2 YEAR POST GRADUATE MCA (MASTER OF COMPUTER APPLICATIONS)

[W.E.F. Academic Year 2021-2022]

A Two-Year Fulltime Semester Based PG Programme in

Master of Computer Applications

Department of Computer Science & Engineering

Aliah University

II A/27, New Town

Kolkata – 700156, West Bengal, India.

MCA Program Specific Outcome (PSO)

After completion of MCA Program, a student should be able to:

PSO1: Apply the knowledge of mathematics and computing fundamentals to various real life applications for any given requirement.

PSO2: Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.

PSO3: Design and developing applications to analyze and solve all computer science related problems.

PSO4: Analyze and review the literatures to invoke the research skills to design, interpret and make inferences from the resulting data.

PSO5: Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations.

PSO6: Integrate and apply efficiently the contemporary IT tools to all computer applications.

PSO7: Function effectively both as a team leader and team member on software projects to demonstrate computing and management skills.

PSO8: Involve in perennial learning for a continued career development and progress as a computer professional.

PSO9: Communicate effectively and present technical information in oral and written reports.

PSO10: Function competently as an individual and as a leader in multidisciplinary projects.

PSO11: Utilize the compute knowledge efficiently in projects with concern for societal, environmental, and cultural aspects.

PSO12: Apply the inherent skills with absolute focus to function as a successful entrepreneur.

PSO13: Create and design innovative methodologies to solve complex problems for the betterment of the society.

SEMESTER-I

Discrete Mathematics and Graph Theory

Code: MCAPGPC01
Contacts: 3L
Credits: 3

Course Objectives:

- To provide a basic exposure to the fundamental concept of sets, relations and functions.
- To learn the knowledge of algebraic structures and morphisms.
- To provide the fundamental stuffs of principle of mathematical induction & its applications.
- To explain the concepts of generating functions and recurrence relations.
- To present the basic concepts of counting.
- To provide the basic concepts of graph theory.
- To familiarize with various kinds of trees.
- To familiarize with various types of graph theoretic algorithms.

Course Outcomes:

CO 1: Students will be competent to learn the basic concepts of sets, relations and functions.
CO 2: Students will be able to acquire the idea of algebraic structures and morphisms.
CO 3: Students will be proficient to apply the basic principle of mathematical induction on various applications.
CO 4: Students will be able to understand the basic concepts of generating functions and recurrence relations.
CO 5: Students will be capable to know the basic concepts of counting.
CO 6: Students will be proficient to grasp the basic concepts of graph theory.
CO 7: Students will be aware of various kinds of trees.
CO 8: Students will be able to apply graph theoretic algorithms to solve various problems.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√	√	√	√	√		√						√
CO2	√	√	√	√	√	√			√				√
CO3	√	√	√	√	√	√	√		√	√			√
CO4	√	√	√	√	√	√	√		√	√			√
CO5	√	√	√	√	√	√	√		√	√	√	√	√
CO6	√	√					√		√				√
CO7	√	√	√		√		√		√				√
CO8	√	√	√		√		√		√				√

UNIT-I (4L)

Sets, relations and functions: Operations on sets, relations and functions, binary relations, partial ordering relations, equivalence relations, Finite and infinite sets, countable and uncountable sets, Cantor's diagonal argument and the power set theorem, Schroeder-Bernstein theorem.

UNIT-II (4L)

Algebraic structures and morphisms: Algebraic structures with one binary operation – semigroups, monoids and groups, congruence relation and quotient structures. Free and cyclic monoids and groups, permutation groups, substructures, normal subgroups.Algebraic structures with two binary operations – rings, integral domains and fields.Boolean algebra and Boolean ring.

UNIT-III (2L)

PRINCIPLE OF MATHEMATICAL INDUCTION & APPLICATIONS

Mathematical Induction, Strong Induction and Well-ordering, Recursive Definition and structural induction, Recursive Algorithms.

UNIT-IV (8L)

GENERATING FUNCTIONS AND RECURRENCE RELATIONS: Introductory Examples Definition and Examples. Calculational Techniques, Partitions of Integers, the Exponential Generating Function, the Summation Operator. First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients, the Non-homogeneous Recurrence Relation, The Method of Generating Functions

UNIT-V (6L)

Counting: Basic counting techniques – inclusion and exclusion, pigeon-hole principle, permutation, combination, summations, The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials.

UNIT-VI (4L)

Graph Theory: Definitions and Examples, Subgraphs, Complement of a graph, Graph Isomorphism, Degree, Directed and undirected graphs, weighted and unweighted graphs, dual graph, Walk, Trail, Path, Cycle, Euler Trails and Circuits, Planar Graphs, Hamilton Paths and Cycles, Matrix representation of graph, Vertex coloring, Edge coloring, Chromatic Polynomials.

UNIT-VII (4L)

Trees : Definitions, Properties and Examples, Rooted Trees, Trees and Sorting, Binary Trees, Weighted Trees and Prefix Codes

UNIT-VIII (4L)

Graph Algorithms: Graph Traversals, Shortest Path Algorithms, Minimal Spanning Trees – the algorithms of Kruskal and Prim, Max-flow Min-cut Theorem, Matching.

Suggested Readings:

1. F. Harary: Graph Theory
2. N. Deo: Graph Theory with Applications to Engineering and Computer Science
3. A. Tucker: Applied Combinatorics

Database Management System

Code: MCAPGPC02
Contacts: 3L
Credits: 3

Course Objective:

- The objective of this course is
- Students should be exposed to the fundamental concepts of Data Base Management Systems
- Students should be able to model, design and implement Data Base Management Systems
- Students should be able to manipulate a database using Structured Query Language (SQL)
- Students should be able to master techniques for Database Normalization, Transaction Management and database security and recovery management.

Prerequisite: Fundamental of set theory, Basic of Programming knowledge

Course Outcome:

CO 1 Understanding functional components and architecture of DBMS and its role in Information System
CO 2 Mastering SQL queries with background understanding of Relational Algebra and Relational Calculus
CO 3 Applying E-R model and Relational model for designing and implementation of DBMS
CO 4 Understanding Integrity Constraint, Functional Dependency and Normalization Rules
CO 5 Understanding Transaction Processing & Concurrency control
CO 6 Performing Query Optimization and Evaluation
CO 7 Understanding indexing, storage structure and recovery management

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	√	√	√										
CO2	√	√			√								
CO3		√	√	√									√
CO4	√			√									
CO5			√			√		√					
CO6	√		√			√		√					
CO7			√			√		√					

INTRODUCTION [4L]
Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema Architecture of DBMS.

ENTITY-RELATIONSHIP MODEL [4L]
Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

RELATIONAL MODEL [5L]

Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications of the Database.

SQL AND INTEGRITY CONSTRAINTS [5L]

Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, Views, Nested Subqueries, Database security application development using SQL, Stored Procedures and Triggers.

RELATIONAL DATABASE DESIGN [7L]

Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, 2NF, 3NF, Boyce-Codd Normal Form, Normalization using multi-valued dependencies, 4NF, 5NF, Lossless Decomposition

INTERNALS OF RDBMS [6L]

Physical data structures, Query optimization: join algorithm, statistics and cost based optimization. Transaction Processing, Concurrency Control and Recovery Management, Serializability, Lock based protocols, Two Phase Locking.

FILE ORGANIZATION & INDEX STRUCTURES [5L]

File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree.

Reference Books:

1. Abraham Silberschatz, Henry F. Korth and S Sudarshan: "Database System Concepts", McGraw Hill Education.
2. ElmasriRamez and NovatheShamkant: "Fundamentals of Database Systems", Pearson Education.
3. C.J. Date:"An Introduction to Database Systems", Pearson Education
4. Ullman JD.: "Principles of Database Systems", Galgotia Publications.

Computer Organization and Architecture

Code: MCAPGPC03
Contacts: 3L
Credits: 3

Course Objectives:

- To know how Computer Systems work & its basic principles.
- To learn the basics of stored program concepts and different arithmetic and control unit operation.
- To know how I/O devices are being accessed and its principles etc.
- To learn the principles of pipelining.
- To learn memory and mechanism of data storage.
- To distinguish between the concepts of serial, parallel, pipeline architecture.

Course Outcomes:

CO1: Understand how the Computer Systems work & numbers stored in it.

CO2: Learn the basics of stored program concepts and different arithmetic and control unit operation.

CO3: Learn about memory hierarchy and mapping techniques.

CO4: Learn the data transfer mechanism and working mechanism of I/O devices.

CO5: Learn pipelining concepts with a prior knowledge of stored program methods.

CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	P011	P012	P013
CO1	√	√				√		√					
CO2		√	√					√				√	
CO3			√		√	√							
CO4	√	√				√		√			√		
CO5			√			√		√			√	√	

UNIT I

Introduction: [2L]

History of computing, von Neumann machine, Instruction and data, fixed-point and floating point numbers, errors, IEEE standards

UNIT II

Processor design: [7L]

Instruction Set Architecture-Instruction format, opcode optimization; operand addressing; Instruction implementation-data movement, branch control, logical, Input/output and debugging instructions; arithmetic instruction implementation–addition and subtraction, multiplication-division, 2's complement multiplication; Booth's algorithm–theory and examples; bit-pair algorithm; high performance arithmetic

UNIT III

Control unit design: [8L]

Hardwired control, micro-programmed control design – micro-instruction formats, control optimization;

UNIT IV

Memory subsystem: [9L]

Memory technology, memory interfacing, Memory hierarchy–introduction to virtual memory system; Cache memory – performance, address mapping, content addressable memory (CAM), Floppy Disks.

UNIT V

Peripherals: [7 L]

Basic properties, bus architectures, interfacing of I/O devices, data transfer schemes –programmed I/O, DMA, mass storage, RAID

UNIT VI

Pipelining: [3L]

Pipelining data path and instructions, speed up, CPI, latency; linear / non-linear pipeline–reservation table, MAL; super-pipelined and super-scalar processors.

Suggested Books:

1. Mano, M.M., "Computer System Architecture", PHI.
2. BehroozParhami: "Computer Architecture", Oxford University Press
3. Hayes J. P.: "Computer Architecture & Organisation", McGraw Hill,
4. Hamacher: "Computer Organisation", McGraw Hill,
5. N. senthil Kumar, M. Saravanan, S. Jeevananthan: "Microprocessors and Microcontrollers" OUP.
6. Chaudhuri P. Pal: "Computer Organisation & Design", PHI.
7. P N Basu: "Computer Organization & Architecture", Vikas Publishing.
8. J. L. Hennessy and D. A. Patterson: "Computer Architecture: A Quantitative Approach", 3rd & 4th ed, Elsevier.
9. Kai Hwang: "Advanced Computer Architecture: Parallelism, Scalability, Programmability", TMH.

Computational Mathematics

Code: MCAPGPC04
Contacts: 3L
Credits: 3

Course Objective:

- Students should gain an appreciation for the role of computers in mathematics as a complement to analytical and experimental approaches.
- Students should have learned what computational mathematics is about: designing algorithms to solve scientific problems that cannot be solved exactly; investigating the robustness and the accuracy of the algorithms and/or how fast the numerical results from the algorithms converge to the true solutions.
- Students should be able to make appropriate assumptions to come up with a mathematical model that accurately reflects an appropriate scientific theory, and that is amenable to solution with a computer.
- Students should be able to communicate the results of numerical computation, with adequate explanations, in written and graphical form.

Course Outcomes:

CO 1: Apply mathematical and computing knowledge.
CO 2: Demonstrate algebraic facility with algebraic topics including linear, quadratic, exponential, logarithmic, and trigonometric functions
CO 3: Problem solve through modelling of real world phenomena using mathematics and computing
CO 4: Assess current technology and future trends in computer science.
CO 5: Approach mathematics and computer science research questions from a perspective consistent with the norms of the field.

CO - PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	√	√		√	√	√		√		√		√	√

CO2		√	√				√		√			√	
CO3	√		√		√					√			
CO4			√	√		√		√	√	√			√
CO5		√	√	√			√	√			√		√

Module-1 (12L):

Determinants and their properties, Cramer's Rule, Algebra of matrices, Types of matrices, Block matrices, Inverse of a matrix by elementary transformations, Rank of a matrix (Echelon & Normal form), Linear dependence and independence, Characteristic equation, Eigen values and Eigen vectors, Orthogonal bases and orthogonal projections, Gram-Schmidt process, Linear transformations, Singular Value Decomposition. Applications.

Module-2 (12L)

Classifications of Data and frequency distribution, Calculation of measures of Central tendency and measures of dispersion, Skewness and Kurtosis, Permutation and Combination, Probability, Random variables and distribution functions, Mathematical expectations and generating functions, Binomial, Poisson, Geometric, Exponential and Normal distributions, Curve fitting and principal of least square, Correlation and Regression, Index numbers and their importance, Simple Time Series analysis, Sampling and large sample tests, test of significance based on t, Chi-square and F distributions. Applications.

Module-3 (12L)

Approximation in numerical computation. Truncation and rounding errors. Numerical solution of algebraic and transcendental equation. Methods for complex roots of a polynomial. Numerical treatment of a system of a linear equation, iterative methods for linear systems. Interpolation: Lagrange formula. Newton and Gauss formula. Spline functions. Curve fitting. Numerical differentiation and integration. Trapezoidal, Simpson's and Romberg integration. Gauss quadrature. Numerical solution of ordinary differential equations. Runge-Kutta method, Predictor corrector method. Numerical solution of Partial differential Equation. Applications.

Suggested Readings:

1. K.Hoffman and R.Kunze, Linear Algebra, 2nd Edition, Prentice- Hall of India, 2005.
2. M.Artin,Algebra,Prentice-Hall of India, 2005.
3. Hamdy A. Taha: Operations Research-An Introduction, Prentice Hall, 9th Edition, 2010.
4. A. Ravindran, D. T. Phillips and James J. Solberg: Operations Research- Principles and Practice, John Wiley & Sons, 2005.
5. Goon A. M., Gupta M. K., Dasgupta B. (2001): Fundamentals of Statistics (V-2), World Press
6. Snedecor & Cochran (1967): Statistical Methods (6th ed), Iowa State Univ. Press
7. Numerical Algorithms by Krishnamoorthy and Sen
8. Numerical Methods by J.H.Mathews, PHI
9. Computer Systems and Data Analysis by D.K.Basu, M.Nasipuri and M.Kundu, Narosa

10. Introductory Methods of Numerical Analysis by S.S.Sastry , P.H.I.

Formal Languages and Automata Theory

Code: MCAPGPC05
Contacts: 3L
Credits: 3

Course Objectives:

- To provide a formal connection between algorithmic problem solving and the theory of languages and automata and develop them into a mathematical (and less magical) view towards algorithmic design and in general computation itself.
- To clarify the practical view towards the applications of these ideas in computer science.

Course Outcomes:

CO 1: Understand different models and compare their properties.
CO 2: Analyse different computational models using combinatorial methods.
CO 3: Apply rigorously formal mathematical methods to prove properties of languages, grammars and automata.
CO 4: Understand algorithms for different problems and argue formally about correctness on different restricted machine models of computation.
CO 5: Understand computational models, their limitations and possible methods to prove them.
CO 6: Get an overview of different machines in this course and how these are applicable to solve different problems.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√	√	√	√									
CO2	√		√	√									
CO3					√	√							
CO4							√	√		√			
CO5						√					√	√	√
CO6				√		√					√		√

UNIT I [12 Hrs]
Introduction: Alphabet, Languages, Grammars, Productions, Derivation, Chomsky hierarchy of languages, Regular Expressions and Languages. [3L]
Finite Automata (FA): Deterministic finite automata (DFA), Non-deterministic finite automata (NFA), Deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, Minimization of Finite Automata. [6L]
Regular Languages: Regular Sets and Languages, Properties of Regular Languages, Pumping Lemma for Regular Languages. [3L]

UNIT II [12 Hrs]

Context-Free Languages and Pushdown Automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs. [8L]
Context-Sensitive Languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG. [4L]

UNIT III [12 Hrs]
Turing machines: The basic model for Turing machines (TM), Turing-recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, Variants of Turing machines, Nondeterministic TMs and equivalence with deterministic TMs, Universal TMs, Halting Problem, Recursive Functions and Sets, Recursively Enumerable Sets, unrestricted grammars and equivalence with Turing machines, TMs as enumerators. [8L]
Undecidability: Church-Turing Thesis, Universal Turing Machine, The Universal And Diagonalization Languages, Reduction Between Languages And Rice's Theorem, Undecidable Problems About Languages. [4L]

Suggested Books:

1. John Martin: "Introduction to Languages and Theory of Computation", Tata McGraw Hill.
2. J. E. Hopcroft and J. D. Ullman: "Introduction to Automata Theory, Languages and Computation", Pearson Education.
3. H. R. Lewis and C. H. Papadimitriou: "Elements of the Theory of Computation", Second Edition, Pearson Education.
4. Peter Linz: "An Introduction to Formal Languages and Automata", Narosa.
5. Michael Sipser: "Introduction to the Theory of Computation", Thomson Press.
6. Dexter C. Kozenm: "Automata and Computability", Springer.

Database Lab

Code:MCAPGPC06
Contacts: 3P
Credits: 1.5

Course Objective:

- Students should be able to model, design and implement Data Base Management Systems
- Students should be able to manipulate a database using Structured Query Language (SQL)
- Students should be able to master techniques for Transaction Management, database security and recovery management.

Course Outcome:

CO 1 Mastering Design and Implement a database schema
CO 2 Mastering queries using DDL, DML, DCL and TCL commands.
CO 3 Applications using PL/SQL
CO 4 Able to Design and implement a project using SQL and Programming Language.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	√	√	√										
CO2	√	√	√		√								
CO3	√				√	√							
CO4					√	√					√		√

Overview of Structured Query Language

1. **Creating Database**
   - Creating a Database
   - Creating a Table
   - Specifying Relational Data Types
   - Specifying Constraints
   - Creating Indexes
2. **Table and Record Handling**
   - INSERT statement
   - Using SELECT and INSERT together
   - DELETE, UPDATE, TRUNCATE statements
   - DROP, ALTER statements
3. **Retrieving Data from a Database**
   - The SELECT statement
   - Using the WHERE clause
   - Using Logical Operators in the WHERE clause
   - Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING
4. **Clauses**
   - Using Aggregate Functions
   - Combining Tables Using JOINS
   - Subqueries
5. **Database Management**
   - Creating Views
   - Creating Column Aliases
   - Creating Database Users
   - Using GRANT and REVOKE
6. **PL / SQL**
   - Data Types, Variabes, Condition, Loop
   - Cursors, Triggers
   - Stored Procedure

References:

1. Oracle PL/SQL by example, by Rosenzweig, Pearson Publication
2. Practical Oracle SQL, by Kim Berg Hansen, Oreilly Publication

Programming Lab

Code: MCAPGPC07
Contracts: 3P
Credits: 1.5

Course Objectives:

- To make the student learn a programming language.
- To learn problem solving techniques.
- To teach the student to write programs in C and to solve the problems.

Course Outcomes:

After Completion of this course the student would be able to

CO1: Read, understand and trace the execution of programs written in C language.

CO2: Write the C code for a given algorithm.

CO3: Implement Programs with pointers and arrays, perform pointer arithmetic, and use the pre-processor.

CO4: Write programs that perform operations using derived data types.

CO-PSO MAPPING:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√	√	√										
CO2		√	√		√	√				√			
CO3			√		√	√					√		
CO4		√		√		√					√		√

Syllabus

C programming on variables and expression assignment, simple arithmetic Loops, If-else, Case statements, break, continue, go to Single & Multidimensional arrays Functions, recursion, file handling in C Pointers, address operator, declaring pointers & operators on pointers Address of an array, structures, pointer to structure, dynamic memory allocation.

Suggested Books:

1. B.W. Kernighan and D.M. Ritchie: The C Programming Language; PHI.
2. E. Balagurusamy: Programming in ANSI C; TMH.
3. Yashwant Kanetkar: Let Us C, BPB Publications, 9th Edition, 2008.
4. B.S. Gottfried: Programming in C; TMH.
5. H. Schildt: C++: The Complete Reference; TMH.
6. B. Stroustrup: The C++ Programming Language; Addison-Wesley.
7. K. N. King: C Programming: A Modern Approach, W. W. Norton and Company.
8. Pradip Dey and Manas Ghosh: Programming in C, Oxford University Press.

Communication and Soft Skills

Code: MBAUGHU04

Contacts: 2P
Credits: 1

English for Communication Skills: Age of Globalization and the Need for Communicating in English, English as the First or Second language, Uses of English in academic and non-academic situations in India
Non-verbal communications: Gestures, Postures, Facial Expression, Eye Contacts, Body Language (Kinesics)
Verbal Communication (Oral-Aural): Correct Pronunciations, Listening skills, Intonations
Mock Interview Session: Three Vs of interview, SWOT Analysis, STAR Techniques, Five Ts principle of Life
Personality Development: Confidence building, Body Language-Positive and Negative body language, Appearance and Presentation skills. Presentation abilities, Nature vs. Nurture Individual Counseling & Feedback
Time Management: Managing your time effectively, Setting things on priorities
Team management and team dynamics, Team Work, Role Plays, Game Planning, Co-ordination
Etiquettes, Business Etiquettes, Email Etiquettes, Resume Writing

Suggested Books:

1. E. Suresh Kumar:"Communication Skills and Soft Skills", Pearson.
2. John Sonmez:"Soft Skills: The software developer's life manual", Manning Publications.
3. Prof. M.S. Rao: "Soft Skills for Young Managers", Dreamtech Press.
4. Emma-Sue Prince:"The Advantage: The 7 soft skills you need to stay one step ahead", Pearson.

----------END OF SEMESTER I----------

SEMESTER-II

Data Structures and Algorithms

Code: MCAPGPC08
Contracts: 3L
Credits: 3

Course Objectives:

- Identify and use appropriate data structure for a given problem with effective utilization of space and time.
- Describe the linear and nonlinear data structures.
- Analyze the complexities of different sorting techniques.

Course Outcomes:

CO 1: Understand the basic concepts of data structure and data types.
CO 2: Analyze the time and space complexities of Algorithms.
CO 3: Design a solution to a given problem using arrays and linked lists.
CO 4: Develop applications using stacks, queues and linked lists.
CO 5: Choose suitable sorting techniques to maximize the performance.
CO 6: Illustrate operations on Efficient Binary Search Trees, Multiway Search Trees and hashing functions.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√	√											
CO2		√	√										
CO3	√		√			√							
CO4		√	√			√							
CO5		√	√			√							
CO6		√	√			√							

UNIT I [12L]

Introduction: Data and Information, Program Structures, Abstract Data Type, Data Structure - Static and Dynamic Data Structures. [2L]
Array as a Data Structure: Representation of Polynomials and Sparse Matrix, Linear List, Implementation using array, Review of Pointers and Functions. [4L]
Linked List Representations: Single Linked Lists, Doubly Linked Lists, Circularly Linked Lists, Linked List Representation of Polynomial and Applications. [6L]

UNIT II [12L]

Sorting and searching algorithms: Bubble sort, Insertion sort, Selection sort, Merge, Quick, Heap, Radix, Bucket sort, Linear and Binary Search. [6L]

Stack and Queue: Implementations using Arrays and Linked List, Applications, Expression Evaluation and Conversions. [4L]
Recursion: Basic concept, Design of recursive algorithms, Tail recursion. [2L]

UNIT III [12L]

Trees: Binary Trees, Binary Search Trees, Height-Balanced and Weight-Balanced Trees, 2-3 Tree, B-Trees, B+ -Trees. Applications of Trees. [6L]
Graphs: Adjacency Matrix and List, Graph Search Algorithms, Spanning Tree Algorithms, Shortest Path Algorithms. [4L]
Hashing: Terminologies, Hashing Functions, Collision Resolution Techniques, Types of Hashing. [2L]

Suggested Books:

1. E. Horowitz, S. Sahni and S. Anderson-Freed, Fundamentals of Data Structures in C, Second Edition, Universal Press. 2007.
2. M. A. Weiss, Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 2002.
3. A. V. Aho, J. E. Hopcroft and J. D. Ullman, Data Structues and Algorithms, First Edition, Pearson Education, 2002.
4. R. K. Kruse, Bruce P. Leung, Data Structures and Program Design, Prentice Hall, 2006.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, Third Edition, PHI Learning Pvt. Ltd, 2010.
6. Y. Langsam, J. M. Augenstein, M. A. Tenenbaum, Data Structures using C and C++, Second Edition, Pearson Education. 2015.

Operating Systems

Code: MCAPGPC09
Contacts: 3L
Credits: 3

Course Objectives:

- To understand the main components and services provided by an operating system.
- To understand what a process is and how processes are synchronized and scheduled.
- To compare and illustrate various process scheduling algorithms.
- To understand various issues in Inter Process Communication (IPC) and the role of OS in IPC
- To understand different approaches to memory management.
- To summarize the principles of Virtual memory as applied to paging & caching techniques.
- To demonstrate internal file system structure with device drivers and file operations using system calls.
- To study the need for special purpose operating system with the advent of new emerging technologies

Course Outcomes:

CO 1: Understand the basic concepts of an operating system and its components.
CO 2: Describe process management and analyze the synchronization process.

CO 3: Identify the working methodology of multithreaded applications and distinguish different scheduling algorithms.

CO 4: Evaluate the requirement for process synchronization and coordination handled by operating system

CO 5: Identify the reasons of deadlocks, and their remedial measures in an operating system.

CO 6: Understand different memory management techniques and their performances.

CO 7: Classify different file systems and apply the knowledge earned into various operating systems.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√			√									
CO2	√		√	√									
CO3	√		√	√									
CO4	√		√			√							
CO5				√		√							
CO6	√			√									
CO7	√		√	√		√							

UNIT I: [12 Hrs]

Introduction to OS: Introduction to Operating System: Operating system functions, Concept of batch-processing, multi-programmed, time-sharing, real-time, distributed system. Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, and system calls.

Processes: Concept of processes, state diagram, process control block, scheduling of processes, operations on processes, co-operating processes, inter-process communication.

Threads: overview, benefits of threads, user and kernel threads.

CPU scheduling: scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms like FCFS, SJF, RR, Selfish-RR, Priority, Highest Response ratio Next (HRN), and algorithm evaluation, multi-processor scheduling.

UNIT II: [12 Hrs]

Process Synchronization: background, critical section problem, critical region, synchronization hardware, semaphores, discussion of synchronization problems like producer-consumer, readers-writers, dining philosophers, sleeping-barber etc.

Deadlocks: conditions, resource allocation graph, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

Memory Management: background, logical vs. physical address space, address translation, swapping, static partitioning, dynamic partitioning, paging, segmentation, segmentation with paging.

Virtual Memory: background, demand paging, performance, page replacement, page replacement algorithms (FIFO, LRU, Optimal page replacement), allocation of frames, thrashing.

UNIT III: [12 Hrs]

File Systems: file concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, and indexed), and free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance.

I/O Management: I/O hardware, polling, interrupts, DMA, application I/O interface, kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.

Disk Management: disk structure, disk scheduling (FCFS, SSTF, SCAN, C-SCAN), disk reliability, disk formatting, boot block, bad blocks, concept of RAID etc.

Protection and Security: Concepts of domain, Access matrix and its implementation, access control, Security of systems- concepts, threats- Trojan horse, virus, worms etc, introduction to cryptography as security tool, user authentication. Case Studies

Suggested Books:

1. A. Silberschatz, P. Galvin and G. Gagne: "Operating Systems Concepts", Wiley India.
2. Gary Nutt, N. Chaki and S. Neogy: "Operating Systems Concepts", Pearson Education.
3. W. Stallings: "Operating Systems", Pearson Education.
4. D. M. Dhamdhere: "Operating Systems: A Concept-based Approach", Tata McGraw-Hill.

Computer Networks

Code: MCAPGPC10
Contracts: 3L
Credits: 3

Course Objectives:

- Study the basic taxonomy and terminology of the computer networking and enumerate the layers of OSI model and TCP/IP model.
- Read the fundamentals and basics of Physical layer, and will apply them in real time applications
- Study data link layer concepts, design issues, and protocols.
- Gain core knowledge of Network layer routing protocols and IP addressing.
- Study Transport layer services and protocols.
- Acquire knowledge of Application layer and Presentation layer paradigms and protocols.

Course Outcomes:

CO 1: Understand the functions of each layer in OSI and TCP/IP model.
CO 2: Explain different types of transmission media and working procedure of physical layer.
CO 3: Understand the functions of data link layer and explain the protocols.
CO 4: Classify the routing protocols and analyze how to assign the IP addresses for the given networks.
CO 5: Describe the functions of Transport layer and explain the protocols.
CO 6: Get knowledge about the functions of Application layer.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√			√	√								
CO2	√		√	√		√							
CO3	√			√		√							
CO4	√			√		√							
CO5			√	√		√							
CO6		√	√	√		√							

UNIT I: (**12 hours**)

Introduction: Data communications concepts, direction of data flow (simplex, half duplex, full duplex). Networks: physical structure (type of connection, topology), categories of network (LAN, MAN, WAN). Internet: brief history, internet today. Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

Physical layer: Overview of data (analog& digital), signal (analog& digital), transmission (analog& digital) & transmission media (guided & non-guided); TDM, FDM, WDM. Circuit switching and packet switching concepts.

Data link layer: Types of errors, framing (character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back-N ARQ, Selective repeat ARQ, HDLC.

UNIT II: (12 hours)

Medium access sub layer: Point to point protocol, token bus, token ring. Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD. Traditional Ethernet, Fast Ethernet.

Network layer: Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router. Addressing: Internet address, classful address, subnetting. Routing: techniques, static vs. dynamic routing, routing table for classful address. Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing. Protocols: ARP, RARP, IP, ICMP, IPV6. Unicast and multicast routing protocols.

UNIT III: (12 hours)

Transport layer: Process to process delivery; UDP; TCP; Congestion control algorithms. Quality of service: techniques to improve QoS.

Application layer: DNS; SMTP, SNMP, FTP, HTTP & WWW. Security: cryptography, user authentication, security protocols in internet, Firewalls.

Wireless LAN: IEEE 802.11; Introduction to Bluetooth, VLAN‘s, Cellular telephony & Satellite network.

Suggested Readings:

1. Computer Networking: A Top-Down Approach Featuring the Internet, by James F. Kurose and Keith W. Ross, 5th Edition, Pearson Education, 2010

2. Data communication and Networking, by Behrouz A. Forouzan, 4th Edition, Tata McGraw-Hill, 2007

3. Computer Networks, by Andrew S. Tanenbaum, 4th Edition, Prentice Hall India, 2003

4. Computer Networks: A Systems Approach, by Larry L. Peterson and Peter S. Davie,4th Edition, Morgan Kauffman Publishers, 2007

5. Data and Computer Communication, by William Stallings, 9th Edition, Pearson Education, 2011.

Object Oriented Programming with Java

Code: MCAPGPC11
Contacts: 3L
Credits: 3

Course Objectives:

- To understand the basic concepts of object oriented program design techniques.
- To learn the benefits of object oriented programming over structured programming.
- To have a thorough understanding of writing object oriented programs through Java language.
- To understand the concept of packages, multithreading, exception handling in detail.
- To enable the students to solve the real life computing problem by writing programs using object oriented programming principles.

Course Outcomes:

CO 1: Application of object oriented principles in software design process.
CO 2: Learn to choose apply appropriate concepts of structured /object oriented programming paradigm for developing solutions to real life complex computing problems.
CO 3: Understanding various object oriented features like inheritance, encapsulation and polymorphism for solution to various real-world computing problems using Java language.
CO 4: Learn code reusability concept with respect to inheritance, interface, polymorphism and packages.
CO 5: Learn to develop packages, multithreaded programs, exception handling in Java.
CO 6: Development and deployment of Applets.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√		√			√		√		√	√	√	√
CO2	√	√	√			√	√				√		
CO3	√	√	√			√	√				√		
CO4	√		√			√	√				√		
CO5	√	√	√		√	√	√	√		√			√
CO6	√	√	√			√	√	√		√	√		

UNIT I: Object Oriented Thinking [3L]
Need for OOP Paradigm, Principles of Object Oriented Languages, Benefits of OOP, Applications of OOP.

UNIT II: Java Basics [6L]
History of Java, Java Buzzwords, Java Virtual Machine, Platform Independence, Data Types, Variables, Scope and Life time of variables, Operators, Expressions, Control Statements, Type Conversion and Casting, Simple Java Program.

UNIT III: Classes and Objects [5L]
Concepts of Classes, Objects, methods, constructors, this keyword, garbage collection, Compile time polymorphism: overloading methods and constructors, parameter passing, command line arguments, Recursion, nested and inner classes, Exploring String, StringBuffer classes, Arrays.

UNIT III: Inheritance [4L]
Hierarchical abstractions, Base class object, subclass, subtype, forms of inheritance, benefits of inheritance, Member access rules, Usage of super, static and final with inheritance, Run time polymorphism: method overriding, abstract classes, the Object class.

UNIT IV: Packages and Interfaces [3L]
Defining, Creating and Accessing a Package, Understanding CLASSPATH, access control, differences between classes and interfaces, defining an interface, implementing interface, variables in interface and extending interfaces.

UNIT V: Exception Handling [5L]
Concepts of exception handling, benefits of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception classes: throw and throws.

UNIT VI: Multithreading [6L]
Differences between multi-threading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication, thread groups, daemon threads.

UNIT VII: Applet Programming [4L]

Applet & Application, Applet Architecture, Parameters to Applet, Embedding Applets in Web page, Applet Security Policies

Suggested Books:

1. E Balagurusamy: “Programming with Java”, McGraw Hill Education
2. Herbert Schildt: “Java: The Complete Reference”, McGraw Hill Education
3. Sachin Malhotra and SaurabhChoudhary: “Programming in Java”, Oxford University Press
4. Y. Daniel Liang: “Introduction to Java Programming, Brief Version”, Pearson Education
5. Y. Daniel Liang: “Introduction to Java Programming, Comprehensive Version”, Pearson Education
6. Cay S. Horstmann: “Core Java - Vol. I, Vol. II and Vol. II”, Pearson Education
7. E. Balagurusamy: “Object-Oriented Programming with C++”, McGraw Hill Education
8. BjarneStroustrup: “The C++ Programming Language”, Pearson Education
9. R. Lafore: “Object Oriented Programming in C++”, Pearson Education
10. Debasish Jana: “C++ and Object-Oriented Programming Paradigm”, PHI Learning

Artificial Intelligence

Code: MCAPGPC12
Contacts: 3L
Credits: 3

Course Objectives:

- To provide a strong foundation of fundamental concepts in Artificial Intelligence
- To provide a basic exposition to the goals and methods of Artificial Intelligence
- To enable the student to apply these techniques in applications which involve perception, reasoning and learning

Course Outcomes:

CO 1: Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.
CO 2: Apply these techniques in applications which involve perception, reasoning and learning.
CO 3: Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.
CO 4: Acquire the knowledge of real world Knowledge representation.
CO 5: Analyse and design a real world problem for implementation and understand the dynamic behaviour of a system.
CO 6: Use different machine learning techniques to design AI machine and enveloping applications for real world problems.

CO – PO Mapping:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10	PSO 11	PSO 12	PSO 13
CO1	√	√	√	√		√		√					√
CO2	√	√	√	√		√		√					√
CO3	√		√										√
CO4	√	√		√		√							
CO5	√	√	√	√		√		√					√
CO6	√	√						√					√

Module-1 (12 hours)

Introduction, Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.

Problem Solving Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs. Search techniques Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies, Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search.

Module-2 (12 hours)

Fuzzy Set Theory:

Definition, Different types of fuzzy set membership functions, Operations on Fuzzy sets, Fuzzy set theoretic operations, Fuzzy relations, rules, propositions, implications and inferences.

Defuzzification techniques. Fuzzy logic controller design. Some applications of Fuzzy logic

Genetic algorithms---Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques.

Basic GA framework, GA operators: Encoding, Crossover, Selection, Mutation, etc.

Solving single-objective optimization problems using GAs.

Simulated Annealing algorithm for single objective case.

Concept of multi-objective optimization problems (MOOPs) and issues of solving them

Module-3 (12 hours)

Concept of supervised and unsupervised learning. Linear Regression, Logistic regression, gradient descent. Concept of different classifiers: K-NN, Decision Tree, SVM, Naïve-Bayes. Clustering: k-means, hierarchical, fuzzy c-means.

Artificial Neural Networks:

Biological neurons and its working. Simulation of biological neurons to problem solving. Different ANNs architectures. XOR problem, Training techniques for ANNs. Backpropagation algorithm. Concept of perceptron, multi-layer perceptron (MLP), Applications of ANNs to solve some real life problems.

Reference Books:

1. Artificial Intelligence, Ritch& Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. J. S. R. Jang, C.T.Sun and E.Mizutan: Neuro Fuzzy and Soft Computing, PHI,
4. Michalski: Machine Learning - An A. I. Approach, Carbonnel& Michel (Eds.)
5. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
6. Poole, Computational Intelligence, OUP
7. Logic & Prolog Programming, SarojKaushik, New Age International
8. Expert Systems, Giarranto, VIKAS 7. Artificial Intelligence, Russel, Pearson

Elective I

ELECTIVE I- Mobile Technology
Code: MCAPGPE01
Contacts: 3L
Credits: 3

Course Objectives:

- Understand the basics of mobile technology, mobile environment, and architecture, service & management

- Study the key concepts of GPRS.
- Explain different WAP
- Understand Third Generation (3G) Mobile Services
- Explain Global Mobile Satellite Systems; case studies of the IRIDIUM and GLOBALSTAR systems
- Study Mobile, Distributed and Pervasive Computing

Course Outcomes:

CO 1: Learn about mobile computing and architecture and mobile service.
CO 2: Knowledge about GPRS and their technologies.
CO 3: Use and Examine different types of WAP
CO 4: Analyze 3G mobile services and IRIDIUM and GLOBALSTAR systems
CO 5: Understanding of the key components of Distributed and Pervasive Computing

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1		√	√	√									
CO2	√	√	√	√		√							
CO3	√	√		√									
CO4	√	√		√		√	√	√					
CO5		√	√	√		√							√

UNIT I [5L]: Introduction to Personal Communications Services (PCS): PCS Architecture, Mobility management, Networks signaling. Global System for Mobile Communication (GSM) system overview: GSM Architecture, Mobility management, Network signaling.

UNIT II [5L]: General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes. Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP.

UNIT III [5L]: Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML). Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies.

UNIT IV [7L]: Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G.

UNIT V [7L]: Global Mobile Satellite Systems; case studies of the IRIDIUM and GLOBALSTAR systems. Wireless Enterprise Networks: Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols.

UNIT VI [7L]: Mobile, Distributed and Pervasive Computing Pervasive Computing Applications, Architecture of Pervasive Computing Software, Indoor Wireless Environments, Challenges for the Future: Nomadic Computing.

Text Books and References:

1. Pervasive Computing, Burkhardt, Pearson
2. Mobile Communication, J. Schiller, Pearson
3. Adhoc Wireless and Sensor Networks: Architecture and Protocols, Sivaram Murthy, Manoj,Pearson.
4. Wireless and Mobile Networks Architectures, Yi-Bing Lin &ImrichChlamtac, John Wiley & Sons, 2001
5. Mobile and Personal Communication systems and services, Raj Pandya, Prentice Hall of India, 2001.
6. Guide to Designing and Implementing wireless LANs, Mark Ciampa, Thomson learning, Vikas Publishing House, 2001.
7. Wireless Web Development, Ray Rischpater, Springer Publishing,
8. The Wireless Application Protocol, SandeepSinghal, Pearson.
9. Third Generation Mobile Telecommunication systems, by P.Stavronlakis, Springer Publishers

ELECTIVE I- Image Processing
Code: MCAPGPE02
Contacts: 3L
Credits: 3

Course Objectives:

- To learn the fundamentals and advances in image acquisition, representation and operators.
- To know about concepts, filters and transforms in spatial as well as frequency domain.
- To understand noise models and know about image restoration concepts and techniques.
- To know about advanced morphological operations and segmentation techniques as well as image compression basics.
- To learn the analytical tools and methods applied to image information for various aspects of practical applications.

Course Outcomes:

CO 1: Knowledge of advanced notations, operators and preprocessing techniques in monochrome, gray and color images.
CO 2: Skills and insights in image enhancement like linear and non-linear spatial and frequency domain filters.
CO 3: Ability to analyze the performance of Lossless and Lossy compression techniques in images.
CO 4: Knowledge of various segmentation algorithms and morphological operations in connection with practical applications.
CO 5: Understanding about concepts and techniques for image processing applications.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√			√		√		√					√
CO2	√	√	√			√		√			√		
CO3	√	√	√	√		√					√		√

CO4	√	√	√	√		√					√		√
CO5	√	√	√	√		√	√	√	√	√	√	√	√

UNIT-1: (4 HOURS)
Introduction: Overview of Image Processing System, Image Digitization (Sampling and Quantization), Digital Image, Fundamentals of Color image and Color Models, Image File Format

UNIT-II: (4 HOURS)
Spatial Domain Image Enhancement: Contrast Intensification (linear and non-linear stretching), Histogram Equalization, Spatial Domain Smoothing and Sharpening Filters, Correlation and Convolution

UNIT-III: (4 HOURS)
Frequency Domain Image Enhancement: Fourier Transform (1-D and 2-D), Frequency Domain image, Image smoothing, Image sharpening, Correlation and Convolution, Discrete Cosine Transform, Discrete Wavelet Transform.

UNIT-IV: (2 HOURS)
Colure Image Processing: RGB, YCbCr, HIS color models

UNIT-VI: (6 HOURS)
Morphological Image Processing: Dilation and Erosion, Opening and Closing, Some Basic Morphological Algorithms, Extensions to Gray-Scale Images

UNIT-VII: (5 HOURS)
Image Segmentation: Point Detection, Line Detection, Edge Detection **,**Edge Linking and Edge Following by Local Processing, Hough Transform, Thresholding, Region segmentation

UNIT-VIII: (5 HOURS)
Description and Representation: Boundary Representation by Chain Codes, Polygonal Approximation, Skeletons Component Labeling and Counting Geometrical, Texture Analysis, Geometric Moments Texture Descriptor, Gray-level Co Occurrence Matrix

UNIT-X: (6 HOURS)
Image Compression: Loss-less Compression by Run Length Coding, Huffman Coding, Predictive Coding Lossy Compression by Block Truncation Coding, Vector Quantization JPEG Compression

Suggested Readings:

1. Digital Image Processing by Rafael C. Gonzalez and Richard E. Woods

2. Digital Image Processing and Analysis by B. Chanda and D. DuttaMajumder

3. Fundamentals of Digital Image Processing by Anil K. Jain

ELECTIVE I- Modelling and Simulation
Code: MCAPGPE03
Contacts: 3L
Credits: 3

Course Objectives:

- Define the basics of simulation modeling and replicating the practical situations in organizations
- Introduce various system modelling and simulation techniques
- describe the components of continuous and discrete systems and simulate them
- Understand different methods for random number generation
- Solve real world problems which cannot be solved strictly by mathematical approaches
- Develop simulation model using heuristic methods.
- Analysis of Simulation models using input analyzer, and output analyzer
- Explain Verification and Validation of simulation model.

Course Outcomes:

CO 1: Illustrate the role of important elements of discrete event simulation and modeling paradigm.
CO 2: Get a clear understanding of role of simulations to initiate the real problem.
CO 3: Understand to describe the components of continuous systems and their performances by simulating hem.
CO 4: Be able to select the suitable techniques for simulations.
CO 5: Explain Verification and Validation of simulation models.
CO 6: Interpret the model and apply the results to resolve critical issues in a real world environment.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√	√	√	√									
CO2		√	√								√		
CO3		√	√	√							√		
CO4				√		√		√					
CO5						√	√						
CO6										√	√	√	√

UNIT I: (12 hours)
System models and role of simulation.Entities, Attributes, States and Activities.

Types of systems - Deterministic, Stochastic, Continuous and Discrete systems.Steps in simulation studies.

Statistical tools and techniques- generation of pseudorandom numbers, random variate generation for uniform, Poisson and normal distributions, sampling and estimation, maximum likelihood estimation, confidence intervals and hypothesis testing, stochastic processes and Markov models.

UNIT II: (12 hours)
Discrete event simulation languages. Simulation of inventory and queuing systems - single and multiserver queues, network of queues. Modelling and performance evaluation of computers and computer communication networks.Workload characterization.

UNIT III: (12 hours)
Continuous system simulation languages, growth and decay models, system dynamics diagrams.Biological and Sociological system simulation. Verification and validation of

simulation models - input/output validation, sensitivity analysis, performance measures and their estimation.Case studies.

References:

1. Fishwick P.: Simulation Model Design and Execution, PrenticeHall, 1995.
2. Law A., Kelton D.: Simulation Modelling and Analysis, McGraw-Hill, 1991.

3. Rábová Z. a kol: Modelování a simulace, VUT Brno, 1992.
4. Ross, S.: Simulation, Academic Press, 2002.

ELECTIVE I- Visual Programming & Multimedia
Code: MCAPGPE04
Contacts: 3L
Credits: 3

Course Objectives:

- Learn about the syntax rules, variables and data types of Visual Basic IDE.
- Learn to create applications using decision, loops and functions.
- Discuss the technical details of multimedia system architecture, data formats, protocols and the multimedia databases.
- Learn about the different technicalities of multimedia family of standards.
- Discuss the various storage management systems and retrieval technologies.
- Learn about the different technical details of compression methods of images, audio and video content.
- Discuss the design issues of distributed application design and Virtual reality.
- Learn about the technical aspects of hypermedia messaging and distributed multimedia systems.

Course Outcomes:

CO 1: Design and build Visual Basic applications by implementing different syntax rules and applying arithmetic operations for displaying numeric output.
CO 2: Write and apply different decision and loop structures for performing various operations, repetitive tasks and procedures to create manageable code.
CO 3: Analyze the different media representation available for building multimedia applications.
CO 4: Understand the different techniques for compression used in Multimedia applications.
CO 5: Analyze and review different video and audio file formats.
CO 6: Comprehend various coding techniques and use them for solving real world problems.
CO 7: Apply the knowledge of various optical storage media suitable for multimedia applications.
CO 8: Build and evaluate various multimedia systems applications in real time.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√	√	√	√	√								
CO2	√	√					√						

CO3	√	√	√	√		√							
CO4	√	√	√	√	√	√					√		√
CO5	√	√	√	√		√							
CO6	√	√	√	√	√	√			√		√		√
CO7	√	√	√		√	√			√				√
CO8	√	√	√		√						√	√	√

UNIT I: (12 Hrs)

WINDOWS PROGRAMMING

Windows environment – a simple windows program – windows and messages – creating the window – displaying the window – message loop – the window procedure –
message processing – text output – painting and repainting – introduction to GDI – device context – basic drawing – child window controls

VISUAL C++ PROGRAMMING – INTRODUCTION

Application Framework – MFC library – Visual C++ Components – Event Handling – Mapping modes – colors – fonts – modal and modeless dialog – windows common controls – bitmaps

THE DOCUMENT AND VIEW ARCHITECTURE

Menus – Keyboard accelerators – rich edit control – toolbars – status bars – reusable frame window base class – separating document from its view – reading and writing SDI and MDI documents – splitter window and multiple views – creating DLLs – dialog based applications

UNIT II: (12 Hrs)

ACTIVEX AND OBJECT LINKING AND EMBEDDING (OLE)

ActiveX controls Vs. Ordinary Windows Controls – Installing ActiveX controls – Calendar Control – ActiveX control container programming – create ActiveX control at runtime – Component Object Model (COM) – containment and aggregation Vs. inheritance – OLE drag and drop – OLE embedded component and containers – sample applications

ADVANCED CONCEPTS

Database Management with Microsoft ODBC – Structured Query Language – MFC ODBC classes – sample database applications – filter and sort strings – DAO concepts – displaying database records in scrolling view – Threading – VC++ Networking issues – Winsock – WinInet – building a web client – Internet Information Server – ISAPI server extension – chat application – playing and multimedia (sound and video) files

UNIT III: (12 Hrs)

Multimedia

Introduction

Multimedia today, Impact of Multimedia, Multimedia Systems, Components and Its Applications

Text and Audio

Text: Types of Text, Ways to Present Text, Aspects of Text Design, Character, Character Set, Codes, Unicode, Encryption; Audio: Basic Sound Concepts, Types of Sound, Digitizing Sound, Computer Representation of Sound (Sampling Rate, Sampling Size, Quantization), Audio Formats, Audio tools, MIDI

Image and Video

Image: Formats, Image Color Scheme, Image Enhancement; Video: Analogue and Digital Video, Recording Formats and Standards (JPEG, MPEG, H.261) Transmission of Video Signals, Video Capture, and Computer based Animation.

Synchronization

Temporal relationships, synchronization accuracy specification factors, quality of service

Storage models and Access Techniques

Magnetic media, optical media, file systems (traditional, multimedia) Multimedia devices – Output devices, CD-ROM, DVD, Scanner, and CCD

Image and Video Database

Image representation, segmentation, similarity based retrieval, image retrieval by color, shape and texture; indexing- k-d trees, R-trees, quad trees; Case studies- QBIC, Virage. Video Content, querying, video segmentation, indexing

Document Architecture and Content Management

Content Design and Development, General Design Principles Hypertext: Concept, Open Document Architecture (ODA), Multimedia and Hypermedia Coding Expert Group (MHEG), Standard Generalized Markup Language (SGML), Document Type Definition (DTD), Hypertext Markup Language (HTML) in Web Publishing. Case study of Applications

Suggested Book:

1. Charles Petzold, "Windows Programming", Microsoft Press, 1998
2. David J. Kruglinski, George Shepherd, Scot Wingo, "Programming Microsoft
3. Visual C++", Microsoft Press, 2006
4. Kate Gregory 'Using Visual C++", Prentice Hall of India Pvt., Ltd., 1999.
5. Buford J. K. – "Multimedia Systems" – Pearson Education.
6. Andleigh&Thakrar, "Multimedia", PHI
7. Balagurusamy E, "Programming in C# ", Tata McGraw Hill, 2010

ELECTIVE I- Computer Graphics
Code: MCAPGPE05
Contacts: 3L
Credits: 3

Course Objectives:

- To provide comprehensive introduction to advanced computer graphics system, design of algorithms and transformations.
- To have deeper understanding about concepts and techniques of three dimensional graphics along with representation, transformations and viewing.
- To prepare students for activities involving design, development and testing of modeling, rendering and shading.

Course Outcomes:

CO 1: Knowledge about the foundations of computer graphics.

CO 2: Concepts about geometric/mathematical transforms and other algorithms necessary for programming computer graphics.

CO 3: Understanding of object rendering, representation and viewing in modern display systems.
CO 4: Knowledge about illumination, ray tracing, animation, etc.
CO 5: Familiarity with different aspects and components about recent applications of computer graphics and insights into upcoming prospective graphics-powered applications.

CO – PSO Mapping:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12	PSO 13
CO1		√				√		√	√		√		
CO2	√	√	√			√			√	√	√		
CO3	√	√	√	√		√		√	√	√	√	√	
CO4	√	√	√	√		√		√	√	√	√	√	
CO5	√	√	√	√		√		√	√	√	√	√	

Unit I. Introduction to Computer Graphics & Graphics Systems (5L)
Overview of computer graphics, graphical display devices, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics softwares; Character generation

Unit II. Scan Conversion (6L)
Points and lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon fill algorithm, boundary fill algorithm, flood fill algorithm.

Unit III. 2D Transformation (4L)
Basic transformations - translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection, shear, Transformation of points, lines, parallel lines, intersecting lines.

Unit IV. Viewing in 2D (4L)
Viewing pipeline, Window to viewport co-ordinate transformation, clipping operations, point clipping, line clipping, Cohen Sutherland Algorithm, clipping circles, polygons & ellipse, Sutherland Hodgeman algorithm.

Unit V. 3D Transformation and Viewing (4L)
Translation, rotation, scaling & other transformations, Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, viewport clipping, 3D viewing.

Unit VI. Curves and Surfaces (5L)
Object representation; Curve and surface designs, Bezier curves, Continuity conditions; B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves.

Unit VII. Hidden Surfaces (4L)
Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Printer's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry.

Unit VIII. Color and shading Models (4L)
Light and color model; interpolative shading model; Texture; Ray tracing; Animation

Suggested Books:

1. Computer Graphics C version, by D. Hearn and M.P. Baker, Pearson Education.
2. Computer Graphics by Samit Bhattacharya, Oxford University Press.
3. Procedural Elements for Computer Graphics by David F.Rogers, TMHpublication.
4. Mathematical Elements for Computer Graphics by David F. Rogers and J. A.Adams, TMH publication.
5. Computer Graphics Principles &Practice in C by J.D. Foley, A. van Dam, S.K.Feiner and F. H. John, Pearson.
6. Computer Graphics – A Programming Approach by S. Harrington, TMHpublication.
7. Computer Graphics by A.N. Sinha and A.D. Udai, TMH publication

Data Structures Lab with Python

Code: MCAPGPC13
Contracts: 3P
Credits: 1.5

Course Objectives:

- Design and analyze linear and nonlinear data structures
- Acquire programming skills to implement sorting and searching techniques
- Identify and apply the suitable data structure for the given real world problem

Course Outcome

CO1: Implement insert, delete, search, sort and traverse operations using arrays and linked lists.
CO2: Develop applications on stacks and queues.
CO3: Understand nonlinear data structures to solve computing problems.
CO4: Implement optimized sorting techniques for a given data set.
CO5: Implement hashing techniques to perform dictionary operations and binary search trees.
CO6: Develop applications on linked lists.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	√	√	√	√		√				
CO2		√	√	√		√				
CO3		√	√	√		√				
CO4		√	√	√	√	√				
CO5				√	√	√				
CO6			√	√		√				

Experiments should include but not limited to:

1. Implementation of various sorting algorithms such as Bubble sort, Insertion sort, Selection sort, Merge sort, Quick sort, Heap sort, etc.
2. Implementation of searching techniques namely: Linear and Binary Search.
3. Implementation of stacks and queues using arrays and using linked lists.
4. Applications of linked lists: polynomial arithmetic, set operations, etc.
5. Sparse Matrices: Multiplication, addition.

6. Implementation of Binary Trees, Binary Search Trees, B-Trees, B+-Trees.
7. Implementation of Hash tables.

Reference Books:

1. A. V. Aho, J. E. Hopcroft and J. D. Ullman:"Data Structures and Algorithms", First Edition, Pearson Education, 2002.
2. R. K. Kruse, Bruce P. Leung:"Data Structures and Program Design", Prentice Hall, 2006.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein:"Introduction to Algorithms", Third Edition, PHI Learning Pvt. Ltd, 2010.
4. Hemant Jain: " Problem Solving in Data Structures & Algorithms Using Python"
5. Dr. Basant Agarwal and Benjamin Baka: "Hands-On Data Structures and Algorithms with Python"

Operating Systems Lab

Code: MCAPGPC14
Contracts: 3P
Credits: 1.5

Course Objectives:

- To discuss basic unix commands.
- To write and demonstrate Shell programming.
- To understand process creation, execution, deletion and different types of processes in the system.
- To write semaphore and threads programming.
- To understand inter-process communication.

Course Outcomes:

CO 1: Understand basic unix commands.
CO 2: Able to write and develop Shell programming.
CO 3: Understand process creation, execution, deletion and different types of processes in the system.
CO 4: Able to write semaphore and threads programming.
CO 5: Able to understand inter-process communication.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1			√	√		√							
CO2	√		√	√		√							
CO3	√		√	√		√							
CO4	√		√	√		√							
CO5	√		√	√		√							

1. **Shell programming:** creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands).

2. **Process:** starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.
3. **Signal:** signal handling, sending signals, signal interface, signal sets.
4. **Semaphore:** programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).
5. **POSIX Threads:** programming with pthreadfunctions(viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)
6. **Inter-process communication:**pipes(use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO)

Suggested Books:

1. UNIX concepts and Applications, Sumitabha Das, 4th Edition, Tata McGraw-Hill
2. Introduction to UNIX SHELL Programming, M.G. Venkateshmurthy, Pearson Education
3. UNIX and SHELL Programming, B.M. Harwani, Oxford Higher Education

Computer Networks Lab

Code: MCAPGPC15
Contracts: 3P
Credits: 1.5

Course Objectives:

- To familiar with network cables, different connectors, connecting devices like hubs, switches.
- To write, execute and debug c programs which use Socket API.
- To understand the use of client/server architecture in application development.
- To understand how to use TCP and UDP based sockets and their differences
- To write and implement data link layer protocols.

Course Outcomes:

CO1 Demonstrate the networking cables, connectors and connecting devices.
CO2 Demonstrate the socket program using TCP & UDP.
CO3 Develop simple applications using TCP & UDP.
CO4 Develop and simulate the code for different Data link layer protocols.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1			√	√		√							
CO2	√		√	√		√							
CO3	√					√							
CO4	√		√	√		√							
CO5			√	√		√							

1. **Familiarization with**
    - Networking cables (CAT5, UTP)
    - Connectors (RJ45, T-connector)
    - NIC Installation & Configuration (Windows/Linux)

- Hubs, Switches

2. **TCP/UDP Socket Programming**
3. **Implementation/Simulation of**
    - Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)
    - Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)
    - Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)

Suggested Books and References:

1. Comer – "Internetworking with TCP/IP, vol. 1, 2, 3(4 th Ed.)" – Pearson Education/PHI
2. Unix Network Programming: The Sockets Networking Api, W. Richard Stevens, Bill Fenner, Andrew M. Rudoff
3. Hands-On Network Programming with C: Learn socket programming in C and write secure and optimized network code, Lewis Van Winkle

Object Oriented Programming Lab

Code: MCAPGPC16
Contracts: 3P
Credits: 1.5

Course Objectives:

- To understand the basic concepts of object oriented program design techniques.
- To learn the benefits of object oriented programming over structured programming.
- To have a thorough understanding of writing object oriented programs through Java language.
- To understand the concept of packages, multithreading, exception handling in detail.
- To enable the students to solve the real life computing problem by writing programs using object oriented programming principles.

Course Outcomes:

CO 1: Application of object oriented principles in software design process.
CO 2: Learn to choose apply appropriate concepts of structured /object oriented programming paradigm for developing solutions to real life complex computing problems.
CO 3: Understanding various object oriented features like inheritance, encapsulation and polymorphism for solution to various real-world computing problems using Java language.
CO 4: Learn code reusability concept with respect to inheritance, interface, polymorphism and packages.
CO 5: Learn to develop packages, multithreaded programs, exception handling in Java.
CO 6: Development and deployment of Applets.

CO – PO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√		√			√		√		√	√	√	√
CO2	√	√	√			√	√				√		
CO3	√	√	√			√	√				√		

CO4	√		√			√	√				√		
CO5	√	√	√		√	√	√	√		√			√
CO6	√	√	√			√	√	√		√	√		

1. Assignments on class, constructor, overloading, inheritance, overriding,
2. Assignments on abstract classes, String handling
3. Assignments on wrapper class, arrays
4. Assignments on developing interfaces- multiple inheritance, extending interfaces
5. Assignments on creating and accessing packages
6. Assignments on Exception handling
7. Assignments on multithreaded programming
8. Assignments on applet programming

Suggested Books:

1. E Balagurusamy: "Programming with Java", McGraw Hill Education
2. Herbert Schildt:"Java: The Complete Reference", McGraw Hill Education
3. Sachin Malhotra andSaurabhChoudhary: "Programming in Java", Oxford University Press
4. Y. Daniel Liang: "Introduction to Java Programming, Brief Version", Pearson Education
5. Y. Daniel Liang:"Introduction to Java Programming, Comprehensive Version", Pearson Education
6. Cay S. Horstmann: "Core Java - Vol. I, Vol. II and Vol. II", Pearson Education
7. E. Balagurusamy: "Object-Oriented Programming with C++", McGraw Hill Education
8. BjarneStroustrup: "The C++ Programming Language", Pearson Education
9. R. Lafore: "Object Oriented Programming in C++", Pearson Education
10. Debasish Jana: "C++ and Object-Oriented Programming Paradigm", PHI Learning

----------END OF SEMESTER II----------

SEMESTER-III

Design and Analysis of Algorithms

Code: MCAPGPC17
Contracts: 3L
Credits: 3

Course Objectives:

- Student will learn about algorithms, asymptotic notations and can analyze the algorithms.
- Student will be able to write algorithms for problem solving.
- Student can learn various searching and sorting techniques and graph traversing algorithms and data structures.
- Apply the knowledge of algorithms in real life problem solving.
- Compare between different data structures. Pick an appropriate data structure for a design situation.

Course Outcomes:

CO 1: To analyze best and worst-case running times of algorithms using asymptotic analysis.
CO 2: To learn about divide-and-conquer method, dynamic-programming, greedy, backtracking etc and explain what competitive analysis is and to which situations it applies. Perform competitive analysis.
CO 3: Familiar with the data structures like stack /tree /graphs to models and can use this to solve engineering problems.
CO 4: To understand computational complexity of problems & can compare the complexity.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√	√											
CO2		√	√		√	√					√		√
CO3				√	√	√					√		√
CO4		√	√	√	√								√

UNIT I (12 hours)
Models of computation:RAM,TM etc. time and space complexity
Asymptotic Notation: Big-O, omega, theta etc.; finding time complexity of well-known algorithms like heap sort, search algorithm etc.
Algorithm design techniques:. Recursion: use, limitations, examples.
Divide and Conquer: basic concept, use, examples (Merge sort, Quick Sort, Binary Search).

UNIT II (12 hours)
Dynamic Programming: basic concept, use, examples (matrix-chain multiplication, all-pair shortest paths, single-source shortest path, travelling salesman problem).
Branch and Bound: basic concept, use, examples (15-puzzle problem).

Backtracking: basic concept, use, examples (Eight queens problem, graph coloring problem, Hamiltonian problem).
Greedy Method: basic concept, use, examples (Knapsack problem, Job sequencing with deadlines, minimum spanning tree).
Lower Bound Theory: Bounds on sorting and sorting techniques using partial and total orders.
Disjoint Set Manipulation: Set manipulation algorithm like UNION-FIND, union by rank, Path compression.

UNIT III (12 hours)
Properties of graphs and graph traversal algorithms: BFS and DFS.
Matrix manipulation algorithms: Different types of algorithms and solution of simultaneous equations, DFT & FFT algorithm; integer multiplication schemes.
Notion of NP-completeness: P class, NP-hard class, NP-complete class, Circuit Satisfiability problem, Clique Decision Problem.
Approximation algorithms: Necessity of approximation scheme, performance guarantee, Polynomial time approximation schemes: 0/1 knapsack problem.

Suggested Books:

1. Introduction to Algorithms – T.H. Cormen, C.E. Leiserson., R.L. Rivest, C. Stein.
2. Fundamentals to Computer Algorithms – E. Horowitz, S. Sahni, S. Rajasekaran.
3. Combinatorial Optimization Algorithms and Complexity – C.H. Papadimitriou, E. Steiglitz.

Information Security

Code: MCAPGPC18
Contracts: 3L
Credits: 3

Course Objectives:

- To provide basic knowledge of Information Security System, cryptographic system and Digital Signature and other Security Measures which is available.
- To showcase IP Security Architecture & Transport Layer Security to identify the vulnerability of the Internet systems and recognize the mechanisms of the attacks.
- To get the knowledge of the firewall design principles and various intrusion detection system.
- To aware the knowledge about cyber security
- To aware the knowledge of cloud security
- To aware the basic knowledge of legal and ethical issue of information security.

Course Outcomes:

- CO1: Illustration of the basic knowledge of Network Security and Compare Various Symmetric and Asymmetric Cryptographic methods used for Network Security.

- CO2: illustrate the various Algorithms to be used at various TCP/IP Layers & to operate Digital Signature in Real World Situation

- CO3: Implement Firewall design principles and identify various intrusion detection systems and be able to achieve highest system security
- CO4: illustrate IP Security Architecture &Transport Layer Security to identify the vulnerability of the Internet systems and recognize the mechanisms of the attacks, and apply them to design and evaluate counter-measure tools
- CO5 : illustrate cyber security , cloud security, database security, operating system security and legal and ethical issues of information security.

CO-PSO MAPPING

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PS0 10	PSO 11	PSO 12	PSO1 3
CO1	√		√										
CO2						√							√
CO3		√	√		√								
CO4					√	√	√	√					
CO5					√	√		√					

Module I: (6 hrs)

Cryptography: -Concepts & Techniques Introduction, Plaintext & Cipher text, Attacks on Computers & Computer Security - Introduction, Need for Security, Security approaches, Principles of Security, Types of attack

Module II: (12 hrs)

Symmetric Key Algorithm: - Introduction, DES (Data Encryption Standard) algorithm, IDEA (International Data Encryption Algorithm) algorithm, RC5(Rivest Cipher 5) algorithm.

Asymmetric Key Algorithm, Digital Signature and RSA - Introduction, Overview of Asymmetric key Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required)

Module III: (8 hrs)

Internet Security Protocols, User Authentication - Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication. Electronic Mail Security - Basics of mail security, Pretty Good Privacy, S/MIME Firewall - Introduction, Types of firewall, Firewall Configurations, DMZ Network

Cyber Security- Cyber Security Fundamentals – Attacker techniques and motivation – Malicious Code – Défense and Analysis Techniques – Memory Forensics – Honeypots – Malicious code Naming – Automated code analysis systems – Intrusion Detection System.

Operating Systems Security: Access Control, File Protection, User Authentication, Security Policies, Models of Security

Module IV: (10 hrs)

Cloud Security- Cloud Computing Concepts, Service Models, Deployment Models, moving to the Cloud, Risk Analysis Cloud Provider Assessment, Switching Cloud Providers, Cloud Security Tools and Techniques Data Protection in the Cloud, Cloud Application Security, Cloud Identity Management.

Data base Security: Security requirements, Reliability and integrity, Sensitive data, Inference, multilevel database, proposals for multilevel security.

Legal and Ethical Issues: Protection of data and Information Laws, Employees rights, Software failure, Computer Crime, Privacy, Ethics

Suggested Books and References:

1. Cryptography and Network Security, AtulKahate, Tata McGraw Hill
2. Network Security Essentials:Applications and Standards, William Stallings PEA. 2
3. Modern Cryptography: Theory and Practices, W. Mao, Pearson Ed
4. Computer Forensics, David Cowen
5. The basics of digital forensics: the primer for getting started in digital forensics, J. Sammons.

Compiler Design

Code: MCAPGPC19
Contracts: 3L
Credits: 3

Course Objectives:

- To make the student understand the process involved in a compiler, create an overall view of various types of translators, linkers, loaders, and various phases of a compiler.
- Understand what are lexical and syntax analysis, various types of parsers especially the top down approach, awareness among students the various types of bottom up parsers.
- Understand the semantic analysis and, intermediate code generation, type checking, the role of symbol table and its organization, code generation, machine independent code optimization and instruction scheduling.

Course Outcomes:

CO 1: To illustrate the basic concept of compilers and discuss on the components as well as the purposes of various phases of designing a compiler.

CO 2: To formulate the theories of creating simple compilers using C programming languages and/or various automated tools like LEX, YACC.

CO 3: To explain the roles of finite automata, context free grammars in compiler design.

CO 4: To design and analyze algorithms for syntactic and semantic analysis of the process of designing compilers.

CO 5: Identify the similarities and differences among various parsing techniques and grammar transformation techniques.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√		√		√	√	√	√	√	√	√		√
CO2	√	√	√	√		√				√		√	√
CO3	√	√	√			√							√
CO4	√	√	√	√	√	√							√
CO5	√		√		√	√							√

UNIT I [8L]

Introduction to Compiling [2L]
Compilers, Analysis-synthesis model, The phases of the compiler, Cousins of the compiler.
Lexical Analysis [6L]
The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of tokens, Recognition of tokens, Finite automata, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).

UNIT II [10L]
Syntax Analysis [6L]
The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.
Syntax directed translation [4L]
Syntax directed definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Top-down translation, Bottom-up evaluation of inherited attributes.

UNIT III [8L]
Type checking [3L]
Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions, Overloading of functions and operators.
Run time environments [5L]
Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.

UNIT IV [10L]
Intermediate code generation [3L]
Intermediate languages - Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples), Declarations, Assignment statements, Boolean expressions.
Code generations [4L]
Issues in the design of code generator, The target machine, Run-time storage management, Basic blocks and flow graphs, A simple code generator, Register allocation and assignment, The DAG representation of basic blocks, Peephole optimization.
Code optimization [3L]
Introduction, The principle sources of optimization, Optimization of basic blocks, Loops in flow graphs.

Suggested Books:

1. Aho, Sethi, Ullman: Compiler Principles, Techniques and Tools, Pearson Education.
2. K. V. N. Sunitha: Compiler Construction, Pearson Education
3. O.G. Kakde: Compiler Design, Laxmi Publications
4. Holub: Compiler Design in C, PHI.
5. Tremblay and Sorenson: Compiler Writing, McGrawHill International.
6. Chattopadhyay: Compiler Design, PHI.

Internet and Web Technology

Code: MCAPGPC20
Contracts: 3L
Credits: 3

Course Objectives:

- Get knowledge on HTML, DHTML and web page design.
- Learn about various tags and components of HTML5 documents to create web pages.
- To learn to use JavaScript in Webpages for client side validation.
- To know XML documents and schema and transformation.
- To design dynamic web pages using PHP and JSP.

Course Outcomes:

CO 1: To create dynamic webpage by the use of java script and DHTML.
CO 2: To apply CSS properties to design web pages to make the pages more dynamic.
CO 3: To write a well formed / valid XML document. to store and transport data.
CO 4: To write programs in PHP and JSP.
CO 5: To write a server side java application called JSP to catch form data sent from client and store it on database.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1			√			√						√	√
CO2	√	√	√			√					√		
CO3		√	√			√		√			√		√
CO4		√	√				√	√			√	√	√
CO5		√	√			√		√		√		√	

UNIT I –

Static Web Pages [3L]

HTML: Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout,

Dynamic Web Pages [3L]

The need of dynamic web pages; an overview of DHTML, Cascading Style Sheet (CSS), comparative studies of different technologies of dynamic page creation

Active Web Pages [3L]

Need of active web pages; Java Applets: Container Class, Components, Applet Life Cycle, Update method; Parameter passing Applet, Applications.

UNIT II

Java Script [4L]

Data types, variables, operators, conditional statements, Array object, Date object, String object, Function, Errors, Validation.

Extensible Markup Language (XML) (3L)

Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief.

Cookies & Sessions (3L)
Definition of cookies; Create and Store a cookie with example; Sessions.

UNIT III
Java Servlet [3L]
Servlet environment and role, HTML support, Servlet API, The Servlet life cycle, Servlet Programs.
JSP [10L]
JSP architecture, JSP servers, JSP tags, understanding the layout in JSP, Declaring variables, methods in JSP, inserting java expression in JSP, processing request from user and generating dynamic response for the user, inserting applets and java beans into JSP, using include and forward action, comparing JSP and CGI program, comparing JSP and ASP program; Creating ODBC data source name, introduction to JDBC, prepared statement and callable statement.
PHP & MySQL [4L]
Overview of PHP, Basics web programming using PHP, Introducing MySQL, Database connectivity using PHP.

Suggested Books:

1. Uttam K. Roy: "Web Technologies", Oxford University Press
2. Ivan Bayross, Sharanam Shah, Cynthia Bayross, Vaishali Shah: "Java Server Programming for Professionals", Shroff Publishers and Distributors
3. C. Xavier: "Web Technology and Design", New Age
4. Kogent Learning Solutions Inc.: "Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, ASP.NET, XML and Ajax, Black Book: HTML, Javascript, PHP, Java, Jsp, XML and Ajax, Black Book", Dreamtech Press
5. N.P. Gopalan and J. Akilandeswari: "Web Technology: A Developer's Perspective", PHI.
6. Luke Welling, Laura Thomson: "PHP and MySQL Web Development", Pearson Education
7. Mike McGrath: "PHP and MySQL", McGraw Hill Education
8. Meloni J C: "Sams Teach Yourself PHP MY SQL and Apache", Pearson Education
9. Jain &Siddiqui with NIIT: "J2EE Professional Projects", PHI
10. Uttam K. Roy: "Advanced Java Programming", Oxford University Press

Software Engineering
Code: MCAPGPC21
Contacts: 3L
Credits: 3

Course Objectives:

- To acquire the generic software development skill through various stages of software life cycle.
- To ensure the quality of software through software development with various protocol based environment.
- To generate test cases for software testing.
- To handle software development models through rational method.
- To get the basic concept of Structural Modeling, and UML Notation

Course Outcomes:

CO 1: Identify unique features of various software application domains and classify software applications.
CO 2: Choose and apply appropriate lifecycle model of software development.
CO 3: Describe principles of agile development, discuss the various processes and distinguish agile process model from other process models.
CO 4: Identify user needs and formulate software specifications.
CO 5: Analyze software requirements by applying various modeling techniques.
CO 6: Translate the requirements model into the design model.
CO 7: Describe and demonstrate use of software and user-interface design principles.
CO 8: List and classify CASE tools and discuss recent trends and research in software engineering.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√	√								√			
CO2		√	√										
CO3	√		√										
CO4			√	√		√			√				
CO5		√	√				√				√		
CO6					√	√			√				
CO7							√						
CO8	√											√	√

UNIT I [12 Hrs]
Overview: System Analysis & Design, Business System Concept, System Development Life Cycle, Waterfall Model, Spiral Model, Prototype Model, Feasibility Analysis, Technical Feasibility, Cost-Benefit Analysis, COCOMO model.
System Requirement Specification: DFD, Data Dictionary, ER diagram,
System Design: Problem Partitioning, Top-Down and Bottom-Up design; Decision tree, decision table and structured English; Functional vs. Object- Oriented approach.

UNIT II [12 Hrs]
Coding & Documentation: Structured Programming, OO Programming, Information Hiding, Reuse, System Documentation.
Testing: Levels of Testing, Integration Testing, Test case Specification, Reliability Assessment, Validation & Verification Metrics, Monitoring & Control.

UNIT III[12 Hrs]
Software Project Management: Project Scheduling, Staffing, Software Configuration Management, Quality Assurance, Project Monitoring.
CASE tools**:** Concepts, use and application.
UML diagrams: Fundamentals of Object Oriented design in UML.

References:

- Roger Pressman: "Software Engineering, A practitioner's approach"
- Rajib Mall: "Software Engineering"
- Pankaj Jalote: "Software Engineering"

Elective II

ELECTIVE II- Pattern Recognition
Code: MCAPGPE06
Contacts: 3L
Credits: 3

Course Objectives:

- To learn advanced concepts, issues and approaches to development of pattern recognition and machine intelligence systems.
- To know about various feature extraction techniques, and develop insights into feature fitness, feature selection and dimensionality reduction.
- To understand and apply both supervised and unsupervised approaches to analyze patterns in real-world data.
- To develop prototype pattern recognition systems that can be used to study algorithm behavior and performance against real-world multivariate data.

Course Outcomes:

CO 1: Knowledge about advanced aspects of pattern recognition and approaches to solutions.
CO 2: Ability to analyze different classification and clustering problems of practical relevance and solve using pattern recognition techniques.
CO 3: Knowledge of quantitative performance evaluation methods for pattern recognition algorithms and insights into their significance and scope of applicability.
CO 4: Comparative view of different methods in regard to real-world problems such as document analysis, image classification, etc.
CO 5: Skills for implementation of pattern classifiers, classifier combinations, and structural pattern recognizers.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√	√	√			√		√	√		√	√	√
CO2	√	√	√			√		√		√	√	√	√
CO3	√	√	√	√		√		√		√	√	√	√
CO4	√	√	√	√		√		√		√	√	√	√
CO5	√	√	√	√		√		√	√		√	√	√

UNIT I (4 Hours)

Introduction and Mathematical Preliminaries: Pattern Recognition? Clustering vs. Classification; Applications; Probability: independence of events, conditional and joint probability, Bayes theorem Random Processes: Stationary and non-stationary processes, Expectation, Autocorrelation, Cross-Correlation, spectra; Linear Algebra: Inner product, outer product, inverses, eigen values, eigen vectors, singular values, singular vectors; Vector Spaces, Probability Theory, Estimation Techniques.

UNIT II (8 Hours)

Bayes Decision Theory: Minimum-error-rate classification; Classifiers, Discriminant functions, Decision surfaces; Normal density and discriminant functions;Discrete features.

Parameter Estimation Methods: Maximum-Likelihood estimation:Gaussian case. Maximum a Posteriori estimation. Bayesian estimation: Gaussian case. Sequential Pattern Recognition: Hidden Markov Models (HMMs), Discrete HMMs. Continuous HMMs.

UNIT III (4 Hours)
Dimensionality reduction: Principal component analysis - its relationship to eigen analysis. Fisher discriminant analysis - Generalised eigen analysis. Eigen vectors/Singular vectors as dictionaries. Factor Analysis, Total variability space - a dictionary learning methods.Non negative matrix factorisation - a dictionary learning method.

UNITIV (10 Hours)
Classification: Error Probability, Error Rate, Minimum Distance Classifier, Mahalanobis Distance; K-NN Classifier, Linear Discriminant Functions and Non-Linear Decision Boundaries. Fisher's LDA,Training Set and Test Sets, Standardization and Normalization;
Non-metric methods for pattern classification: Non-numeric data or nominal data. Decision trees: Classification and Regression Trees (CART).
Artificial neural networks: Multilayer perceptron - feedforwark neural network. A brief introduction to deep neural networks, convolutional neural networks, recurrent neural networks.

UNIT V (6Hours)
Clustering: Different Distance Functions and Similarity Measures, Minimum Within Cluster Distance Criterion, K-Means Clustering, Single Linkage and Complete Linkage Clustering, K-Medoids, DBSCAN, Visualization of Datasets, Existence of Unique Clusters or No Clusters.

UNIT VI (4Hours)
Feature Selection: Problem Statement and Uses, Probabilistic Separability based Criterion Functions, Interclass Distance based Criterion Functions, Branch and Bound Algorithm, Sequential Forward/Backward Selection Algorithms, (l,r) Algorithm.
Feature Extraction: PCA, Kernel PCA.

Suggested Books and References:

1. K. Fukunaga, Statistical pattern Recognition, Academic Press, 2000.
2. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.
3. V.S. Devi, M.N. Murty, Pattern Recognition: An Introduction, Universities Press, Hyderabad.
4. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, Wiley, 2000.

ELECTIVE II- Distributed Database Design
Code: MCAPGPE07
Contacts: 3L
Credits: 3

Course Objectives:

- Enhanced the knowledge in the area of Distributed Database system.
- Comprehend the Distributed query processing
- The subject explores the ideas of Transaction management and concurrency control.
- Know the parallel database system architecture.
- Become conscious about current trends.

Course Outcomes:

CO 1: Aware of fundamentals of Distributed Database systems.
CO 2: Use the different techniques of Distributed query processing.
CO 3: Set the rules over management of transaction and concurrency control.
CO 4: Familiar with parallel database system architecture.
CO 5: Expose active and emerging issues in distributed database systems and application development.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√	√		√		√	√			√			√
CO2	√	√	√	√									√
CO3	√	√	√	√									√
CO4	√			√			√			√			√
CO5	√	√		√		√		√			√	√	√

UNIT-1: (4 hours)

INTRODUCTION: Distributed data processing; DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts.

UNIT-2: (6 hours)

ARCHITECTURE & DESIGN: Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues, Alternative design strategies; Distributed design issues; Fragmentation; Data allocation

UNIT-3: (4 hours)

SEMANTICS DATA CONTROL: View management; Data security; Semantic Integrity Control

UNIT-4: (8 hours)

QUERY PROCESSING & OPTIMIZATION: Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data, Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms

UNIT-5: (4 hours)

TRANSACTION MANAGEMENT: The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models

UNIT-6: (4 hours)

CONCURRENCY CONTROL: Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management

UNIT-7: (6 hours)

RELIABILITY: Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols

Suggested Readings:

1. Principles of Distributed Database Systems, M.T. Ozsu and P. Valduriez, Prentice-Hall, 1991. (Required).
2. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992. (Referenced).
3. Additional papers from the literature may be assigned as reading material.

ELECTIVE II- Operations Research
Code: MCAPGPE08
Contacts: 3L
Credits: 3

Course Objectives:

- To understand basic concepts of linear programming, game theory and various models.
- To develop models and then analyze the model using the techniques of Operations Research.
- To grow decision making ability under uncertainty and risk.
- To apply the principles of different Methods/Model of Operations Research to solve practical problems.

Course Outcomes:

CO 1: Understand and formulate linear programming problems and solve them by appropriate techniques and optimization solvers.
CO 2: Interpret the results obtained and translate solutions into directives for action.
CO 3: Achieve expertise in strategy making by solving various games.
CO 4: Develop mathematical skills to analyze and solve integer programming and network models arising from a wide range of applications.
CO 5: Effectively communicate ideas, explain procedures and interpret results and solutions in written and electronic forms to different audiences.
CO 6: Solve a real-world problem and influence for further research in developing prototypes of mathematical problems.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1			√					√					√
CO2	√												
CO3				√									√
CO4	√	√	√							√			√
CO5								√	√				
CO6	√			√			√			√	√		

UNIT-I: [Linear Programming Problems (LPP)] [2 Hrs]
Basic LPP and Applications; Various Components of LP Problem Formulation.

UNIT-II: [Solution of Linear Programming Problems] [8 Hrs]
Solution of LPP: Using Simultaneous Equations and Graphical Method; Definitions: Feasible Solution, Basic and non-basic Variables, Basic Feasible Solution, Degenerate and Non-degenerate

Solution, Convex set and explanation with examples. Solution to LPP by Simplex Method; Charnes' Big-M Method; Duality Theory.

UNIT-III: [Transportation Model and Its Variants] [8 Hrs]
Introduction to Transportation Problems, Balanced and Unbalanced Transportation Problems, Methods for Initial Basic Feasible Solution: North-West Corner Method, Least – Cost Method, Vogel's Approximation Method, Degeneracy, Optimality Test – Modified Distribution (MODI) Method, Maximization in Transportation Problems

Introduction to Assignment Problems, Balanced and Unbalanced Assignment Problems, Hungarian Method, Maximization in Assignment Problems

UNIT-IV: [Game Theory] [4 Hrs]
Introduction; 2-Person Zero-sum Game; Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance.

UNIT-V: [Network Analysis] [5 Hrs]
Shortest Path: Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded).

UNIT-VI: [Inventory Control] [4 Hrs]
Introduction to EOQ Models of Deterministic and Probabilistic; Safety Stock; Buffer Stock.

UNIT-VII: [Queuing Theory] [5 Hrs]
Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems.

Suggested Books:

1. H. A. Taha: ―Operations Research, Pearson.
2. P. M. Karak: ―Linear Programming and Theory of Games, ABS Publishing House.
3. Ghosh and Chakraborty: ― Linear Programming and Theory of Games, Central Book Agency.
4. Ravindran, Philips and Solberg: ― Operations Research, Wiley India.
5. Kanti Swaroop: ―Operations Research, Sultan Chand & Sons.
6. Rathindra P. Sen: —Operations Research: Algorithms and Applications, PHI
7. R. Panneerselvam: — Operations Research, PHI
8. A.M. Natarajan, P. Balasubramani and A. Tamilarasi: — Operations Research, Pearson.
9. M. V. Durga Prasad: — Operations Research, Cengage Learning.
10. J. K. Sharma: — Operations Research, Macmillan Publishing Company.

ELECTIVE II- Wireless Sensor Networks
Code: MCAPGPE09
Contacts: 3L
Credits: 3

Course objectives:

- To introduce the overview of wireless sensor networks (WSNs).
- To define the basic architecture and various communication protocols of WSNs.
- To provide the basic requirement for establishing the infrastructure of WSNs.

- To explain various sensor network platforms and tools for WSNs.

Course Outcomes:

CO 1: To understand the overview of WSNs, challenges and various applications.
CO 2: To understand architecture of WSNs.
CO 3: To identify various protocols in MAC layers and network layers.
CO 4: To understand various topologies, synchronization and localization technique for infrastructure establishment.
CO 5: To design a WSN's platform and recognize various simulator to implement it.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√		√			√							√
CO2	√	√											
CO3	√	√	√										
CO4	√	√	√	√									
CO5	√	√		√									

UNIT I: (12 hours)
Introduction and Overview: Overview of wireless networks, types, infrastructure-based and infrastructure-less, introduction to MANETs (Mobile Ad-hoc Networks), characteristics, reactive and proactive routing protocols with examples, introduction to sensor networks, commonalities and differences with MANETs, constraints and challenges, advantages, applications, enabling technologies for WSNs.

UNIT II: (12 hours)
Architectures: Single-node architecture - hardware components, design constraints, energy consumption of sensor nodes, operating systems and execution environments, examples of sensor nodes, sensor network scenarios, types of sources and sinks – single hop vs. multi hop networks, multiple sources and sinks – mobility, optimization goals and figures of merit, gateway concepts, design principles for WSNs, service interfaces for WSNs.

Communication Protocols : Physical layer and transceiver design considerations, MAC protocols for wireless sensor networks, routing protocols- classification, gossiping, flooding, energy-efficient routing, unicast protocols, multi-path routing, data-centric routing, data aggregation, SPIN, LEACH, Directed-Diffusion, geographic routing.

UNIT III: (12 hours)
Infrastructure Establishment: Topology control, flat network topologies, hierarchical networks by clustering, time synchronization, properties, protocols based on sender-receiver and receiver-receiver synchronization, LTS, TPSN, RBS, HRTS, localization and positioning, properties and approaches, single-hop localization, positioning in multi-hop environment, range based localization algorithms – location services, sensor tasking and control.

Sensor Network Platforms and Tools: Sensor node hardware, Berkeley motes, programming challenges, node-level software platforms, node-level simulators, state-centric programming, Tiny OS, nesC components, NS2 simulator, TOSSIM.

Suggested Readings:

1. Holger Karl & Andreas Willig, ―Protocols and Architectures for Wireless Sensor Networks‖, John Wiley, 2005.

2. Feng Zhao & Leonidas J. Guibas, ―Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

3. KazemSohraby, Daniel Minoli, &TaiebZnati, ―Wireless Sensor Networks- Technology, Protocols, and Applications‖, John Wiley, 2007.

4. Anna Hac, ―Wireless Sensor Network Designs‖, John Wiley, 2003.

5. Thomas Haenselmann, "Sensor Networks", available online for free, 2008.

6. Edgar Callaway, "Wireless Sensor Networks: Architectures and Protocols", Auerbach, 2003.

ELECTIVE II- Bioinformatics
Code: MCAPGPE10
Contacts: 3L
Credits: 3

Course Objectives:

- To give an introduction to the basic practical techniques of bioinformatics.
- Emphasis will be given to the application of bioinformatics and biological databases to problem solving in real research problems.

Course Outcomes:

CO 1: To get introduced to the basic concepts of Bioinformatics and its significance in Biological data analysis.

CO 2: Describe the previous related works, scope and importance of Bioinformatics.

CO 3: Explain different methods and machine learning algorithms to characterize and manage different types of Biological data.

CO 4: Introduce the basic concept of machine learning and classification in different types of Biological Databases.

CO 5: Introduction to the basics of sequence alignment and analysis.

CO 6: Overview of biological macromolecular structures and structure prediction methods.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√	√		√									
CO2		√	√			√							
CO3		√	√	√		√							
CO4	√	√	√	√		√							
CO5			√	√									
CO6							√	√					

UNIT I [12 Hrs]

Background: Why computational biology, biological information, challenges in computational biology.

Sequence Assembly: Fragment assembly, Sequencing by hybridization, Overlap-layout-consensus
Sequence Alignment: Introduction to biological sequences, DNA sequence, dynamic programming methods for global and local alignment, gap penalty functions, heuristics in alignment, BLAST, pairwise sequence alignment, multiple sequence alignment

UNIT II [12 Hrs]:
Biological Database and its Types: Introduction to data types and Source. Population and sample, Classification and Presentation of Data.Quality of data, private and public data sources.General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL). Protein databases (Primary, Composite, and Secondary). Specialized Genome databases: (SGD, TIGR, and ACeDB). Structure databases (CATH, SCOP, and PDBsum)

Phylogenetic Trees: Distance, parsimony, and probabilistic methods of phylogenetic tree construction, models of sequence evolution

UNIT III [12 Hrs]
Clustering approaches to biological datasets: High-throughput technologies, clustering algorithms, evaluation of clusters.

Gene Expression analysis: Representation of patterns and relationship General introduction to Gene expression in prokaryotes and eukaryotes, transcription factors binding sites. SNP, EST, STS. Introduction to Regular Expression, Hierarchies, and Graphical models (including Marcov chain and Bayes notes).Genetic variability and connections to clinical data**.**

Modelling and analysis of biological networks: Biological networks, computational problems in network biology, Bayesian networks, module networks, parameter and structure learning, regression-based network inference, network applications.

Machine Learning algorithms and its usage in modelling biological data.

Suggested Books:

1. JIN XIONG: "Essential Bioinformatics", Cambridge University Press.
2. Joachim Selbig and Stefanie Hartmann: "Introductory Bioinformatics: Fourth Edition",
3. Jonathan Pevsner: "Bioinformatics and Functional Genomics", Wiley- Blackwell.
4. S.C. Rastogi, N Mendiratta, P Rastogi: "Bioinformatics: Methods & Applications", PHI.
5. Stanley I. Letovsky: "Bioinformatics: Databases and Systems", Springer.
6. SorinDraghici: "Bioinformatics Databases: Design, Implementation, and Usage (Chapman & Hall/ CRC Mathematical Biology & Medicine)",
7. Arthur M.Lesk: "Data base annotation in molecular biology, Principles and Practices", Wiley.
8. Tao, Jiang, Ying Xu, Michael Q. Zang: "Current topics in computational molecular biology", Ane Books Pvt. Ltd (2004).

ELECTIVE II- Computer Vision
Code: MCAPGPE11
Contacts: 3L
Credits: 3

Course Objectives:

- To provide an introduction to computer vision, including fundamentals of image formation, camera imaging geometry, feature detection and matching, stereo, motion estimation and tracking, image classification, scene understanding, and deep learning with neural networks.
- Understand the basic methods for applications that include finding known models in images, depth recovery from stereo, camera calibration, image stabilization, automated alignment, tracking, boundary detection, and recognition.

Course Outcomes:

CO 1: Familiarize with both the theoretical and practical aspects of computing with images;
CO 2: Describe the foundation of image formation, measurement, and analysis;
CO 3: Understand the geometric relationships between 2D images and the 3D world;
CO 4: Gain exposure to object and scene recognition and categorization from images;
CO 5: Grasp the principles of state-of-the-art segmentation methodologies; and
CO 6: Develop the practical skills necessary to build computer vision applications.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√		√	√									
CO2	√			√			√		√	√			
CO3		√	√				√	√	√				
CO4						√	√				√	√	√
CO5		√	√						√				
CO6			√		√				√	√	√		√

UNIT I [3 Hrs]

Image formation: Monocular imaging system, Orthographic & Perspective Projection, Camera model and Camera calibration, Binocular imaging systems.

UNIT II [7 Hrs]

Processing & Analysis: Overview of Image Processing System, Image Digitization (Sampling and Quantization), Digital Image, Fundamentals of Color image, Color Models (RGB, YCbCr, HIS), Image File Format, Spatial & Frequency Domain Image analysis (Filtering, Correlation, Convolution), Morphological Image Processing&Morphological Algorithms.

UNIT III [6 Hrs]

Segmentation: Point Detection, Line Detection, Edge Detection **,**Edge Linking and Edge Following by Local Processing, Hough Transform, Thresholding, Region segmentation, Active contours, Split and merge, Mean shift and mode finding, Normalized cuts, Graph cuts and energy-based methods.

UNIT IV [9 Hrs]

Representation & Feature Extraction: Boundary Representation by Chain Codes, Polygonal Approximation, Skeletons Component Labeling and Counting Geometrical, Texture Analysis, Geometric Moments Texture Descriptor, Gray-level Co Occurrence Matrix, some object recognition

methods, Shape correspondence and shape matching, Principal Component analysis, Shape priors for recognition, Texture Description.

UNIT V [5 Hrs]

Motion Structure & Estimation:

Triangulation, Two-frame structure from motion, Factorization, Bundle adjustment, Constrained structure and motion, Translational alignment, Parametric motion, Spline-based motion, Optical flow, Layered motion.

UNIT VI [6 Hrs]

Recognition:
Object detection, Face recognition, Instance recognition, Category recognition, Context and scene understanding, Recognition databases and test sets.

Suggested Books:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2010.
2. Shapiro, L. & Stockman, G., "Computer Vision". Prentice Hall, 2001.
3. D. Forsyth and J. Ponce, "Computer Vision - A modern approach", Prentice Hall.
4. E. Trucco and A. Verri, "Introductory Techniques for 3D Computer Vision", Publisher: Prentice Hall.
5. Haralick R M and Shapiro L G, "Computer & Robot Vision", Vo: I and II Addison Wesley, 1993.
6. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing".
7. B. Chanda and D. Dutta Majumder, "Digital Image Processing and Analysis".
8. The Computer Vision Homepage" (Carnegie Mellon University): http://www-2.cs.cmu.edu/_cil/vision.html.

Web Technology Lab

Code: MCAPGPC22
Contracts: 3P
Credits: 1.5

Course Objectives:

- To acquire knowledge and Skills for creation of Web Site considering both client- and server-side Programming.
- To create Web application using tools and techniques used in industry.
- To be well versed with XML and web services Technologies.
- To be familiarized with open source Frameworks for web development.

Course Outcomes:

CO 1: Design a basic web site using HTML5 and CSS3 to demonstrate responsive web design.
CO 2: Implement dynamic web pages with validation using JavaScript objects by applying different event handling mechanism.
CO 3: Develop simple web application using server side PHP programming and Database Connectivity using MySQL.

CO 4: Build well-formed XML Document and implement Web Service using Java.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√	√	√			√					√	√	√
CO2	√			√	√	√		√			√		
CO3	√	√	√			√			√		√		√
CO4		√	√					√	√	√	√		√

1. Web Page Design using HTML
2. Use of CSS in Designing Web Pages
3. Applet Design
4. Application of JavaScript in Web Page Development
5. Usage of Cookies & XML
6. Server Side Programming through Servlets
7. Application of Java Server Pages in Server Side programming
8. Application of Java Database Connectivity
9. Web design using PHP and MySQL

Suggested Books:

1. Uttam K. Roy: "Web Technologies", Oxford University Press.
2. Ivan Bayross, Sharanam Shah, Cynthia Bayross, Vaishali Shah: "Java Server Programming for Professionals", Shroff Publishers and Distributors.
3. C. Xavier: "Web Technology and Design", New Age.
4. Kogent Learning Solutions Inc.: "Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, ASP.NET, XML and Ajax, Black Book: HTML, Javascript, PHP, Java, Jsp, XML and Ajax, Black Book", Dreamtech Press.

Information Security Lab

Code: MCAPGPC23
Contracts: 3P
Credits: 1.5

Course Objectives:

- To provide deeper understanding into cryptography, its application to network security, threats/vulnerabilities to networks and countermeasures.
- To familiarize symmetric and asymmetric cryptography
- To explain various approaches to Encryption techniques, strengths of Traffic Confidentiality, Message Authentication Codes.
- Implementation of various type of attack,

Course Outcome:

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

1. Identify basic security attacks and services

2. Use symmetric and asymmetric key algorithms for cryptography

3. Make use of Authentication functions

4. use the Intrusion detection system for the defending the attacks.

CO-PO AND CO-PSO MAPPING

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PS0 10	PSO 11	PSO 12	PSO1 3
CO1	√		√										
CO2		√	√			√							
CO3						√							√
CO4					√	√							√

LIST OF EXPERIMENTS:

Lab 1: Implementation of various type of Ciphers (Caesar Cipher, Play fair Cipher, Transposition Cipher, Hill Cipher etc)

Lab 2: Implement DES Encryption and Decryption

Lab 3: Implement the AES Encryption and decryption

Lab 4: Implement RSA Encryption Algorithm

Lab 5: Implementation of Hash Functions

Lab 6. Study of Network Security fundamentals - Ethical Hacking, Social Engineering practices.

Lab 7. Study of System threat attacks - Denial of Services.

Lab 8. Study of Sniffing and Spoofing attacks.

Lab 9. Study of Techniques uses for Web Based Password Capturing.

Lab 10. Study of Different attacks causes by Virus and Trojans.

Lab 11. Study of Anti-Intrusion Technique – Honey pot.

Lab 12. Study of Symmetric Encryption Scheme – RC4.

Lab 13. Study of IP based Authentication

Suggested Books and References:

1. Cryptography and Network Security, AtulKahate, Tata McGraw Hill
2. Network Security Essentials: Applications and Standards, William Stallings PEA. 2
3. Modern Cryptography: Theory and Practices, W. Mao, Pearson Ed
4. Computer Forensics, David Cowen
5. The basics of digital forensics: the primer for getting started in digital forensics, J. Sammons.

----------END OF SEMESTER III----------

SEMESTER-IV

Industrial Ethics and Values
Code: MBAUGHU05
Contracts: 3L
Credits: 3

UNIT-I (12 hours)

Values – Importance, Sources of Value Systems, Types, Values, Loyalty and Ethical Behaviour, Values across Cultures.

2. Industrial Ethics – Nature, Characteristics and Needs, Ethical Practices in Management.

3. Indian Values and Ethics – Respect for Elders, Hierarchy and Status, Need for Security, Non – Violence, Cooperation, Simple Living high Thinking, Rights and Duties, Ethics in Work life, Holistic relationship between Man and Nature, Attitudes and Beliefs.

UNIT-II (12 hours)

4. The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes.

5. Culture and Ethics – Ethical Values in different Cultures, Culture and Individual Ethics.

UNIT-III (12 hours)

6. Law and Ethics – Relationship between Law and Ethics, Other Bodies in enforcing Ethical Business Behavior, Impact of Laws on Business Ethics.

7. Social Responsibilities of Business – Environmental Protection, Fair Trade Practices, Fulfilling all National obligations under various Laws, Safeguarding Health and well being of Customers.

8. Ethics and Corporate Excellence – Code of Ethics in Business Houses, Strategies of Organizational Culture Building, Total Quality, Customer Care, Care of the Employees as per Statutes, Objective and Optimistic Approach.

Suggested Books:

1. S. K. Chakraborty : Values and Ethics in Organisation, OUP
2. R. Roj : A study in Business Ethics, Himalaya Publishing.
3. A. N. Tripathi : Human Values, New Age International
4. L. T. Hosmer : The Ethics of Management, Universal Book.
5. D. Murray : Ethics in Organizational, Kogan Page.

Elective III

ELECTIVE III- E-Commerce and ERP
Code: MCAPGPE12
Contacts: 3L
Credits: 3

Course Objectives:

- To understand strategic IT planning for industries.
- To develop enterprise IT architecture for Information technology solutions for ERP.
- To discuss legal issues and privacy in E-Commerce.
- To develop competence in global sourcing: strategy and management to gain a perspective on the global services sourcing landscape: past, present, and future

Course Outcomes:

CO 1: Demonstrate an understanding of the foundations and importance of E-commerce.
CO 2: Identify strategic IT planning for software development.
CO 3: Recognize enterprise IT architecture for ERP.
CO 4: Create, modify, enhance and publish a simple e-commerce web site.
CO 5: Illustrate various services for planning, implementation and managing ERP projects,
CO 6: Analyze e-commerce business needs and resources and match to technology considering human factors and budget constraints.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1					√				√				
CO2				√					√				
CO3			√			√							
CO4	√	√						√				√	
CO5				√							√		
CO6				√			√	√		√			
CO7					√				√				

UNIT I: [12 Hrs]

E – Commerce

Electronic Commerce : Overview, Definitions, Advantages & Disadvantages of E – Commerce, Threats of E – Commerce, Managerial Prospective, Rules & Regulations For Controlling E – Commerce, Cyber Laws.

Technologies : Relationship Between E – Commerce & Networking, Different Types of Networking For E – Commerce, Internet, Intranet & Extranet, EDI Systems

Wireless Application Protocol : Definition, Hand Held Devices, Mobility & Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement For E – Commerce.

Business Models of e – commerce : Model Based On Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance.

E – strategy: Overview, Strategic Methods for developing E – commerce.

Four C's : (Convergence, Collaborative Computing, Content Management & Call Center).

Convergence: Technological Advances in Convergence – Types, Convergence and its implications, Convergence & Electronic Commerce.

Collaborative Computing : Collaborative product development, contract as per CAD, Simultaneous Collaboration, Security.

UNIT II : [12 Hrs]

Content Management : Definition of content, Authoring Tools & Content Management, Content – partnership, repositories, convergence, providers, Web Traffic & Traffic Management; Content Marketing.

Call Center : Definition, Need, Tasks Handled, Mode of Operation, Equipment , Strength & Weaknesses of Call Center, Customer Premises Equipment (CPE).

Supply Chain Management : E – logistics, Supply Chain Portal, Supply Chain Planning Tools (SCP Tools), Supply Chain Execution (SCE), SCE - Framework, Internet's effect on Supply Chain Power.

E – Payment Mechanism : Payment through card system, E – Cheque, E – Cash, E – Payment Threats & Protections. E – Marketing:. Home –shopping, E-Marketing, Tele-marketing

Electronic Data Interchange (EDI) : Meaning, Benefits, Concepts, Application, EDI Model, Protocols (UN EDI FACT / GTDI, ANSI X – 12), Data Encryption (DES / RSA).

Risk of E – Commerce : Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures.

UNIT III [12 Hrs]

Introduction to ERP: Common ERP myths, Evolution of ERP, Advantages, Characteristics, Process integration with ERP system, Implementation costs, Roadmap for successful ERP implementation.

ERP Market and Vendors: ERP market, ERP vendors, Service oriented architecture, ERP package features.

Extended ERP services: Defining Extended ERP, Supply chain Management (SCM) and ERP, ERP and Business Intelligence (BI), ERP and E-commerce.

Business Process Re-engineering (BPR) and ERP: Defining BPR, BPR Vs TQM, BPR and change management, approaches in BPR implementation, Methodologies for BPR implementation, BPR success/failure factors.

Planning for ERP: Planning for ERP implementation, understanding organizational requirement, Economic and strategic justification, Project scope, Determining resources, organizational commitment to change, budget for ERP, select right ERP package.

Implementation of ERP: Designs of ERP system, ERP implementation approach, ERP implementation life cycle, different phases of ERP implementation

Managing ERP projects: Risk/Failure factors in ERP implementation, Example of ERP failure, Critical success factors, Complexities of ERP projects, Evaluating ERP projects.

ERP: Going Live and post implementation: Preparing to go live, Strategies for migration to new ERP system, Managing ERP after Go Live, Maintenance of ERP system.

ERP, Internet and WWW – ERP II: The internet explosion, ERP, Internet and WWW, ERP to ERP II, Best practices of ERP II.

Future directions and Trends in ERP: New markets, New channels, Easier communication tools, Business models, Need based applications, Expenditures, Reduction in implementation time, Market snap shots, Shifting revenue models

Suggested Books:

1. David Whitley:"E-Commerce-Strategy, Technologies & Applications", TMH.
2. Kamlesh K. Bajaj:"E-Commerce- The cutting edge of business", TMH.
3. W Clarke: "E-Commerce through ASP", BPB.
4. Mathew Reynolds, Wrox:"Beginning E-Commerce with VB, ASP, SQL Server 7.0 & MTS",WROX Press Ltd.
5. J. Christopher Westland and Theodore H. K Clark:"Global Electronic Commerce- Theory and Case Studies", University Press.
6. Enterprise Resource Planning, Ashim Raj Singla, Cengage Learning India Pvt. Ltd., New Delhi, 2008.
7. Alexis Leon: "Enterprise Resource Planning", 2nd edition, Tata Mcgraw Hill Education Pvt. Ltd., NewDelhi, 2008.
8. Grant Norris, James R. Hurley, Kenneth M.Hartley, John R. Dunleavy, John D. Balls: "E-Business and ERP: Transforming the Enterprise",John Wiley and Sons, 2000.
9. V.K. Garg: "Enterprise Resource Planning: Concepts and Practice", Wiley.

ELECTIVE III- Natural Language Processing
Code: MCAPGPE13
Contacts: 3L
Credits: 3

Course Objectives:

- Student should understand the theoretical concepts of natural language processing in Linguistics and Formal Language theory
- Enable students to be capable to syntactic, semantic and pragmatic processing of Natural Languages
- Student should be able to analyze NLP models and algorithms using both the traditional and the statistical approaches

Prerequisites: Basics of Probability and Statistics

Course Outcome:

CO 1: Understanding fundamentals of syntax, semantics and rules in NLP and Automata Theory
CO 2: Mastering Text Processing Operations
CO 3: Learning Language modeling techniques
CO 4: Understanding Information Retrieval Techniques
CO 5: Ability to Perform Text Classification using Machine Learning
CO 6: Understanding Context Free Grammars and Probabilistic Context Free Grammars

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√	√	√	√									
CO2			√	√		√					√		
CO3		√	√										√
CO4		√				√					√		√
CO5		√	√	√				√					
CO6	√	√	√										
CO7	√	√	√	√									

UNIT I. REGULAR EXPRESSIONS AND AUTOMATA (2L)
Introduction to NLP, Regular Expression, Finite State Automata

UNIT II. BASIC TEXT PROCESSING (6L)
Word Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition,Multi Word Extraction, Spell Checking – Bayesian Approach, Minimum Edit Distance; Morphology – Inflectional and Derivational Morphology, Finite State MorphologicalParsing, The Lexicon and Morphotactics, Morphological Parsing with Finite StateTransducers, Orthographic Rules and Finite State Transducers, Porter Stemmer

UNIT III. LANGUAGE MODELING (8L)
Introduction to N-grams, Chain Rule, Smoothing – Add-One Smoothing, Witten-BellDiscounting; Backoff, Deleted Interpolation, N-grams for Spelling and Word Prediction, Evaluation of language models; Markov Chain, Hidden Markov Models, Forward Algorithm, Viterbi Algorithm, Part of Speech Tagging – Rule based and Machine Learning based approaches, Evaluation

UNIT IV. TEXT CLASSIFICATION (6L)
Text Classification, Naïve Bayes' Text Classification, Evaluation, Sentiment Analysis –Opinion Mining and Emotion Analysis, Resources and Techniques

UNIT V. CFG AND LEXICAL SEMANTICS (6L)

Context Free Grammar and Constituency, Some common CFG phenomena for English,Top-Down and Bottom-up parsing, Probabilistic Context Free Grammar, DependencyParsing; Introduction to Lexical Semantics – Homonymy, Polysemy, Synonymy, Thesaurus –WordNet, Computational Lexical Semantics – Thesaurus based and Distributional WordSimilarity

UNIT VI. INFORMATION RETRIEVAL (8L)

Boolean Retrieval, Term-document incidence, The Inverted Index, Query Optimization,Phrase Queries, Ranked Retrieval – Term Frequency – Inverse Document Frequencybased ranking, Zone Indexing, Query term proximity, Cosine ranking, Combiningdifferent features for ranking, Search Engine Evaluation, Relevance Feedback

Reference Books

1. Jurafsky and Martin: Speech and Language Processing, Pearson Education.
2. Manning and Schutze: Foundation of Statistical Natural Language Processing, MIT.

ELECTIVE III- Advanced Java Programming
Code: MCAPGPE14
Contacts: 3L
Credits: 3

Course Objectives:

- To understand the features and basic concepts of Object Oriented Programming.
- To be familiar with the features of JDBC.
- To understand the concepts of all the event handling methods as well as the AWT class.
- To understand the basic concepts of Java Server Pages and network programming.
- To understand the concepts of generating a client's request and tracking a userusing Java servlet.

Course Outcomes:

CO 1: Demonstrate terms and concepts of Object Oriented Programming.
CO 2: Create an application and connect it with databases.
CO 3: Create an application using AWT class and the event handling methods.
CO 4: To be able to demonstrate the concepts of Java Server Pages and network programming.
CO 5: Demonstrate the concepts of Java servlet and how to generate a client request as well as tracking it.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1									√	√	√	√	
CO2		√	√			√							
CO3	√	√	√			√							
CO4	√				√		√	√	√				
CO5	√			√					√				√

Introduction (6 Hours)

Basic Concepts in Java: Objects, Classes, Encapsulation, Inheritance, Polymorphism, Packages, Access Protection, interfaces, Arrays, String Handling, Exception Handling, Multithreading, Applets.

Networking (6 Hours)

Networking Basics, Introduction of Socket, Types of Socket, Socket API, TCP/IP client sockets, URL, TCP/IP server sockets, Datagrams, java.net package Socket, ServerSocket, InetAddress, URL, URLConnection, RMI Architecture, Client Server Application using RMI.

JDBC Programming (6 Hours)

JDBC Architecture, Types of JDBC Drivers, Introduction to major JDBC Classes and Interface, Creating simple JDBC Application, Types of Statement (Statement Interface, PreparedStatement, CallableStatement), Exploring ResultSet Operations, Batch Updates in JDBC.

Java Server Pages (6 Hours)

Introduction to JSP , Comparison with Servlet, JSP Architecture, JSP Life Cycle, JSP Scripting Elements, JSP Directives, JSP Action, JSP Implicit Objects.

Java Servlet (5 Hours)

Servlet as an improved CGI, Servlet Fundamentals / API, What is a Web-Container, Servlet Life Cycle / Architecture, HTTP GET and POST Request Method, Processing Html Forms, What is Name-Value pair, Content Types and MIME.

Event Handling (7 Hrs)
Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes. The AWT class hierarchy, user interface components- labels, button, canvas, scrollbars, text components, check box, check box groups, choices, lists panels – scroll pane, dialogs, menu bar, graphics, layout manager – layout manager types – border, grid, flow, card and grid bag.

Suggested Books:

1. E Balagurusamy: ―Programming with Java‖, McGraw Hill Education.
2. Herbert Schildt:―Java: The Complete Reference,McGraw Hill Education.
3. Sachin Malhotra and SaurabhChoudhary:―Programming in Java, Oxford University Press.
4. Y. Daniel Liang:―Introduction to Java Programming, Brief Version, Pearson Education.
5. Y. Daniel Liang:―Introduction to Java Programming, Comprehensive Version‖, Pearson Education.
6. Cay S. Horstmann: ―Core Java - Vol. I, Vol. II and Vol. II, Pearson Education.
7. Paul J. Deitel and H. Deitel: ―Java 9 for Programmers, Pearson Education India.
8. Harold Elliotte Rusty: ―Java Network Programming, Shroff Publishers & Distributers.
9. George Reese: ―Java Database Best Practices: Persistence Models and Techniques for Java Database Programming, O'Reilly.
10. Uttam K. Roy: ―Advanced Java Programming, Oxford University Press.

ELECTIVE III- Embedded Systems
Code: MCAPGPE15
Contacts: 3L
Credits: 3

Course Objectives:

- Understand Hardware and Software requirements in Embedded systems.
- Analyze the embedded systems' specification and develop software programs.
- Evaluate the requirements of programming Embedded systems, related software architectures and tool chain for Embedded systems.

Course Outcomes:

CO 1: Ability to understand the evolution of Embedded System.
CO 2: Ability to learn the architecture of components of Embedded systems.
CO 3: Foster the ability to program microcontroller.
CO 4: Foster the ability to understand the role of embedded system in Industry.
CO 5: Understand the internal architecture and interfacing of peripheral devices with microcontrollers.
CO 6: Familiarity with the functioning of time bound Operating Systems.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√	√	√					√				√	
CO2		√	√	√							√	√	√
CO3	√		√			√					√		
CO4		√		√		√		√				√	√
CO5	√	√	√								√	√	
CO6	√			√		√					√		√

UNIT -I: [6 Hrs]

Introduction to Embedded Systems:
Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT -II: [8 Hrs]

Typical Embedded System:
Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT -III: [5 Hrs]

Embedded Firmware:
Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT -IV: [6 Hrs]

RTOS Based Embedded System Design:
Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

UNIT -V: [5 Hrs]

Task Communication:
Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

UNIT –VI: [6 Hrs]

8051, AVR, PIC, ARM Microcontroller Interfacings with:
LEDs and LCD, DC Motor and Stepper Motor, Switches and Relays , HEX Keypad, ADC CENTRE

Suggested Books:

1. Shibu K.V: "Introduction to Embedded Systems", McGraw Hill.
2. Raj Kamal: "Embedded Systems", TMH.
3. Frank Vahid, Tony Givargis,: "Embedded System Design", Wiley.
4. Lyla: "Embedded Systems", Pearson, 2013.
5. David E. Simon: "An Embedded Software Primer", Pearson Education.

ELECTIVE III- Distributed & Cloud Computing
Code: MCAPGPE16
Contacts: 3L
Credits: 3

Course Objectives:

- Understand the basics of cloud computing, cloud deployment model, service models
- Study the key concepts of virtualization.
- Explain different Cloud Computing services
- Define cloud implementation, programming and Mobile cloud computing.
- Explain key components of Amazon Web Services, Google Web Services, Microsoft Web Services

Course Outcomes:

CO 1: Learn about cloud computing and memorize the different cloud service and deployment models.

CO 2: Knowledge about importance of virtualization along with their technologies.

CO 3: Use and Examine different cloud computing services –IaaS, Paas, SaaS.

CO 4: Analyze the components of open stack & Google Cloud platform and understand Mobile Cloud Computing.

CO 5: Understanding of the key components of Amazon web Service, Google Web Services, Microsoft Web Services.

CO-PSO mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1		√	√	√									
CO2	√	√	√	√		√							
CO3	√	√		√									
CO4	√	√		√		√	√	√					
CO5		√	√	√		√							√

UNIT I (12 hours)

Definition of Cloud Computing: Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public, Private, Hybrid and Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ service providers, Cloud Reference model Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing

Cloud Architecture: A brief introduction, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients

Services and Applications by Type:

IaaS– Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos

PaaS– Basic concept, tools and development environment with examples

SaaS- Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform

UNIT II (12 hours)

Concepts of Abstraction and Virtualization: Virtualization technologies: Types of virtualization (access, application, CPU, storage), Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Hypervisors: Virtual machine technology

Use of Google Web Services

Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service.

Use of Amazon Web Services: Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store, Amazon SimpleDB and Relational Database Service

Use of Microsoft Cloud Services: Windows Azure platform: Microsoft‘s approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services

UNIT III (12 hours)

Cloud Infrastructure:

Types of services required in implementation – Consulting, Configuration, Customization and Support

Cloud Management

An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle)

Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs**Applications in the Cloud:** Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service, attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs **Cloud-based Storage:** Cloud storage definition – Manned and Unmanned

Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services

References:

1. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013
2. Mastering Cloud Computing by RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, McGraw Hill Education (India) Private Limited, 2013
3. Cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill
4. Cloud Computing, Miller, Pearson
5. Building applications in cloud: Concept, Patterns and Projects, Moyer, Pearson

ELECTIVE III- Big Data Analytics
Code: MCAPGPE17
Contacts: 3L
Credits: 3

Course Objectives:

- To enable the student to understand basic Big Data concepts.

- To learn to detect and diagnose common data issues, such as missing values, special values, outliers, inconsistencies, and localization.
- To make aware of how to address advanced statistical situations
- To understand regression and clustering.
- To understand feature generation and feature selection

Course Outcomes:

CO 1: Students should be able to understand the problem.
CO 2: Able to comprehend the problem.
CO 3: Able to define suitable statistical model to be adopted.
CO 4: Able to apply different Big Data Analysis Techniques using Hadoop and MapReduce.
CO 5: Able to generate features and select features from meaningful data.
CO 6: Understand different case studies.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1		√	√		√	√			√	√			
CO2		√	√	√	√		√					√	
CO3		√		√	√			√				√	
CO4		√	√		√					√		√	
CO5	√	√		√					√		√		√
CO6		√			√	√		√					√

Unit I. Data Definitions and Analysis Techniques [6 hrs]
Elements, Variables, and Data categorization; Levels of Measurement; Data management and indexing; Introduction to statistical learning and R-Programming

Unit II. Descriptive Statistics and Basic AnalysisTechniques [8 Hrs]
Measures of central tendency; Measures of location of dispersions; Practice and analysis with R; Statistical hypothesis generation and testing; Chi-Square test; t-Test; Analysis of variance; Correlation analysis; Maximum likelihood test; Practice and analysis with R

Unit III. Data Analysis Techniques [10 Hrs]
Relation analysis; Regression analysis; Classification techniques; Clustering; Association rules analysis; Practice and analysis with R

Unit IV. Big Data Processing [8 Hrs]
Big data concepts; Introduction to Hadoop; Hadoop Distributed File System; Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Typesand Formats, Map Reduce Features; HadoopEcoSystem

Unit V. Case Studies and Projects [4 Hrs]
Understanding business scenarios; Feature engineering and visualization; Scalable and parallel computing with Hadoop and Map-Reduce; Sensitivity Analysis

Suggested Books:

1. Joel Grus: “Data Science from Scratch”, O’Reilly Publisher.

2. R. Myers and R. Walpole: “Probability and Statistics for Engineers and Scientists”, Pearson.
3. SeemaAcharya and SubhasiniChellappan: “Big Data Analytics”, Wiley Publisher.
4. Tom White: “Hadoop: The Definitive Guide”, O’Reilly Publisher.

Elective IV

ELECTIVE IV- Internet of Things
Code: MCAPGPE18
Contacts: 3L
Credits: 3

Course Objectives:

- To explore the interconnection and integration of the physical world and the cyberspace.
- To understand building blocks of Internet of Things and its characteristics.
- To design and develop IoT Device.

Course Outcomes:

CO 1: To analyze basic protocols in wireless sensor network.
CO 2: To understand the concepts of Internet of Things.
CO 3: To recognize the M2M communication protocols.
CO 4: To design IoT applications in different domain on embedded platform and be able to analyze their performance.
CO 5: Compare and Contrast the use of Devices, Gateways and Data Management in IoT.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√		√										
CO2		√		√					√				
CO3	√		√		√						√		
CO4						√	√	√				√	√
CO5						√			√				

UNIT I: [12 Hrs]
Introduction to IoT: Sensing, Actuation, Basics of Networking.
Basics of Networking, Communication Protocols, Sensor Networks.
Machine-to-Machine Communications

UNIT II: [12 Hrs]
Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.

Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi.

Cloud Computing.

UNIT III: [12 Hrs]
Fog Computing, Smart Cities and Smart Homes.
Connected Vehicles, Smart Grid, Industrial IoT.
Case Study: Agriculture, Healthcare, Activity Monitoring.

Suggested Books:

1. Pethuru Raj and Anupama C. Raman: "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press.
2. ArshdeepBahga and Vijay Madisetti: "Internet of Things: A Hands-on Approach", Universities Press.

ELECTIVE IV- GIS and Remote Sensing
Code: MCAPGPE19
Contacts: 3L
Credits: 3

Course Objectives:

- To provide background knowledge and understanding of principles of RS, RS Sensors and systems;
- To develop technical skills and competence in data and information acquisition, extraction, management and analysis; spatial and statistical modeling; mapping and visualization.
- To enable spatial and temporal thinking to relate remote sensing for real-world applications.
- To introduce the students to the state-of-the-art concepts and experience of hands-on practices of remote sensing and GIS.

Course Outcomes:

CO 1: Understand concepts of retrieval of information from remote data.
CO 2: Analyze the energy interactions in the atmosphere and earth surface features.
CO 3: Compare different images on the basis of thematic maps.
CO 4: Apply problem specific remote sensing data for engineering applications.
CO 5: Analyze spatial and attribute data for solving spatial problems.
CO 6: Generate comprehensive understanding of the application of remote sensing and GIS in solving the research problems.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√			√									
CO2	√		√					√					
CO3				√			√	√					
CO4		√	√								√	√	
CO5		√						√					
CO6			√				√		√	√			√

UNIT I [12 Hrs]

Fundamentals of remote sensing; Principles of electromagnetic radiation and EM spectrum.Sensors and platforms; remote sensing satellites, multispectral, hyper spectral and thermal sensors; RS data acquisition systems.Image processing; Image enhancement and visualization; Image interpretation and classification.Microwave thermal remote sensing; Radar & laser altimetry.

UNIT II [12 Hrs]

Applications of Remote Sensing; Integration of remote sensing and GIS.Basic concepts of GIS; cartographic principles, map projections and coordinate systems.Geographic information and spatial data types; Hardware and software; Steps of spatial data handling; Database management systems; Spatial referencing.

UNIT III [12 Hrs]

Data quality, measures of location errors on maps. Spatial data input, data preparation; Point data transformation.Analytical GIS capabilities, retrieval and classification, overlay functions.
Neighbourhood operations, network analysis, error propagation; Data visualization.

Suggested Books:

1. Burrough PA: "Principles of Geographic Information System for Land Resources Assessment", Oxford Univ. Press.
2. Curran PJ: "Principles of Remote Sensing", Longman.
3. Jensen JR: "Introductory Digital Image Processing", Prentice Hall.
4. Lillesand TM & Kiefer RW: "Remote Sensing and Image", Wiley.

Data Warehouse and Data Mining

Code: MCAPGPE20
Contracts: 3L
Credits: 3

Course Objectives:

- To identify the scope and essentiality of Data Warehousing and Mining.
- To analyze data, choose relevant models and algorithms for respective applications.
- To study spatial and web data mining.
- To develop research interest towards advances in data mining.

Course Outcome:

CO 1: To understand the fundamental concept of Data Mining and Data Warehouse.
CO 2: Design data warehouse with dimensional modelling and apply OLAP operations.
CO 3: Identify different data mining algorithms to solve real world problems.
CO 4: Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining.
CO 5: Describe complex data types with respect to spatial and web mining.
CO 6: Benefit the user experiences towards research and innovation. integration.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√	√		√									
CO2		√	√	√									
CO3		√	√	√		√							
CO4		√		√		√							
CO5			√	√									
CO6						√	√						

UNIT I (12 hours)

Introduction to Data Mining

Overview, Motivation (for Data Mining), Data Mining-Definition & Functionalities,
Data Processing, Form of Data Preprocessing, Data Cleaning: Missing Values, Noisy Data, (Binning, Clustering, Regression, Computer and Human inspection), Inconsistent Data, Data Integration and Transformation. Data Reduction:-Data Cube Aggregation, Dimensionality reduction

Association Rule Mining:

Mining Association Rules in Large Databases, Association rule mining, mining Single-Dimensional Boolean Association rules from Transactional Databases– Apriori Algorithm, Mining Multilevel Association rules from Transaction Databases and Mining Multi Dimensional Association rules from Relational Databases.

UNIT II (12 hours)

Classification and Predictions:

What is Classification & Prediction, Issues regarding Classification and prediction, Decision tree, Bayesian Classification, Classification by Back propagation, Multilayer feed-forward Neural Network, Back propagation Algorithm, Classification methods K-nearest neighbour classifiers, Genetic Algorithm.

Dimensionality Reduction

Introduction Principal Components Analysis, Singular Value Decomposition, Multidimensional Scaling

UNIT III (12 hours)

Cluster Analysis:

Data types in cluster analysis, Categories of clustering methods, Partitioning methods.
Hierarchical Clustering- CURE and Chameleon, Density Based Methods-DBSCAN, OPTICS,
Grid Based Methods- STING, CLIQUE, Model Based Method –Statistical Approach, Neural Network approach, Outlier Analysis

Data Warehousing:

Overview, Definition, Delivery Process, Difference between Database System and Data Warehouse, Multi Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept hierarchy, Process Architecture, 3 Tier Architecture, Data Marting.

Aggregation, Historical information, Query Facility, OLAP function and Tools.OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse.

Suggested Books:

1. P. Tan, M. Steinbach and V. Kumar: Introduction to Data Mining, Addison Wesley, 2006.
2. J. Han and M. Kamber: Data Mining: Concepts and Techniques, 2nd Edition, Morgan Kaufmann, 2006.
3. Arun K. Pujari: Data Mining Techniques, Universities Press.

ELECTIVE IV- Parallel Computing Techniques
Code: MCAPGPE21
Contacts: 3L
Credits: 3

Course Objectives:

The objective is to familiarize students with the fundamental concepts, techniques and tools of parallel computing. Participation in this course will enable you to better use parallel computing in your application area, and will prepare you to take advanced courses in more specific areas of parallel computing.

Course Outcomes:

1. To get introduced to the basic concepts of parallel computing.
2. Describe the history, scope and importance of parallel computing
3. Explain about the methods to characterize and manage the different types parallel computers.
4. Classify different types of scheduling.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1				√				√					
CO2				√	√	√			√			√	
CO3	√	√	√	√	√	√			√	√		√	√
CO4	√	√		√									

Module 1: (3L)

Introduction: Parallel Processing–Shared Memory Multiprocessing–Distributed Shared Memory–Message Passing Parallel Computers.

Processes & Shared Memory Programming: Processes-Shared Memory Programming–General Model Of Shared Memory Programming–Forking-Creating Processes–Joining Processes-Process Model Under UNIX.

Module 2: (14L)

Basic Parallel Programming Techniques: Loop Splitting–Ideal Speedup–Spin-Locks, Contention And Self-Scheduling. statistics of local alignments, Multiple sequence alignment: Definition, scoring, techniques, Aligners for proteins sequences, Spliced alignment.

Scheduling: Loop Scheduling–Variations On Loop Scheduling–Self-Scheduling–Variations On Self-Scheduling–Indirect Scheduling–Block Scheduling.

Barriers And Race Conditions The Barrier Calls–Expression Splitting.

Module 3: (19L)

Thread-BasedImplementation:ThreadManagement–ThePOSIXThreadApplication ProgrammerInterface-SynchronizationPrimitivesinPOSIX-ExampleWithThreads–Attributes Of Threads–Mutual Exclusion With Threads–MutexUsageOfThreads–Thread Implementation–EventsAnd condition Variables–Deviation Computation With Threads–JavaThreads.Comparative genomics: gene regulation, gene finding, genome rearrangements.

ProgrammingUsingtheMessagePassingParadigmPrinciplesofMessage-PassingProgramming.TheBuildingBlocks:SendandReceiveOperations.MPI:TheMessagePassingInterface.Topologiesand Embedding.OverlappingCommunicationwithComputation.CollectiveCommunicationandComputation Operations.

Algorithms For Parallel Machines: Models Of Computation–Analysis Of ParallelAlgorithms–PrefixComputation–Histogram Computation–Parallel Reduction–SortingNetworks-Matrix Multiplication

Suggested Readings:

1. Introduction To Parallel Programming-By Steven Brawer.
2. IntroductiontoParallelComputing,AnanthGrama,AnshulGupta,GeorgeKarypis,VipinKumar,ByPearson Publication.
3. Introduction To Parallel Processing–By M.Sasikumar, Dinesh ShikhareAnd P.Ravi Prakash

ELECTIVE IV- VLSI Design
Code: MCAPGPE22
Contacts: 3L
Credits: 3

Course objectives:

- To introduce the concepts and techniques of modern integrated circuit design and testing (CMOS VLSI).
- Be able to design static CMOS combinational and sequential logic at the transistor level, including mask layout.
- Describe the general steps required for processing of CMOS integrated circuits.
- Estimate and optimize combinational circuit delay using RC delay models and logical effort.
- Estimate and optimize interconnect delay and noise.
- Design for higher performance or lower area using alternative circuit families

- Describe and avoid common CMOS circuit pitfalls and reliability problems
- Compare the tradeoffs of sequencing elements including flip-flops, transparent latches, and pulsed latches
- Design functional units including adders, multipliers, ROMs, SRAMs, and PLAs

Course Outcomes :

Students undergoing this course are expected to:
CO1: Express the Layout of simple MOS circuit using Lambda based design rules.
CO2: Apply the Lambda based design rules for subsystem design
CO3: Be able to use mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits, including logic components and their interconnection.
CO4: Be able to create models of moderately sized CMOS circuits that realize specified digital functions.
CO5: Be able to apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect, and to verify the functionality, timing, power, and effects.
CO6: Have an understanding of the characteristics of CMOS circuit construction and the comparison between different state-of-the-art CMOS technologies and processes.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√			√		√			√				
CO2	√		√	√					√				
CO3	√	√	√			√				√	√	√	
CO4			√		√	√		√		√		√	√
CO5	√	√	√							√	√	√	√
CO6	√			√	√							√	

UNIT I MOS transistor principle (7 hrs)
NMOS and PMOS transistors, Process parameters for MOS and CMOS, Electrical properties of CMOS circuits and device modeling, Scaling principles and fundamental limits, CMOS inverter scaling, propagation delays, Stick diagram, Layout diagrams

UNIT II Combinational logic circuits (7 hrs)
Examples of Combinational Logic Design, Elmore‟s constant, Pass transistor Logic, Transmission gates, static and dynamic CMOS design, Power dissipation – Low power design principles

UNIT III Sequential logic circuits (7 hrs)
Static and Dynamic Latches and Registers, Timing issues, pipelines, clock strategies, Memory architecture and memory control circuits, Low power memory circuits, Synchronous and Asynchronous design

UNIT IV Designing arithmetic building blocks (7 hrs)
Data path circuits, Architectures for ripple carry adders, carry look ahead adders, High speed adders, accumulators, Multipliers, dividers, Barrel shifters, speed and area tradeoff

UNIT V Implementation strategies (8 hrs)

Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures.

Text Book

- Jan Rabaey, AnanthaChandrakasan, B.Nikolic, "Digital Integrated Circuits: A Design Perspective", Second Edition, Prentice Hall of India, 2003.
- M.J. Smith, "Application Specific Integrated Circuits", Addisson Wesley, 1997
- N.Weste, K.Eshraghian, "Principles of CMOS VLSI Design", Second Edition, Addision Wesley 1993
- R.Jacob Baker, Harry W.LI., David E.Boyee, "CMOS Circuit Design, Layout and Simulation", Prentice Hall of India 2005
- A.Pucknell, Kamran Eshraghian, "BASIC VLSI Design", Third Edition, Prentice Hall of India, 2007.

ELECTIVE IV- Machine Learning
Code: MCAPGPE23
Contacts: 3L
Credits: 3

Course Objectives:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To explain mathematical background of the Machine Learning Algorithms
- To develop skills for solving practical problems using Machine Learning

Prerequisite: Basic knowledge of algebra, discrete math, statistics and Algorithm

Course Outcomes:

Students will be able to:

CO 1 Recognize characteristics of machine learning that make it useful in certain types of real-world analysis problems.
CO 2 Characterize machine learning algorithms as supervised, semi-supervised, and unsupervised.
CO 3 Understanding of Loss functions and Efficiency of Machine Learning Models
CO 4 Become familiar with feature engineering and Dimensionality reduction Techniques
CO 5 Performing complex regression, clustering, classification, and reinforcement task
CO 6 Effectively use Python Machine Learning libraries
CO 7 Identifying research problem and application of ML in multidisciplinary domains

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1		√	√	√	√								
CO2	√	√	√								√		
CO3	√	√	√										
CO4	√	√	√										
CO5					√	√					√		√
CO6						√		√			√		√
CO7		√	√					√		√			√

Module 1 (12 hours)

Introduction: Overview of topics and applications

Supervised Learning: Linear Regression: gradient descent, Normal equations. Probabilistic Interpretation, Logistic Regression, Newton's method, Locally weighted Linear Regression, Nearest Neighbors, Exponential Families, Generalized Linear Models, Optimization: Convex functions, Convex problems, Generative Learning Algorithms, Gaussian Discriminant Analysis, Feature selection, Kernels, Support vector Machine.

Module 2 (12 hours)

*Unsupervised Learning:*Curse of Dimensionality, Dimensionality Reduction, PCA, Mixture of Gaussians, EM Algorithm. Examples of EM, clustering, spectral clustering. Multi-dimensional Scaling (MDS), Isomaps, Non Negative Matrix Factorization.

Module 3 (12 hours)

Probabilistic Graphical Models: Introduction, Representation, Markov Blanket, variable elimination, HMM, Inference on a chain (sum-product specific case), Kalman Filters, Directed / Undirected graphs, MRFs, Sum-product, Max-product,
Special Topic: Graphical Models, Deep Learning.

Reference Books:

- Machine Learning, Tom Mitchell, McGraw Hill
- The Elements of Statistical Learning Trevor Hastie, Robert Tibshirani, and Jerome Friedman, Springer
- Ethem Alpaydin, Introduction to Machine Learning, PHI
- Chris Bishop, Pattern Recognition and Machine Learning

----------END OF SEMESTER IV----------

Syllabus for Bridge courses

Foundations of Computer Science
Code: MCAPGBR01
Contacts: 3L
Credit: 0

Course Objectives :

- To understand the basics of computer and the difference between flowchart, algorithm and program.
- To learn the importance of compilers, interpreters as well as the importance of Von Neumann architecture in computer science.
- To be familiar with the basics of C programming.
- To be able to demonstrate the fundamentals of data structure.
- To understand the basics of Binary representation of different data in computer science.

Course Outcome :

CO1: To be able to demonstrate the basics of computers as well as the difference between flowchart, algorithm and program.

CO2: To be able to discuss the importance of Von Neumann architecture in computer science.

CO3: To be able to describe the basic features of C programming.

CO4: To be able to discuss the basic fundamentals of data structure.

CO5: To demonstrate the binary representations and its different formats in computer science.

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P0 10	PO 11	PO 12	PO 13
CO1	√				√				√				
CO2			√	√		√							
CO3									√	√		√	√
CO4		√					√		√		√		
CO5	√		√					√					

Syllabus

Module I: [12 Hours]
History of Computing, Evolution of Programming Languages, Compilers, Interpreters. Overview of computers, basic organization of the von Neumann machine, instruction fetch, decode, and execution. Flowcharts, algorithms and programming languages and its compilation process. Machine level, Assembly level and High level languages. Syntax and semantics of a higher-level language like C. Algorithms and problem-solving: Problem-solving strategies; the concept of an algorithm, properties of algorithms.

Module II: [12 Hours]
Brief History of C, C Standards, Structure of a C Program, C Libraries and Linking, Compiling a C Program. Variables, types, expressions, and assignment, conditional and iterative control statements. Functions, calling functions and parameter passing.

Module III: [12 Hours]

Fundamental data structures: Primitive types, arrays, records, strings and string processing, pointers and references, runtime storage management. Machine level representation of data: Bits, bytes, and words. Binary representation of integers, representation of character data, representation of records and arrays. Introduction to data structures: stacks and queues.

Suggested Books:

1. Parsons and Oja: "Computer Concepts--Illustrated Series", Introductory, 6th Edition, (Concepts Textbook),
2. Herbert Schildt: "C: The Complete Reference", 4th Edition, Tata McGraw Hill, 2000.
3. YashwantKanetkar: "Let Us C", BPB Publications, 9th Edition, 2008.

Programming Techniques
Code: MCAPGBR02

Contacts: 3L
Credit: 0

Module 1 [12L]

Introduction: History of Computing, Evolution of Programming Languages, Compilers, Interpreters. **[2L]**

Problem Solving Method: Algorithms and Flowcharts. **[2L]**

Overview of C: Brief History of C, C Standards, Structure of a C Program, C Libraries and Linking, Compilation and Execution process of C Program. **[2L]**

Expressions: Basic Data Types, Variables, Type Qualifiers, Storage Class Specifiers, Variable Scopes, Constants, Operators, Operator Precedence, Expression Evaluation, Type Conversion in Expressions, Type Casting. **[6L]**

Module 2 [12L]

Console I/O: Reading and Writing Characters, Reading and Writing Strings, Formatted Console I/O. **[1L]**

Control Statements: Selection Statements (if, if-else, Nested if-else, switch-case), Iteration Statements (for loop, while loop, do-while loop), Jump Statements (return, goto, label, break, continue, exit). **[3L]**

Arrays and Strings: Single Dimension Arrays, Initializing An Array, Two Dimension Arrays, Strings, Pointers and Strings, String Library Functions, Two-Dimensional Array of Characters, Arrays of Pointers to Strings, Limitation of Array of Pointers to Strings. **4L]**

Functions: General Form, Passing Values between Functions, Scope Rule of Functions, Calling Convention, Function Declaration and Prototypes, Call by Value and Call by Reference, Parameter Passing Mechanisms, Command Line Arguments, Recursion. **[4L]**

Module 3 [12L]

Pointers: Pointer Variables, Pointer Operators, Pointer Expressions, Pointers and Arrays, Array of Pointers, Functions and Pointers, Pointers to Functions, Dynamic Memory Allocation. **[4L]**

Structures, Unions, Enumerations and Typedef: Structures, Arrays of Structures, Structure Pointers, Unions, Bit Fields, Enumerations, Typedef. **[4L]**

File I/O: Data Organization, File Operations, Text Files and Binary Files, Random Access, Files, Command Line Arguments. **[2L]**

The Preprocessor: Preprocessor Directives, Macros with Arguments, Macro versus Function, File Inclusion, Conditional Compilation. **[2L]**

Suggested Readings:

1. B.S. Gottfried: Programming in C; TMH.
2. B.W. Kernighan and D.M. Ritchie: The C Programming Language; PHI.
3. H. Schildt: C++: The Complete Reference; TMH, 4e.
4. B. Stroustrup: The C++ Programming Language; Addison-Wesley.
5. E. Balagurusamy: Programming in ANSI C; TMH.
6. Yashwant Kanetkar: Let Us C; BPB Publications.
7. C Programming: A Modern Approach: K. N. King, W. W. Norton and Company.

Digital Logic
Code: MCAPGBR03
Contacts: 3L
Credit: 0

Course objective:

The objectives of this course are to:

- Introduce the concept of digital and binary systems.
- To understand the concept of Boolean algebra and various logic gates.
- Design and analyze combinational logic circuits.
- Design and analyze sequential logic circuits.
- To provide knowledge about digital integrated circuits.

Course outcomes:

CO 1: Explain the principles and methodology of digital logic design at the gate and switch level.
CO 2: Define different number systems, binary addition and subtraction, 2's complement representation and operations with this representation.
CO 3: Understand Boolean algebra and basic properties of Boolean algebra; able to simplify simple Boolean functions by using the basic Boolean properties.
CO 4: Familiar with basic combinational logic circuits: Adder, subtractor, encoder, decoder, comparator etc.
CO 5: Familiar with basic sequential logic components: flip-flops, registers and counters.
CO 6: Understands the concepts of Diodes, transistors, MOS, CMOS etc.

CO –PO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12	PSO13
CO1	√	√											√
CO2	√	√											√
CO3	√		√										
CO4		√		√									
CO5	√	√		√									√
CO6	√	√		√									

Module - 1: [12 Hrs]

Number Systems, Boolean Algebra & Logic Gates: Binary numbers & Boolean algebra, Venn diagram, Logic gates, Truth Tables and function minimization using algebraic method, Karnaugh map, Quine- Mcclusky method; BCD, ASCII, EBDIC, Gray codes and their conversions, Signed binary number representation with 1's and 2's complement methods, Maxterm, Minterm, Representation in SOP and POS forms ; Realization of Boolean functions using NAND/NOR gates, two-level and multilevel logic circuit synthesis.

Module - 2: [12 Hrs]

Combinational circuits: Adder and Subtractor circuits (half & full adder & subtractor); Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator and checker; ROM, PLA .

Module - 3: [12 Hrs]

Sequential Circuits: Latch, Flip-flop. Design of Flip-flops with logic gates. Counters, Registers. Design and analysis of sequential circuits -Moore and Mealy model description, state diagram and state table – Minimization methods. Memory unit. Racing and Logic hazards. Implementation of hazard free logic circuit. asynchronous sequential circuit synthesis.

Suggested Books:

1. Floyed and Jain: “Digital Fundamentals”, Pearson Education.
2. Morries Mano: “Digital Logic Design”, PHI.
3. Leach & Malvino: “Digital Principles & Application”, 5/e, Tata McGraw Hill.
4. Kharate: “Digital Electronics”, Oxford.
5. Bigmell and R.Donovan: “Digital Electronics - Logic & Systems”, Cambridge Learning.
6. D.J.Comer: “Digital Logic and State Machine Design”, 3/e. OUP.
7. P.Raja: “Digital Electronics”, Scitech Publications.
8. R.P.Jain: “Modern Digital Electronics”, 2/e , Tata McGraw Hill.
9. H.Taub and D.Shilling: “Digital Integrated Electronics”, Tata McGraw Hill.
10. D. Ray Chaudhuri: “Digital Circuits”, vol I & II, 2/e, Platinum Publishers.
11. Tocci and Widmer: “Moss-Digital Systems”, 9/e, Pearson Education.
12. J. Bignell and R. Donovan: “Digital Electronics”, 5/e, Cenage Learning.