common statistical analyses.
8. Students can make a career in Data specialist, Client services coordinator, Marketing specialist and Data analyst after completion of the program in Software Industries, Government Organization and R &D organizations.

Reference:

1. Gupta, S.C. and Kapoor, V. K. (2008): Fundamentals of Mathematical Statistics, 4th Edition (Reprint), Sultan Chand & Sons.
2. Goon, A. M., Gupta, M. K. and Dasgupta, B. (2002): Fundamentals of Statistics, Vol.I & II, 8th Edn. The World Press, Kolkata.
3. Wilke, Claus O. (2019): Fundamentals of Data ,Visualization, Oreilly.
4. R.C. Campbell.(1974) : Statistics for Biologists, Cambridge University Press
5. Christopher Chatfield (1981) : Statistics for Technology, Chapman and Hall
6. Douglas A. Lind, William C. Marchal, Samuel A. Wathen (2012), "Basic Statistics for Business & Economics" McGraw-Hill Education
7. Harry Frank and Steven C. Athoen (1997) : Statistics: Concepts & Applications, Cambridge University Press.
8. J.Medhi (1992): Statistical Methods : An Introductory Text, Wiley Eastern Limited.

CA-501 Object Oriented Programming using Java

Course Objectives:

1. Understand the basics of Java, Java toolchains and features of the language
2. Use Java programming language with object-oriented programming principles.

Course Contents:

Unit 1
Basics of Java. JDK & JRE. Writing, Compiling, and running Java programs. Data Types. Variables. Type conversion and casting. Arrays. Operators. Control Statements. Objects, and Encapsulation. Classes. methods, constructors. Keywords: this, static, final. Access control.

Unit 2
Inheritance in Java. Use of super keyword. Multilevel inheritance. Calling of constructors. Polymorphism: Method overloading and overriding. Abstract class. Runtime Polymorphism through Inheritance. Polymorphism using interface. Generics in Java: Generics, Generic methods and constructors. Primitive Type Wrappers. Packages: Defining a package, Access Protection, Importing packages.

Unit 3
Exception Handling in Java: Understanding Exception handling, Exception types, Uncaught Exceptions, Using try and catch, Multiple catch, Nested try statements, Understanding of throw, throws and finally, Java's Built-in Exceptions, Chaining Exceptions. Collection Framework in Java: Collection Interfaces and Classes, Iterators, Using List interface and classes like ArrayList and LinkedList, Map Interfaces and classes, Using Hashmap, Using Comparators.

Unit 4
I/O in Java: I/O Basics, Streams and Stream Classes: Byte Stream Classes, Character Stream Classes. Reading and Writing Files. Multithreading programming with java: Understanding Java Thread Model, The Thread class and Runnable interface, Thread creation, Synchronization, Interthread communication.

Course Outcomes:

After successful completion of the course, student shall be able to:
1. Design, create, build, and debug Java applications
2. Write Java programs using object-oriented programming techniques including classes, objects, methods, instance variables, composition, inheritance, and polymorphism.
3. Java is in the top five most used languages professionally. Companies are actively using it for their projects and there are enough jobs in this field. Successful completion increase employability.

Reference:

1. Herbert Schildt, "Java: The Complete Reference", Tenth Edition, Oracle Press
2. E. Balagurusamy, "Programming with Java ", 6th Edition, McGraw-Hill Education
3. Harvey M. Deitel & Paul J. Deitel, "Java How to Program", 8th Edition, PHI
4. Debasish Jana, ―Java and Object-Oriented Programming Paradigm", PHI

CA-503 Software Engineering

Course Objectives:

1. To enable students to design and build software using the knowledge acquired in this course

Course Contents:

Unit 1
Software Engineering paradigms – Waterfall Life cycle model – Spiral Model – Prototype Model – Evolutionary model -fourth Generation Techniques – Planning – Software Project Scheduling, – Risk analysis and management – Requirements and Specification –Project Plan and SRS

Unit 2
Abstraction – Modularity – Software Architecture – Cohesion – Coupling – Various Design Concepts and notations – Real time and Distributed System Design – Documentation – Dataflow Oriented design – Designing for reuse – Programming standards – C
Study for Design of any Application Project.

Unit 3
Software Testing Fundamentals – Software testing strategies – Black Box Testing – White Box Testing – System Testing – Object Orientation Testing – State based Testing - Testing Tools – Test Case Management – Software Maintenance Organization – Maintenance Report – Types of Maintenance

Unit 4
Scope – Classification of metrics – Measuring Process and Product attributes – Direct and Indirect measures – Cost Estimation - Reliability – Software Quality Assurance – Standards – COCOMO model, Need for SCM – Version Control – SCM process – Software Configuration Items – Taxonomy – CASE. Repository – Features – Software reverse Reengineering

Course Outcomes:

A student who takes this course should be able to

1. Apply SE principles to software design in future
2. Modularize software development
3. To design reusable components
4. Testing types and levels
5. Using CASE tools
6. Start a career as Applications developer, Cyber security analyst, Game developer, Information systems manager, IT consultant, Multimedia programmer, Web developer after completion of the program. Students get jobs in Government and private sectors also can go for higher studies.

Reference:

1. Mall Rajib, "Fundamentals of Software Engineering", PHI.
2. Roger S. Pressman, "Software Engineering A practitioner’s Approach", 5th Edition, McGraw-Hill Higher Education.

CA-505 Data Warehousing and Data Mining

Course Objectives:

1. Be familiar with mathematical foundations of data mining tools.
2. Understand and implement classical models and algorithms in data warehouses and data mining.
3. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
4. Master data mining techniques in various applications like social, scientific and environmental context.
5. Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

Course Contents:

Unit 1
Concept of Data warehousing, 3-tier architecture, multidimensional data model, OLAP, ROLAP, and MOLAP operations. Commercial Importance of Data Warehouse, Data Mart structure, Usage of Data Mart, Security in Data Mart, Data warehouse and Data Mart.

Unit 2
Basic Elements of Data Warehouse & ETL: Source System, Data Staging Area, Presentation Server, data Cleaning, Extraction of Data, Transformation of Data, Loading of Data

Unit 3
Introduction to data mining, knowledge discovery, DBMS vs. Data Mining. Concept hierarchies, Interestingness measures, Data generalization and Summarization-based characterization, Mining Association Rules, Apriori algorithm for finding frequent item-sets, Mining Multilevel Association Rules, Mining distance-based Association Rules, Correlation Analysis.

Unit 4
Classification and prediction: decision tree based classification, Bayesian classification, classification by back propagation, k-nearest neighbor classifier. Cluster analysis: categorization of clustering methods, partitioning methods, k-Means and k-Medoids, hierarchical methods, Density-based clustering (DBSCAN)

Course Outcomes:

1. Understand the functionality of the various data mining and data warehousing components.
2. Appreciate the strengths and limitations of various data mining and data warehousing models.
3. Explain the analyzing techniques of various data.
4. Describe different methodologies used in data mining and data warehousing.
5. Compare different approaches of data warehousing and data mining with various technologies.
6. There is a growing demand for data mining specialists around the worldand they enjoy handsome salaries, students can get employment in multinational companies, government organizations and private sectors.

Reference:

1. Jain Pei, Jiawei Han, Micheline Kamber, "Data Mining: Concepts and Techniques", 3rd Edition, Elsevier/Morgan Kaufmann
2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, "Introduction to Data Mining", 1st Edition, Pearson India
3. A.K.Pujari, "Data Mining", University Press

4. Ian H. Witten, Eibe Frank, "Data Mining Practical Machine Learning Tools and Techniques", 2nd Edition, Elsevier/Morgan Kaufmann
5. Ralph Kimball , Margy Ross, "The Data Warehouse Toolkit : The Definitive Guide to Dimensional Modeling", 3rd Edition, Wiley India
6. Paulraj Ponniah, "Data Warehousing: Fundamentals for IT Professionals", 2nd Edition, Wiley India
7. S. Anahory, D. Murray, "Data Warehousing", Pearson Education

CA-507 Artificial Intelligence

Course Objectives:

1. To understand and define AI; Design and implement AI programs / applications

Course Contents:

Unit 1
Problems and Search: What is Artificial Intelligence?, The AI Problems, The Underlying Assumption, What is an AI Technique, The Level of the Model, Criteria for Success, Problems, Problem Spaces, and Search: Defining the Problem as a State Space Search, Problem Characteristics.

Heuristic Search Techniques: Generate-and- Test, Hill Climbing, Best- First Search, Problem Reduction, Constraint Satisfaction, A* algorithm.

Unit 2
The Prepositional Calculus : Introduction – Syntax of the Prepositional Calculus – Truth-Assignments – Validity and Satisfiability – Equivalence and Normal Forms – resolution in Prepositional Calculus.

Using Predicate Logic:- Representing Instance and ISA Relationships, Computable Functions and Predicates, Resolution ; Truth Maintenance Systems

Unit 3
Historical notes- human Brain, Al and NN. Learning process: Supervised and unsupervised learning, adaptation, statistical nature of the learning process. Perceptron. Multilayered network architecture, Back Propagation Algorithm, Approximation properties of RBF networks and comparison with multilayer perceptron.

Unit 4
Introduction to AI Programming: PROLOG, LISP, MATLAB, WEKA Tool

Course Outcomes:

A student who takes this course should be able to
1. Compare the various heuristic algorithms
2. Represent knowledge in a retrievable form
3. Design NL interfaces
4. Program in LISP / PROLOG/ Python / MATLAB
5. Many employers prefer applicants with a master's degree in computer science or higher. Traditional education can provide a strong framework for a career in AI. Students can be employed in multinational companies, government organizations and R & D organizations.

Reference:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Third Edition, 2010, Pearson Education, New Delhi.
2. Joseph Giarratano and Gary Riley, “Expert Systems: Principles and Programming”, Fourth Edition, CENGAGE Learning India Pvt. Ltd., New Delhi.
3. Elaine A. Rich and Kevin Knight, “Artificial Intelligence”, 3rd Edition, 2009, McGraw-Hill Education (India), New Delhi.
4. Nills J. Nilsson, “Artificial Intelligence: A New Synthesis”, 2nd Edition, 2000, Elsevier India Publications, New Delhi.
5. Michael Negnevitsky, “Artificial Intelligence: A Guide to Intelligent Systems”, Second Edition, 2005, Pearson Education, Inc. New Delhi.
6. Dan W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”, 1st Edition, 1996, PHI Learning Pvt. Ltd., New Delhi.
7. Ben Coppin, “Artificial Intelligence Illuminated”, 2005, Narosa Publication, New Delhi.

(Elective-1)

CA-509-A Combinatorics and Graph Theory

Course Objectives:

The objective of the course is to explain basic concepts in combinatorial graph theory.

1. Define how graphs serve as models for many standard problems.
2. Discuss the concept of graph, tree, Euler graph, cut set and Combinatorics.
3. See the applications of graphs in science, business and industry.

Course Contents:

Unit 1

Fundamental principles of counting, permutation and combinations, binomial theorem, generating functions, the exponential generating function, recurrence relations-first order and second order- non homogeneous recurrence relations.

Unit 2

Basic Terminology of Graph theory, Walks, Paths, Circuits, Connectedness, Handshaking Lemma, Isomorphism, Sub Graphs, Reach Ability, Union and Interaction of Graphs. Euler Graph, Shortest Path Problem, Hamiltonian Graph, Bipartite Graphs

Unit 3

Introduction to Trees, Rooted Trees, Path Length in Rooted Trees, Spanning Trees, Fundamental Circuits, Spanning Trees of a Weighted Graph, Cut Sets and Cut Vertices, Fundamental Cut Set, Minimum Spanning Tree

Unit 4

Directed Graphs and Connectedness, Directed Trees, Network Flows, Max Flow-Mincut Theorem, Matrix Representation of a Graph, Planar Graphs: Combinational and Geometric Duals, Kuratowski's Graphs, Detection of Planarity, Thickness and Crossing**.**

Course Outcomes:

1. To define graph theoretic concepts, state and prove their properties,
2. To describe graph theoretic algorithms and prove their correctness,
3. To formulate problems in terms of graphs and apply the theorems and algorithms taught in the course to solve them,
4. To define the various types of generating functions,
5. To state and prove the basic properties of generating functions,
6. To use generating functions to solve a variety of combinatorial problems
7. This course help students to br employable in IT sector and R&D organizations.

Reference:

1. C.L. Liu, Elements of Discrete Mathematics, Tata McGraw Hill, 2nd Edition, 2000.
2. J.K. Mantri & T.K. Tripathy, A Modern Approach to Discrete Mathematics & structure
3. N. Deo, Graph Theory with Applications to Engineering and Computer Science, PHI publication, 3rd edition, 2009

CA-509 -B Computer Security

Course Objectives:

1. Learn fundamentals of cryptography and its application to network security.
2. Understand vulnerability analysis of network security.
3. Acquire background on hash functions; authentication; firewalls; intrusion detection techniques.

Course Contents:

Unit 1
The Security Problem in Computing: The meaning of computer Security, Computer Criminals, Methods of Defense; Elementary Cryptography: Substitution Ciphers, Transpositions, Making "Good" Encryption Algorithms, Private-Key Cryptosystems, The Data Encryption Standard, The AES Encryption Algorithm, Public-Key Cryptosystems, Public Key Encryptions, Uses of Encryption

Unit 2
Program Security : Secure Programs, Non-malicious Program Errors, viruses and other malicious code, Targeted Malicious code, controls Against Program Threats, Protection in General-Purpose operating system protected objects and methods of protection memory and address protection, File protection Mechanisms, User Authentication Designing Trusted O.S : Security policies, models of security, trusted O.S. design, Assurance in trusted OS, Implementation examples.

Unit 3
Database Security: Security requirements, Reliability and integrity, Sensitive data, Inference, multilevel database, proposals for multilevel security

Network Security: Threats in Network, Network Security Controls, Firewalls, Intrusion Detection Systems, Secure E-mail.

Unit 4
Administering Security: Security Planning, Risk Analysis, Organizational Security policies, Physical Security; The Economics of Cyber security; Privacy in Computing; Legal and Ethical Issues in Computer Security: Protecting Programs and data, Information and the law, Rights of Employees and Employers, Software failures, Computer Crime.

Course Outcomes:

1. Describe network security services and mechanisms.
2. Symmetrical and Asymmetrical cryptography.
3. Data integrity, Authentication, Digital Signatures.
4. Various network security applications, IPSec, Firewall, IDS, Web security, Email security, and Malicious software etc
5. Skills like networking and knowledge of operating systems are required to start a cyber security career. Students can get jobs in multinational, government and private organizations.

Reference:

1. Charles P. Pfleeger & Shari Lawrence Pfleeger, "Security in Computing", 4th Edition,Pearson Education
2. Josef Pieprzyk, Thomas Hardjono, Jennifer Seberry, "Fundamentals of Computer Security", Springer & Universities Press India
3. Dieter Gollmann, "Computer Security", 2nd Edition, Wiley India
4. William Stallings & Lawrie Brown, "Computer Security: Principles and Practice", 1st Edition, Pearson Education
5. Charlie Kaufman, Radia Perlman & Mike Speciner, "Network Security: Private Communication in a Public World", 2nd Edition, PHI Learning
6. Chuck Easttom, "Computer Security Fundamentals", 1st Edition, Pearson Education

CA-509 -C Computer Graphics

Course Objectives:

1. The main objective of the course is to introduce students with fundamental concepts and theory of computer graphics.
2. It presents the important drawing algorithm, polygon fitting, clipping and 2D transformation curves and an introduction to 3D transformation.
3. It provides the basics of OpenGL application programming interface which allows students to develop programming skills in CG.

Course Contents:

Unit 1
Introduction: Application areas of Computer Graphics, overview of graphics systems, video-display devices, raster-scan systems, random scan systems, graphics monitors and work stations and input devices. Output primitives**:** Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms. Filled area primitives: Scan line polygon fill algorithm, boundary-fill and flood-fill algorithms.

Unit 2
2-D and 3D geometrical transforms: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems. 3D viewing and General projection transforms (Parallel & Perspective Projections and their Transformations)

Unit 3
Viewing and Clipping: The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Liang-Barsky line clipping algorithms, Sutherland –Hodgeman polygon clipping algorithm.

Unit 4
Bezier curve and B-Spline curves, Bezier and B-Spline surfaces. Basic illumination models, polygon rendering methods. Illumination models: Basic Models, Displaying Light Intensities, halftone patterns and Dithering Techniques Visible surface detection methods: Classification, back-face detection, depth-buffer, scan-line, depth sorting. Surface Rendering Methods: Polygon Rendering Methods, Gouraud shading Phong Shading

Course Outcomes:

After successful completion of the course, student shall be able to:

1. Explain the core concepts of computer graphics, including viewing, projection, perspective, modelling and transformation in two and three dimensions.
2. Apply the concepts of colour models, lighting and shading models, textures, ray tracing, hidden surface elimination, anti-aliasing, and rendering.
3. Interpret the mathematical foundation of the concepts of computer graphics.
4. Describe the fundamentals of animation, parametric curves and surfaces, and spotlighting.
5. Graphics programmers are in high demand in the ever-expanding industry of computer and video games. They are responsible for creating believable graphics characters and realistic animation.

Reference:

1. Donald **Hearn** & M. Pauline **Baker**, "Computer Graphics with OpenGL", Third Edition, 2004, Pearson Education, Inc. New Delhi.
2. Ze-Nian **Li** and Mark S. **Drew**, "Fundamentals of Multimedia", First Edition, 2004, PHI Learning Pvt. Ltd., New Delhi.
3. Jennifer **Burg**, "The Science of Digital Media", First Edition, 2009, Pearson Education Inc., New Delhi.
4. Francis S. **Hill** & Stephen M. **Kelly**, "Computer Graphics using OpenGL", Third Edition, 2007, PHI Learning Pvt. Ltd., New Delhi.

CA-509 -D Internet of Things

Course Objectives:

1. Students will be explored to the interconnection and integration of the physical world and the cyber space.
2. They are also able to design & develop IOT Devices.

Course Content:

Unit 1
Introduction, Design and Technologies: Introduction- Definition & Characteristics of IoT –Physical design of IoT-Things in IoT and IoT protocols, Logical Design of IoT- IoT Functional Blocks-IoT Communication Model and IoT Communication APIs - IoT Enabling Technologies - Wireless Sensor Networks -Cloud Computing- Big Data Analytics - Communication Protocols Embedded Systems-IoT Levels & Deployment Templates.

Unit 2
Domain, M2M and System Management : Introduction- Home Automation – Cities - Industry- Health & Lifestyle- M2M-SDN and NFV for IoT - Software Defined Networking - Network Function Virtualization- IoT System Management- Need for IoT Systems Management -Simple Network Management Protocol -Limitations of SNMP - Network Operator-Requirements

Unit 3
Protocols and Developing Internet Of Things: Infrastructure - 6LowPAN- IPv6, Identification - EPC-uCode-URIs,Comms / Transport - Wifi, Bluetooth- LPWAN,Discovery- Physical Web- mDNS-DNS-SD, IoT Platforms Design Methodology - IoT System for Weather Monitoring – IoT System for Agriculture.

Unit 4
Cloud Services for IOT: Introduction to Cloud Storage Models & Communication APIs -WAMP - AutoBahn for IoT-Xively Cloud for IoT -Python Web Application Framework, Case studies – Environment- IoT systems for weather Reporting Bot- Air Pollution Monitoring System-Forest Fire Detection-IoT system for Energy-Smart grid-Renewable Energy Systems.

Course Outcome:

1. Able to understand the application areas of IOT
2. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
3. Able to understand building blocks of Internet of Things and characteristics.
4. Make students employable in emerging IT companies and startups with IOT technology.

Reference:

1. ArshdeepBahga and Vijay Madisetti, ―Internet of Things - A Hands-on Approach", Universities Press, 2015
2. Dieter Uckelmann et.al, ―Architecting the Internet of Things", Springer, 2011.
3. CunoPfister, ―Getting Started with the Internet of Things", O'Reilly, 2011.
4. Adrian McEwen, Hakim Cassimally, ―Designing the Internet of Things", Wiley, 2014.
5. Honbo Zhou , ―The Internet of Things in the Cloud: A Middleware Perspective ―, CRC Press , 2012
6. Olivier Hersent, David Boswarthick, Omar Elloumi, ―The Internet of Things – Key applications and Protocols", Wiley, 2012.

CA-511 Lab-3:- Programming using Java

Course Objectives:

1. To know compilation, execution and debugging of Java Programs
2. To apply Object Oriented Programming Principles in the Programs

Course Contents:

01. Introduction, Compiling & executing a java program.

02. Program with data types & variables.

03. Program with decision control structures: if, nested if etc.

04. Program with loop control structures: do, while, for etc.

05. Program with classes and objects.

06. Implementing data abstraction & data hiding.

07. Implementing inheritance.

08. Implementing and polymorphism.

09. Implementing packages.

10. Implementing generics.

Course Outcomes:

After successful completion of the course, student shall be able to:

1. Build a basic software using Java programming language
2. Get in-depth experience in classes, objects, methods, instance variables, object composition, inheritance, and polymorphism.
3. Students can get job in multinational companies, government organizations, banking jobs and R & D organizations.

(Elective-2)

CA-502-A Machine Learning

Course Objectives:

The objective of the course is

1. To understand the basic theory underlying machine learning.
2. To be able to formulate machine learning problems corresponding to different applications.
3. To understand a range of machine learning algorithms along with their strengths and weaknesses.
4. To be able to apply machine learning algorithms to solve problems of moderate complexity.
5. To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Course Contents:

Unit 1

Introduction- Natural Vs. Machine Learning, Types of Learning - Supervised and Unsupervised Learning; Inductive Classification - Concept Learning and General-to-Specific Ordering; Decision Tree Learning - Properties, Top-down Induction, Entropy, Overfitting, Other Issues

Unit 2

Artificial Neural Networks - Perceptron learning, Multilayer N/w, Backpropagation, Applications; Support Vector Machine(SVM) - Separation, Classification, optimization, Applications Deep Learning: Convolutional Neural Networks(CNN), Recurrent Neural Networks(RNN), Reinforcement Learning, Applications

Unit 3

Computational Learning Theory - PAC model, Version Spaces, Complexity, Hypotheses Spaces, VC dimension; Bayesian Learning - Naïve bayes, regression, Generative model and inference; Instance based Learning - Distance Metrics, K-nearest neighbour and Variations with Applications

Unit 4

Evolutionary Learning – Genetic Algorithm, Particle Swarm Optimization, Ant Colony Optimization, Firefly algorithm, Implementation in MATLAB / WEKA/ PYTHON.

Course Outcome:

After completing this course, the student will be able to

1. Appreciate the importance of visualization in the data analytics solution
2. Apply structured thinking to unstructured problems
3. Understand a very broad collection of machine learning algorithms and problems
4. Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory
5. Develop an appreciation for what is involved in learning from data.
6. Get employability as the prospect of Machine Learning in India, as well as in other parts of the world, is high in comparison to other career fields when it comes to job opportunities.

Reference:

1. Ethem Alpaydin, Introduction to Machine Learning, MIT Press/ Prentice Hall of India.
2. K.L.Priddy and Paul E. Keller, Artificial Neural Networks- An Introduction, PHI/ EEE edition. 3. Nils J. Nilsson, An Introduction to Machine Learning.
3. Tom Mitchell, Machine Learning, Mc Graw Hill , 1997.

CA-502-B Block Chain Technology

Course Objectives:

1. To assess blockchain applications in a structured manner.
2. To impart knowledge in block chain techniques and able to present the concepts clearly and structured.
3. To get familiarity with future currencies and to create own crypto token.

Course Content:

Unit 1

Basics: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

Unit 2

Blockchain: Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain**.**

Unit 3

Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate. Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - MINING strategy and rewards**,**

Unit 4

Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin Blockchain Applications: Internet of Things, Medical Record Management System and future of Blockchain

Course Outcomes

1. Understand the various technologies and its business use.
2. Analyse the block chain applications in a structure manner.
3. Explain the modern concepts of block chain technology systematically.
4. Handle the cryptocurrency.
5. Understand the modern currencies and its market usuage
6. It provides opportunity to be employable in IT industry.

References:

1. Daniel Drescher, Block chain basics A non-technical introduction in 25 steps, Apress , 2017.
2. Paul Vigna and Michael J.Casey. The Age of Cryptocurrency, 2015.
3. Narayanan, Bonneau, Felten, Miller and Goldfeder, “Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction”, Princeton University Press

CA-502-C Mobile Computing

Course Objectives:

1. learn about the concepts and principles of mobile computing;
2. Explore both theoretical and practical issues of mobile computing;
3. Develop skills of finding solutions and building software for mobile computing applications.

Course Content:

Unit 1
Introduction to Mobile Communications and Computing**:** Introduction to Mobile Computing, novel applications, limitations, and architecture. GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services.

Unit 2
Wireless Medium Access Control**:** Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA. Spreading techniques.
Mobile Network Layer: Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations).

Unit 3
Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP. Transaction oriented TCP. Database Issues: Hoarding techniques, caching invalidation mechanisms, client server computing with adaptation. Data Dissemination: Communications asymmetry, classification of new data delivery mechanisms, push based mechanisms, pull-based mechanisms.

Unit 4
Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, routing and various routing algorithms, security in MANETs. Protocols and Tools: Wireless Application Protocol-WAP. (Introduction, protocol architecture, and treatment of protocols of all layers), Bluetooth (User scenarios, physical layer, MAC layer, networking).

Course Outcomes:

1. A student who takes this course should be able to
2. Define mobile technologies in terms of hardware, software, and communications.
3. Utilize mobile computing nomenclature to describe and analyze existing mobile computing frameworks and architectures.
4. Evaluate the effectiveness of different mobile computing frameworks.
5. Describe how mobile technology functions to enable other computing technologies
6. Get a job in Mobile computing as it has grown immensely in recent years and it is projected that in the future, mobile computing will control almost all technological activities in the world.

Reference:

1. Jochen Schiller, Mobile Communications, Pearson Education.
2. Stojmenovic and Cacute, Handbook of Wireless Networks and Mobile Computing, Wiley.
3. Reza Behravanfar, Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML, Cambridge University Press.
4. Frank Adelstein, Sandeep K.S Gupta, Golden Richard III, Loren Schwiebert, Fundamentals of Mobile and Pervasive Computing, TMH.
5. Uwe Hansmann, Lothar Merk, Martin S, Nicklous, Thomas Stober, Principles of Mobile Computing, Springer.
6. Martyn Mallick, Mobile and Wireless Design Essentials, Wiley.

CA-502-D Data Science using Python

Course Objectives:

The objective of this course is to:

1. To acquire in-depth understanding of the theoretical concepts in statistics, data analysis, data mining, machine learning and other advanced data science techniques.
2. To empower students with tools and techniques for handling, managing, analyzing and interpreting data.
3. Ability to understand the abstract concepts that lead to various data science theories in Mathematics, Statistics and Computer science.
4. To identify, analyze and design solutions for data science problems using fundamental principles of mathematics, Statistics, computing sciences, and relevant domain disciplines.

Course Content

Unit 1
Python basics: Modules, Arithmetic, Control Flow, Functions, Strings, Exceptions, Lists, Tuples, Dictionaries, Sets

Unit 2
Data Visualization with matplotlib. Hypothesis and Inference: Statistical Hypothesis Testing, Confidence Intervals, P-hacking. Gradient Descent: The idea behind Gradient Descent, Estimation of Gradient, Applying Gradient Descent. Machine Learning: Modeling, types, Overfitting and Underfitting, Correctness, The Bias-Variance Trade-off.

Unit 3
k-Nearest Neighbors: The Model, Application, The Curse of Dimensionality. Implementing a spam filter with Naive Bayes. Correlation and Regression. Simple Linear Regression: The Model, Using Gradient Descent, Maximum Likelihood Estimation. Logistic Regression: Applying the Logistic Function model, Goodness of Fit.

Unit 4
Decision Trees: Decision Tree, Entropy. Neural Networks: Perceptrons, Feed-Forward Neural Network, Backpropagation. k-Means Clustering.

Course Outcomes:

After successful completion of the course, student shall be able to:

1. Understand the key concepts in data science.
2. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science.
3. Produce Python code to statistically analyse a dataset.
4. Critically evaluate data visualisations based on their design and use for communicating stories from data.
5. Plan and generate visualisations from data using Python.
6. Get a job in Government, private, academic and R & D sectors as the use of Python for data science applications has been gaining steam in recent years.

Reference:

1. Joel Grus. ―Data Science from Scratch: First Principles With Python‖, O'Reilly
2. Jake vanderplas. ―Python data science handbook: essential tools for working with data‖, O'Reilly
3. Davy Cielen, Arno D. B. Meysman, Mohamed Ali. "Introducing Data Science", Manning Publication
4. Cathy O'Neil and Rachel Schutt. "Doing Data Science, Straight Talk From The Frontline". O'Reilly.
1. Sinan Ozdemir, "Principles of Data Science", Packt.

(Elective-3)

CA-504-A Digital Image Processing

Course Objectives:

1. To treat the 2D systems as an extension of 1D system design and discuss techniques specific to 2D systems

Unit 1
Introduction: The digitized image and its properties: Applications of image processing, image function, image representation, sampling, quantization, color images, metrics and topological properties of digital images, histograms, image quality, noise image.

Unit 2
Image preprocessing: Pixel brightness transformation, position dependent brightness correction, gray scale transformation; geometric transformation, local preprocessing- image smoothening, edge detectors, zero-crossing, scale in image processing, canny edge detection, parametric edge models, edges in multi spectral images, local preprocessing and adaptive neighborhood pre processing; image restoration.

Unit 3
Image Segmentation: Threshold detection methods, optimal thresholding, multispectral thresholding, thresholding in hierarchical data structures; edge based image segmentation, edge image thresholding, edge relaxation, border tracing, border detection.

Unit 4
Mathematical Morphology: Basic morphological concepts, four morphological principles, binary dilation, erosion, Hit or miss transformation, opening and closing; thinning and skeleton algorithms; Morphological segmentation -particles segmentation and watersheds, particles segmentation.
Image textures: Statistical texture description, methods based on spatial frequencies, cooccurrence matrices, edge frequency, and texture recognition method applications. Image representation and description: Representation, boundary descriptors, regional descriptors

Course Outcomes:

1. Earn different techniques employed for the enhancement of images.
2. learn different causes for image degradation and overview of image restoration techniques.
3. Understand the need for image compression and to learn the spatial and frequency domain techniques of image compression.
4. learn different feature extraction techniques for image analysis and recognition
5. It provides opportunity to be employable in IT industry and Academics.

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, 3rd Edition, 2008, Pearson Education, Inc. New Delhi.
2. Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image Processing, Analysis, and Machine Vision”, 3rd Edition, 2008, CENGAGE Learning, New Delhi.
3. William K. Pratt, “Digital Image Processing: PIKS Scientific Inside”, 4th Edition, 2008, Wiley India Pvt. Ltd., New Delhi.
4. Bernd Jähne, “Digital Image Processing”, 6th Revised and Extended Edition, 2006, Springer Science. ISBN 978-3-540-24035-8.
5. Anil K. Jain, “Fundamentals of Digital Image Processing”, 1989, PHI Learning Pvt. Ltd. New Delhi.

CA-504-B Cloud Computing

Course Objectives:

1. To understand the principle of cloud virtualization, cloud storage, data management and data visualization.
2. To learn the key dimensions and challenges of Cloud Computing.
3. To facilitate to choose the appropriate technologies, algorithms, and approaches for the related issues.
4. Able to develop and deploy cloud application using popular cloud platforms.

Course Content:

Unit 1

Introduction:Cloud Computing – History – Working of cloud computing – Cloud computing today – Pros and cons of Cloud Computing – Benefits of cloud computing – Non users of Cloud computing – Developing cloud services – Pros and Cons of Cloud service Development – Types of Cloud Service Development – Discovering Cloud Services development services and tools.

Unit 2

Cloud Computing for Everyone: Centralizing Email Communications – Collaborating of Grocery lists – Collaborating on To-Do lists – Collaborating on Household budgets – Collaborating on Contact lists – Communicating across the community – Collaborating on Schedules – Collaborating on group projects and events – Cloud computing for corporation

Unit 3

Cloud Services:Exploring online calendar applications – Exploring online scheduling applications – Exploring online planning and task management – Collaboration on event management – Collaboration on Contact Management – Collaboration on Project Management – Collaborating on Word Processing and Databases – Storing and Sharing files and other online content

Unit 4

Issues in Cloud:Federation in cloud – Four levels of federation – Privacy in cloud – Security in Cloud –Software as a security service – Case Study: Aneka – service level agreementsCloud Storage: Over view of cloud storage – Cloud storage providers – Amazon S3 – Cloud file system – Map Reduce – Hadoop and Cloud Deployment Tools

Course Outcomes:

1. Analyze the trade-offs between deploying applications in the cloud and over the local infrastructure
2. Describe various service delivery models of cloud computing architecture
3. Deploy applications over commercial cloud computing infrastructures such as Amazon Web Services and Google AppEngine.
4. Describe the virtualization technology behind the working of cloud computing.
5. Make student employable in IT sector and R &D.

Reference:

1. Danielle Ruest and Nelson Ruest, “Virtualization: A Beginners’s Guide”, McGraw Hill,2009.
2. Tom White, “Hadoop: The Definitive Guide”, O’RIELLY Media 2009.
3. RajkumarBuyya, James Broberg, AndrezjGoscinski, “Cloud computing – Principles and Paradigms”, John Wiley and Sons, 2011

MOOCs

1. https://www.mooc-list.com/course/introduction-cloud-computing-edx
2. https://www.coursera.org/learn/cloud-computing
3. https://www.mooc-list.com/course/comptia-cloud-cybrary

CA-504-C Simulation and Modeling

Course Objectives:

1. Define the basics of simulation modeling and replicating the practical situations in organization Generate random numbers and random variates using different techniques.
2. Develop simulation model using heuristic methods.
3. Analysis of Simulation models using input analyzer, and output analyzer
4. Explain Verification and Validation of simulation model

Course Content:

Unit 1
Introduction to Systems and Simulation; Discrete Event Simulation; Mathematical and Statistical Models- useful models and Distributions; Poisson Process; Random Numbers and Random Variate Generation

Unit 2
Queuing Theory and Models – Characteristics, Notations, Long run Performance Measures, Steady state behavior of Finite and Infinite Markovian Models

Unit 3 Monte-Carlo Simulation - Need and importance; Simulation Software - Input Modeling and Output Analysis; SPSS / MATLAB/ NS2

Unit 4
Verification and Validation of Simulation Models; Comparison of alternative Designs; Simulation of Network Models; Applications

Course Outcomes:

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

1. Describe the role of important elements of discrete event simulation and modeling paradigm.
2. Conceptualize real world situations related to systems development decisions, originating from source requirements and goals.
3. Develop skills to apply simulation software to construct and execute goal-driven system models.
4. Students can employable in R &D sector and IT sector.

Reference:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, Discrete *Event System Simulation*, Prentice Hall International Series in Industrial & Systems Engineering, Fourth Edition.
2. Sankar Sengupta, System Simulation and Modeling, Pearson Publishing, Edition-1.

CA-504-D Compiler Design

Course Objectives:

1. To teach the students about the phases of designing a Compiler and describe the various data structures those can be used to represent the phases of the Compiler.

Course Content:

Unit 1
Introduction to Compilers : Phases of a Compiler - Syntax Definition – Context Free Grammars – Top Down Parsing – Bottom up Parsing – Predictive Parsing – Operator Precedence Parsing – LR Parser – SLR Parsing

Unit 2
Program representation in Abstract Syntax Trees (AST); Symbol tables and scope rules for C-like languages; Type-checking for C-like languages

Unit 3
Intermediate Code Generation - Different forms of intermediate code (IR); Generation of intermediate code; Call stacks and activation posts

Unit 4
Code Optimization and Generation for RISC-like machines; Basic blocks, control-flow graphs, likeness analysis, register allocation

Course Outcomes:

On completion of the course, the student should be able to:

1. structure a compiler as a sequence of distinct translation steps
2. use regular languages to describe the lexical elements of a programming language
3. describe lexical analysis using a finite automaton
4. use context free languages to describe the syntactic structure of a programming language
5. use the parsing methods top-down (recursive descent) and bottom-up (LR)
6. use abstract syntax trees to represent the results of the syntactic analysis
7. Students can employable in R &D sector and IT sector.

Reference:

1. John J. Donovan ―System Programming , Tata Mc Graw- Hill.
2. A.V. Aho Sethi, J.D. Ullman, ―Compiler Principles, Techniques and Tools, Addison Wesley Publishing Company, 1986.
3. Dhamdhare D., ―System Programming and Operating System , Tata Mc Graw-Hill.

(Elective-4)

CA-506-A Organizational Behavior

Course Objectives:

1. To introduce students to psychology theories and research at individual, group and organizational levels;
2. To help students understand organizational behaviour and management practices by examining psychological principles;
3. To facilitate a critical evaluation of organisational practices and their impact on work behaviours, attitudes and performance.

Course Content:

Unit 1

Basics of OB—History of OB: Stages of development- Pre-Scientific, Classical, Behavioural, Modern Organization structure & process: Components and their interaction Approaches: Traditional & Modern: Contributing disciplines Emerging Issues: Globalization, Diversity, Demographics, Ethical behaviour

Unit 2

The Individual—Personality: Factors (Big Five), Attributes, Measurement (Myers-Briggs Type Indicator); Job Attitude: Components, Major attitudes, Job satisfaction & its measurement, Dissatisfaction; Motivation: Early theories (Need hierarchy & Two-factor) & Recent Theories (ERG & Expectancy)

Unit 3

Personnel Management—Personnel Function: Its evolution, objectives, principles, philosophies and policies, duties and responsibilities of the personnel manager, position of the personnel department on the organization, Line and staff relationship. Manpower planning: Its uses and benefits, problems. limitations, manpower skill analysis and practices. Recruitment: Job specification, selection process, psychological testing, interviewing techniques, transfers, promotion and its policies. Training and Developments: Its objectives and places, planning and organizing then training department, training manager and his job. On and off the job training, techniques, career planning, objectives of Performance appraisal and its methods.

Unit 4

The Group—Groups: Types, Roles, Norms, Size, Group vs. Team, Cohesiveness, Group Decision Making Leadership: Theories (Trait, Behavioural & Contingency), Finding and Creating Effective Leaders. Conflict: Approach, Sources & Negotiation: Stages in the process and remedial strategies; The Organization—Structure: Basics, Common Designs: Simple, Bureaucratic and Matrix structures Culture: Basics, Functions: Boundary, Identity, Commitment & Stability and Management Change: Agents, Resistance, Management: Lewin's 3-step and Kotter's 8-step models

Course Outcomes

1. To understand the main theories of Organisational Behaviour;
2. To be able to analyse how these theories and empirical evidence can help to understand contemporary organisational issues;
3. To apply theories to practical problems in organisations in a critical manner.
4. Make the student employable in IT organization and Small scale industries.

Reference Books:

1. Robbins, Sanghi & Judge, Essentials of Organisational Behaviour, PHI
2. Kavita Singh, Organisational Behaviour :Text and cases, Pearson
3. Fiona Wilson, Organisational Behaviour and Work, Oxford.

CA-506-B Web and Text Mining

Course Objectives:

1. Learn both the theoretical and practical aspects of web mining and text mining
2. Learn fundamental of Information Retrieval and Natural Language Processing
3. Explore the domain of Social Network Analysis

Course Content

Unit 1:
Basic Concepts of Information Retrieval, Information Retrieval Models: Boolean Model, Vector Space Model, Statistical Language Model. N-Gram Language Model: Simple (Unsmoothed) N-grams, Smoothing: Add-one Smoothing, Witten Bell Discounting, Good Turing Discounting.

Unit 2:
Text and Web Page Pre-Processing: Stopword Removal, Stemming, Web Page Pre-Processing, Duplicate Detection. Inverted Index and Its Compression: Inverted Index, Search Using an Inverted Index, Index Construction, Index Compression.

Unit 3:
Web Search: Searching and Ranking. Web Crawling, Basic Crawler Algorithm: Breadth-First Crawlers, Preferential Crawlers, Craweler Implementation Issues: Fetching, Parsing, Stopword Removal and Stemming, Link Extraction and Canonicalization, Spider Traps.

Unit 4:
Introduction to Social Network Analysis, Social Networks Preliminaries and Properties: Homophily, Triadic Closure and Clustering Coefficient, Dynamics of Network Formation, Power-Law Degree Distributions, Measures of Centrality and Prestige: Degree Centrality and Prestige, Closeness Centrality and Proximity Prestige, Betweenness Centrality, Rank Centrality and Prestige.

Learning Outcomes:

A student who takes this course should be able to

1. Design and implement a crawler application to collect and index documents from the web.
2. Analyze text to determine the reliability of the information including potential bias.
3. Evaluate and apply key analytics techniques used in natural language processing and text retrieval
4. Interpret the results, gain insights, and recommend possible actions from analytics performed on text data.
5. Explore career path as Data Scientist, Business Analyst, and Data Analyst.

Reference:

1. Liu, Bing. Web data mining: exploring hyperlinks, contents, and usage data. Vol. 1. Berlin: springer, 2011.
2. Jurafsky, Dan. Speech & language processing. Pearson Education India, 2000.
3. Aggarwal, Charu C. Data mining: the textbook. Vol. 1. New York: springer, 2015.
4. Christopher, D. Manning, Raghavan Prabhakar, and Schutze Hinrich. An Introduction to information retrieval. Cambridge University Press, 2008.
5. Chakrabarti, Soumen. Mining the Web: Discovering knowledge from hypertext data. Morgan Kaufmann, 2002.
6. Zong, Chengqing, Rui Xia, and Jiajun Zhang. Text Data Mining. Vol. 711. Springer, 2021.
7. Scime, Anthony, ed. Web Mining: applications and techniques. IGI Global, 2005.

CA-506-C Big Data Analytics

Course Objectives:

1. To provide in-depth knowledge, information, techniques and about the activities associated with Computer Data Analytics, in a comprehensive manner.
2. To focus on theoretical and practical aspects and principles techniques in an academic discipline such as Operating System, Database Management System, Design and Analysis of Algorithms, Computer Networking, Programming, etc.

Course Content:

Unit 1

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics

Unit 2

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing mapreduce calculations.

Unit 3

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures

Unit 4

MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats. Hbase, data model and implementations, Hbase clients, praxis. Cassandra

Course Outcomes:

The students will be able to

1. Describe big data and use cases from selected business domains
2. Explain NoSQL big data management
3. Install, configure, and run Hadoop and HDFS
4. Perform map-reduce analytics using Hadoop.
5. Make students employable in R & D, It sector and Biotechnology industry

Reference:

1. Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning, Raj kamal, Preeti Saxena, McGraw Hill, 2018.
2. Big Data, Big Analytics: Emerging Business intelligence and Analytic trends for Today's Business, Michael Minelli, Michelle Chambers, and AmbigaDhiraj, John Wiley & Sons, 2013
3. Hadoop: The Definitive Guide, Tom White ,Third Edition, O'Reilley, 2012.

CA-506-D Bioinformatics

Course Objectives:

1. To provide an integrative approach to the understanding of both theory and practice of bioinformatics
2. To apply biological concepts at different levels to study gene / protein analysis, and the
3. proteins implicated in diseases
4. To understand the evolution of the life

Course Content:

Unit 1

Molecular Biology and Biological Chemistry: The Genetic Material, Gene structure and Information Content, Protein Structure and Function, The nature of Chemical bonds, Molecular Biology Tools, Genomic Information Content, Data Searches and Pairwise Alignments: Dot Plot, Simple Alignments, Gaps, Scoring Matrices, Needleman and Wunsch Algorithm, Global and local Alignments, Database searches, Multiple sequence Alignments,

Unit 2

Substitution Patterns: Patterns of substitutions within Genes, Estimating Substitution numbers, Variations in evolutionary rates between Genes, Molecular clocks, evolution in Organelles. Distance based methods of Phylogenetics: History of Molecular Phylogenies, Phylogenetic trees, Distance matrix methods, Maximum likelihood approaches, Multiple sequence Alignments. Character Based methods of Phylogenetics: Parsimony, Inferred ancestral sequences, Strategies for Faster searches, Consensus trees, tree confidence, Comparison of Phylogenetic methods, Molecular Phylogenies.

Unit 3

Genomics and Gene Recognition: Prokaryotic genomes, Prokaryotic gene structure, GCcontent Prokaryotic genomes, Prokaryotic gene density, Eukaryotic genomes, Eukaryotic gene structure, Open reading frames, GC-content Eukaryotic genomes, Gene expression, Transposition, Repetitive elements, Eukaryotic gene density, Protein and RNA structure prediction: Amino acids, Polypeptide composition, Secondary structure, Tertiary and quaternary structure,

Unit 4

Algorithms for Modeling Protein Folding, Structure prediction, Predicting RNA secondary structures, Proteomics: from Genomes to Proteomes, Protein classification, Experimental techniques, Inhibitors and drug design, Ligand screening, X-ray crystal structures, NMR structures, Empirical methods and prediction techniques, Post-translational modification prediction. .

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Course Outcomes: A student who takes this course should be able to

1. Get knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics
2. Use existing software effectively to extract information from large databases and to use this information in computer modeling
3. Develop problem-solving skills, including the ability to develop new algorithms and analysis methods
4. Get an understanding of the intersection of life and information sciences, the core of shared concepts, language and skills the ability to speak the language of structure-function relationships, information theory, gene expression, and database queries

5. Make students employable in R & D, It sector and Biotechnology industry.

Reference:

1. Dan E. Krane, Michael L. Raymer, “Fundamental Concepts of Bioinformatics”, First Edition, 2003, Pearson Education, Inc. New Delhi.
2. Teresa Attwood, David Parry-Smith, “Introduction to Bioinformatics”, 1999, Pearson Education, Inc. New Delhi.
3. Shuba Gopal, A. Haake, R. P. Jones, P. Tymann, “Bioinformatics: A Computing Perspective”, First Edition, 2009, McGraw-Hill Education (India), New Delhi.
4. Yi-Ping P. Chen, “Bioinformatics Technologies”, 2006, Springer India Pvt. Ltd., New Delhi.
5. Arthur Lesk, “Introduction to Bioinformatics”, 2009, Oxford University Press, ISBN-13: 978-0199208043. 4. Bryan Bergeron, “Bioinformatics Computing”, 2003, PHI Learning. New Delhi.
6. Zoe Lacroix, Terence Critchlow, “Bioinformatics: Managing Scientific data”, 2009, Elsevier India Pvt. Ltd., New Delhi.