FOR ADMISSION BATCH 2024-25
MASTER IN COMPUTER APPLICATION
SECOND YEAR (THIRD SEMESTER)

Sl. No.	Category	Course Code	Course	Contact Hrs. L-T-P	Credit	University Marks	Internal Evaluation
Subject (Theory)							
1.	PC	MCPC2001	Design and Analysis of Algorithms	3-0-0	3	100	50
2.	PC	MCPC2002	Operating Systems	3-0-0	3	100	50
3.	PC	MCPC2003	Artificial Intelligence and Machine Learning	3-0-0	3	100	50
4.	PE	MCPE2001	Computational Intelligence	3-0-0	3	100	50
		MCPE2002	Cryptographic Foundation				
		MCPE2003	Object Oriented Analysis and Design				
		MCPE2004	Internet & Web Technology				
		MCPE2005	Natural Language Processing				
		MCPE2006	Compiler Design				
5.	PE	MCPE2007	Soft Computing	3-0-0	3	100	50
		MCPE2008	Data Mining and Data Warehousing				
		MCPE2009	Advanced Computer Architecture				
		MCPE2010	Blockchain Technology				
		MCPE2011	Operation Research				
		MCPE2012	Software Testing and Quality Assurance				
6.	HS	HSHS2003	Entrepreneurship Development	2-0-0	2	100	50
Subject (Practical / Sessional)							
7.	PC	MCPC2201	Design and Analysis of Algorithms Laboratory	0-0-3	1.5	–	100
8.	PC	MCPC2202	Operating Systems Laboratory	0-0-3	1.5	–	100
9.	PC	MCPC2203	AI & ML Laboratory	0-0-3	1.5	–	100
10.	PSI	MCPS2201	Summer Internship and Research Experience	0-0-3	1.5	–	100
Total				**17-0-12**	**23**	**600**	**700**

Note: Click here to view/download the syllabus of the subjects.

MCPC2001 Design and Analysis of Algorithm (3-0-0)

Course Objectives:
The objective of the course is to:

- Design and analysis of algorithms and find complexity on them.
- Find the complexity of different sorting algorithm.
- Understand the dynamic programming and greedy algorithms
- Analyze and implementation of Graph Algorithms
- Demonstrate NP-Completeness and Approximation Algorithms

Module I
Introduction to design and analysis of algorithms, Growth of functions, Recurrences, Solution of recurrences by Substitution, Recursion tree and Master method, Worst case analysis of Merge sort, Quick sort and Binary search Heap sort: Heaps, Building a heap, The Heap sort algorithm, Priority Queue, Lower bounds for sorting

Module II
Dynamic Programming: Matrix-chain multiplication, Elements of dynamic programming, longest common subsequence Greedy Algorithms: An activity-selection problem, Elements of greedy strategy, Fractional knapsack problem, Huffman codes

Module III
Data structures for Disjoint Sets: Disjoint set operations, Linked-list representation of disjoint sets, Disjoint-set forests. Graph Algorithms: Elementary Graph Algorithms: Representations of graphs, Breadth-first search, Depth-first search, Minimum Spanning Trees: Kruskal and Prim's algorithms, Single-Source Shortest Paths: The Bellman-Ford and Dijkstra's algorithm, All-Pairs Shortest Paths: The Floyd-Warshall Algorithm

Module IV
Maximum Flow: Flow Networks, The Ford-Fulkerson method, Polynomials and the FFT: Representation of polynomials, The DFT and FFT, String Matching: The naïve string-matching algorithm, The Rabin-Karp algorithm.
NP-Completeness: Polynomial time, Polynomial-time verification, NP-completeness and reducibility, NP-completeness proofs, NP-completeness problems, Approximation Algorithms: The vertex-cover problem, The travelling-salesman problem, The set-covering problem, The subset-sum problem.

Course Outcomes:
Upon successful completion of this course, the student shall be able to:
CO 1. Identify the different design technique of algorithm.
CO 2. Analyze the different sorting algorithm based on time and space.
CO 3. Analyze the different approaches of designing algorithm like dynamic programming and greedy algorithms
CO 4. Discuss different graph algorithm.

Books:
1. Introduction to Algorithms: T. H. Cormen, C. E. Leiserson, R. L. Rivest (PHI), Second Edition.
2. E. Horowitz, S. Sahani, S. Rajsekharan," Fundamentals of Computer Algorithms", Second Edition, Universities Press,2007

Reference Books:
1. Design and Analysis of Algorithm – M R Kabat, PHI Learning Pvt. Ltd.
2. Algorithm Design –Goodrich, Tamassia, WileyIndia.
3. Algorithms By Sanjay Dasgupta, Umesh Vazirani – McGraw-Hill Education

CSPC2002 OPERATING SYSTEM (3-0-0)

Course Objectives

- To understand the fundamental concepts and role of Operating System.
- To learn the Process Management and Scheduling Algorithms
- To provide a detailed discussion of the various memory management techniques
- To gain insight on I/O and File management techniques
- Understandvariousproblems related to concurrent operations and their solutions.

MODULE-1

Operating Systems: Definition, Generations of Operating systems, Types of Operating System, Functions of operating System, Abstract view of OS, System Structures, System Calls.

Processes: Definition, Process Relationship, Process states, Process State transitions, Process Control Block, Context switching, Threads, Concept of multithreads, Benefits of threads, Types of threads.

MODULE-2

Process Scheduling: Definition, Scheduling objectives, Types of Schedulers. Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time, Scheduling algorithms: Preemptive and Non-preemptive, FCFS, SJF, RR, Priority Scheduling, Multiple Queue Scheduling, Multilevel Feedback Queue Scheduling.

Deadlocks: Definition, Deadlock characteristics, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

MODULE-3

Inter-process Communication: Race Conditions, Critical Section, Mutual Exclusion, Peterson's Solution, The Producer Consumer Problem, Semaphores, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

Memory Management: Main Memory, Swapping, Memory allocation Methods, Internal and External fragmentation and Compaction, Paging, Structure of Page Table, Segmentation, Virtual Memory: Demand Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing.

MODULE-4

Disk management: DiskStructure, Disk Scheduling, RAID Structure.**I/O Management**: I/O devices, direct memory access. File Management: File concept, access methods, File types, File operation, Directory structure, Allocation methods (contiguous,linked, indexed). **Security & Protection:** Security Environment, Design Principles of Security, User Authentication.

Course Outcomes

CO 1. Understand the structure and functions of Operating System and how of the working principle of various types of operating systems

CO 2. Ability to comprehend the techniques used to implement the process manager

CO 3. Compare the performance of Scheduling Algorithms andAnalyze resource management techniques

CO 4. Ability to comprehend virtual memory abstractions in operating systems

Text Book:

1. Operating System Concepts (9thEdition) by Silberschatz, Peter B. Galvin and Greg Gagne, Wiley Indian Edition.

Reference Books:

1. Modern Operating Systems (Fourth Edition) by Andrew S Tanenbaum, Prentice Hall India.
2. William Stallings, “Operating Systems Internals and Design Principles”, Pearson, 2018, 9th Edition.

MCPC2003 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (3-0-0)

Course Objectives:

1. To provide a strong foundation on fundamental concepts in Artificial Intelligence
2. To Provide a basic exposition to the goals and methods of Computational Intelligence
3. To study of the design of intelligent computational techniques
4. To enable problem-solving through various machine learning techniques.

Module I

Introduction to AI - Intelligent Agents, Problem-Solving Agents, **Searching for Solutions** - Breadth-first search, Depth-first search, Hill-climbing search, simulated annealing search, Local Search in Continuous Spaces. Heuristic functions, Hill Climbing, Best First Search, A*, Adversarial Search: Game Playing, Min-Max Search, Alpha - Beta Pruning.

Module II

Knowledge and Reasoning: A Knowledge Based Agent, WUMPUS WORLD Environment, Propositional Logic, First Order Predicate Logic, Forward and Backward Chaining. Expert Systems: Introduction, Design of Expert systems.

Module III

Introduction MLP. Type of Human Learning, Type of Machine Learning: Supervised, unsupervised, reinforcement, General Model of Learning Agents

Module IV

Supervised: holdout method, K-fold cross-validation method, boot strapping, simple-regression method, unsupervised: clustering, association, reinforcement learning model.

Course Outcomes: Upon successful completion of this course, students should be able to:

CO1: Apply the Computational Intelligence techniques in applications which involve searching, reasoning and learning.

CO2: Understand artificial intelligence techniques for information retrieval

CO3: Apply Computational Intelligence techniques primarily for machine learning.

CO4: Apply the machine learning techniques for problem solving and validating

Text Books:

1. Elaine Rich, Kevin Knight, Shivshankar B Nair, Artificial Intelligence, McGraw Hill, 3rdEdition.
2. Tom Mitchell, Machine Learning, McGraw Hill , 1997,

Reference Books

1. Richard O. Duda, Peter E. Hart, David G. Stork, Pattern classification, Wiley , (2nd edition).Wiley, New York, 2001
2. Dan W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”, 1st Edition,1996, PHI Learning Pvt. Ltd., New Delhi.
3. Nills J. Nilsson, “Artificial Intelligence: A New Synthesis”, 2nd Edition, 2000, Elsevier IndiaPublications, New Delhi.
4. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer , 2011 edition
5. Ian Goodfellow, YoshuaBengio, Aaron Courville, Deep Learning, MIT Press , 2016

MCPC2201 DESIGN AND ANALYSIS OF ALGORITHMS LAB (0-0-3)

1. Program to study divide and conquer approach (Implement Binary search, merge sort and quick sort and find worst case, average case and best-case time complexity)

2. Program to study greedy algorithm (Implement coin change problem, activity selection problem, Travelling Salesman Problem and Huffman Coding)

3. Program to study Minimum cost Spanning Tree (Prim's Algorithm and Kruskal's Algorithm)

4. Program to study shortest path algorithms (Dijkstra's algorithm, Floyd-Warshall's algorithm and Bellman-Ford Algorithm)

5. Program to study divide and conquer algorithm (Matrix chain multiplication or Longest Common Subsequence algorithms)

6. Program to solve n-queen problem and 15-puzzle problem

7. Programs to study whether node cover problem, Hamiltonian cycle and chromatic number problem are polynomial time verifiable or not.

MCPC2202 OPERATING SYSTEM LABORATORY (0-0-3)

COURSE OBJECTIVES:

1. To provide an understanding of the design aspects of operating system concepts through simulation
2. Introduce basic Linux commands, system call interface for process management, inter-process communication and I/O in Unix.
3. Student will learn various process and CPU scheduling Algorithms through simulation programs
4. Student will have exposure to System calls and simulate them.
5. Student will learn deadlocks and process management & Inter Process communication and simulate

Lab 1. Basics of UNIX commands.
Lab 2. Shell programming
Lab 3. Implementation of CPU scheduling. a) Round Robin b) SJF c) FCFS d) Priority
Lab 4. Implement all file allocation strategies
Lab 5. Implementation of Semaphores.
Lab 6. Implementation of File Organization Techniques
Lab 7. Implementation of Bankers algorithm for Dead Lock Avoidance
Lab 8. Implementation of an Algorithm for Dead Lock Detection
Lab 9. Implementation of all page replacement algorithms a) FIFO b) LRU c) LFU
Lab 10. Implementation of Shared memory and IPC
Lab 11. Implementation of Paging Technique of memory management.
Lab 12. Implementation of Threading & Synchronization Applications

COURSE OUTCOMES:

CO 1. Learn the applications of basic Linux commands.
CO 2. Student will learn various process and CPU scheduling Algorithms through simulation programs
CO 3. Student will have exposure to System calls and simulate them.
CO 4. Student will learn deadlocks and process management & Inter Process communication and simulate them

REFERENCE BOOKS:

1. Operating Systems – Internals and Design Principles, William Stallings, Fifth Edition–2005, Pearson Education/PHI
2. Operating System - A Design Approach-Crowley, TMH.
3. Modern Operating Systems, Andrew S Tanenbaum, 2nd edition, Pearson/PHI
4. UNIX Programming Environment, Kernighan and Pike, PHI/Pearson Education
5. UNIX Internals: The New Frontiers, U. Vahalia, Pearson Education

MCPC2203 AI & ML LAB (0-0-3)

1. Write a Program to Implement Breadth First Search using Python.
2. Write a Program to Implement Depth First Search using Python.
3. Write a Program to Implement Tic-Tac-Toe game using Python.
4. Write a Program to implement 8-Puzzle problem using Python
5. Write a Program to Implement Water-Jug problem using Python
6. Write a python program to import and export data using Pandas library functions
7. Demonstrate various data pre-processing techniques for a given dataset
8. Implement Simple Linear Regression Models
9. Develop Decision Tree Classification model for a given dataset and use it to classify a new Sample.
10. Build KNN Classification model for a given dataset.

MCPE2001 COMPUTATIONAL INTELLIGENCE (3-0-0)

Course Objectives:

1. To provide a strong foundation on fundamental concepts in Computational Intelligence
2. To Provide a basic exposition to the goals and methods of Computational Intelligence
3. To study of the design of intelligent computational techniques
4. To enable problem-solving through various searching techniques.

Module I

Introduction to Artificial Intelligence-Search-Heuristic Search-A* algorithm-Game Playing-Alpha-Beta Pruning-Expert Systems-Inference-Rules-Forward Chaining and Backward Chaining- Genetic Algorithms.

Module II

Proposition Logic — First Order Predicate Logic — Unification — Forward Chaining - Backward Chaining — Resolution — Knowledge Representation — Ontological Engineering — Categories and Objects — Events — Mental Events and Mental Objects — Reasoning Systems for Categories — Reasoning with Default Information — Prolog Programming.Non monotonic reasoning-Fuzzy Logic-Fuzzy rules-fuzzy inference-Temporal Logic-Temporal Reasoning-Neural Networks-Neuro-fuzzy Inference.

Module III

Probability basics — Bayes Rule and its Applications — Bayesian Networks — Exact and Approximate Inference in Bayesian Networks — Hidden Markov Models — Forms of Learning — Supervised Learning — Learning Decision Trees — Regression and Classification with Linear Models — Artificial Neural Networks — Nonparametric Models — Support Vector Machines — Statistical Learning — Learning withComplete Data — Learning with Hidden Variables- The EM Algorithm — Reinforcement Learning

Module IV

Natural language processing-Morphological Analysis-Syntax analysis-Semantic Analysis-AI applications — Language Models — Information Retrieval — Information Extraction — Machine Translation — Machine Learning — Symbol-Based — Machine Learning: Connectionist — Machine Learning.

Course Outcomes: Upon successful completion of this course, students should be able to:

CO1: Apply theComputational Intelligence techniques in applications which involve perception, reasoning and learning.
CO2: Apply Computational Intelligence techniques for information retrieval
CO3: Apply Computational Intelligence techniques primarily for machine learning.
CO4: Apply the Intelligent techniques for problem solving

Text Book:

1. Stuart Russell, Peter Norvig, ―Artificial Intelligence: A Modern Approach‖, Third Edition, Pearson Education / Prentice Hall of India, 2010.

Reference Books:

1. Elaine Rich and Kevin Knight, ―Artificial Intelligence‖, Third Edition, Tata McGrawHill, 2010.
2. Patrick H. Winston. "Artificial Intelligence", Third edition, Pearson Edition, 2006.
3. Dan W.Patterson, ―Introduction to Artificial Intelligence and Expert Systems‖, PHI, 2006.
4. Nils J. Nilsson, ―Artificial Intelligence: A new Synthesis‖, Harcourt Asia Pvt. Ltd., 2000.

MCPE2002 CRYPTOGRAPHIC FOUNDATIONS (3-0-0)

Course Description : The course introduces the underlying the principles and design of cryptosystems. The course covers the basics concepts of cryptography including: traditional ciphers, block ciphers, stream ciphers, public and private key cryptosystems. The course also includes the theory of hash functions, authentication systems, network security protocols and malicious logic.

Course Objectives:

After learning the course the students should be able to:

- Understand the principles and practices of cryptographic techniques.
- Understand information security goals for designing secure systems.
- Apply security algorithms in solving real-life security problems in communicating systems.
- Understand different crytographic techniques based on asymmetric key encryption.

Module-I

Introduction: What is modern cryptography, Historical ciphers and their cryptanalysis, The heuristic versus the rigorous approach; adversarial models and principles of defining security

Perfectly-Secret Encryption: Definitions, the one-time pad; proven limitations

Private-Key (Symmetric) Encryption: Computational security, Defining secure, encryption, Constructing secure encryption; pseudo randomness, Stronger security notions, Constructing CPA-secure encryption, Modes of operation; CBC vs. CTR, Security of CTR with n − k bit counter for messages to size 2k blocks with proof directly to the LR definition, CCA attacks.

Module-II

Message Authentication Codes: Message integrity, Definition of security, Constructions from pseudorandom functions, CBC-MAC, Authenticated encryption.

Collision-Resistant Hash Functions: Definitions, The Merkle-Damgard transform, HMAC, Birthday attacks, The Random oracle model, Password hashing, Constructions of Pseudorandom Permutations (Block Ciphers) in Practice, Substitution-permutation and Feistel networks, DES and attacks on reduced-round versions, double-DES and triple-DES, AES, Hash functions from block ciphers.

Module-III

Number Theory: Preliminaries and basic group theory, Primes, factoring and RSA, Cryptographic assumptions in cyclic groups, Collision-resistant hash functions from discrete log, Public-Key (Asymmetric) Cryptography: Introduction and motivation, Diffie-Hellman key exchange

Module-IV

Public-Key (Asymmetric) Encryption: The model and definitions, Hybrid encryption and KEM/DEM, El Gamal, RSA: textbook encryption, attacks on textbook RSA, padded RSA; CCA-secure RSA KEM.Digital Signatures: Definition and applications, Hash and sign, RSA signatures: textbook RSA, hashed RSA, security with ROM, Certificates and public-key infrastructures.

Text Book

1. Jonathan Katz and Yehuda Lindell, Introduction to Modern Cryptography, second edition 2014, CRC Press.

Reference Books

1. Cryptography: Theory and Practice by Douglas Stinson, Third edition, CRC Press.
2. Handbook of Applied Cryptography by Alfred Menezes, Paul Oorschot and Scott Vanstone. Available Online.
3. Foundations of Cryptography by Oded Goldreich. Available Online.
4. Cryptography, an Introduction by Nigel Smart. Available Online

MCPE2003 OBJECT ORIENTED ANALYSIS & DESIGN (3-0-0)

Course Objectives:

1. To learn the concepts of Object-Oriented Analysis and Design;
2. Exposing the development of OOAD based applications

Module - I:

Object Model – Evolution, Elements – Nature of Classes and Objects – Relationships among Classes - Classification – Identification of classes and objects – Key abstractions and mechanisms – Basic and Advanced Modeling techniques. Methodology – Modeling and UML – Rambaugh's Method – Booch Method – Jacobson et al Method – Comparisons – UML – Static-Dynamic Models – Diagrams – Use Cases

Module - II:

Process of design, design principles, architectural patterns, design document, difficulties and risks in design - Frameworks: reusable subsystem. Design patterns – Singleton, observer, adapter, Façade, proxy with examples. - Pattern Categories - Relationships between patterns - Pattern descriptions – Patterns based Applications – Object Oriented Database

Module - III:

Java - Features – Structure – Elements of Java – Array, String, String Buffer, Vectors –Methods – Object Oriented Features- Classes, Objects – Constructors – Package – Inheritance – Interface – Abstract Class - Special types of classes.

Module - IV:

Applet Programming – AWT – Graphics - Event Handling – Exception Handling – Utilities and Collections – I/O Streams - Multithreaded Programming - Swings - J2EE Architecture

Course Outcomes:

CO1: Define the fundamentals of OO approach
CO2: Design OO Application using design patterns.
CO3: Solve real world problems by applying OOAD principle
CO4: Acquire expertise in Java Programming

Books:

[1] Grady Booch, Michael W. Engel, Kelli A. Houston, Robert A. Maksimchuk, Bobbi J. Young, Jim Conallen, "Object-Oriented Analysis and Design with Applications", 3rd Edition, Pearson Education, 2009

[2] Michael Blaha and James Rumbaugh, "Object-Oriented Modeling and Design with UML", 2nd Edition, Pearson Education, 2005

[3] Erich Gamma, Richard Helm, Ralph Johnson & John Vlissides, "Design Patterns: Elements of Reusable Object-oriented Software", Pearson Education India, 2004.

MCPE2004 Internet and Web Technology (3-0-0)

Course Objectives:

- To learn about the concept of Internet and a Web
- To learn how to design Website
- To learn about client scripting and server scripting language to implement client server communication

Module-1: TCP/IP Overview

TCP/IP and Internet: Layers of TCP/IP, Network Layer: Addressing, Sub netting, Introduction to WWW, WWW Architecture, URL, Domain Name, Overview of HTTP, Client server model , Web browser and Web servers , Generation of dynamic web pages, Features of Web 2.0 ,Web Hosting.

Web Design: Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Web site, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation

Module-2: HTML and CSS

HTML :Basics of HTML, formatting and fonts, commenting code, color , images, hyperlink, lists, tables, forms, XHTML, Meta tags, Character entities, frames and frame sets, features of HTML5. **Style sheets** : Need for CSS, introduction to CSS, basic syntax and structure, using CSS, Internal ,External and Inline style, Background images, colors and properties, Manipulatingtext ,Margins and Padding ,Positioning using CSS.

XML: Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas

Module-3: JavaScript

JavaScript: Client side scripting with JavaScript, variables, functions, conditions, loops and repetition**Advance JavaScript**: JavaScript and objects, JavaScript Built in objects, the DOM and web browser environments, Manipulation using DOM, forms and validations

DHTML: Combining HTML, CSS and JavaScript, Events and buttons

Module-4: PHP

Introduction and basic syntax of PHP, decision and looping statement, Arrays, Functions, Browser control and detection, string handling, Form processing ,Files ,PHP with Database connectivity, Cookies and Session handling in PHP

Reference Books:

1. Developing Web Applications, Ralph Moseley and M. T. Savaliya, Wiley-India
2. Web Technologies, Black Book, dreamtech Press
3. HTML 5, Black Book, dreamtech Press
4. The Complete Reference – PHP, Steven Holzner, Tata McGraw Hill, 2008.
5. PHP & MySQL in easy Steps, Mike Mcgrath, Tata McGraw Hill, 2012.
6. Web Design, Joel Sklar, Cengage Learning
7. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel, Pearson

MCPE2005 NATURAL LANGUAGE PROCESSING (3-0-0)

COURSE OBJECTIVES:

1. To teach the fundamentals of NLP, and also to make them for understanding CFG, PCFG in NLP.
2. To know the role of semantics of sentences and pragmatic.
3. To teach the basic concepts of speech processing along with analysis and modeling.

MODULE-1

Introduction: Origins and challenges of NLP, Language modeling: grammar-based LM, statistical LM regular expressions, finite-state automata, English morphology, transducers for lexicon and rules, tokenization, detecting and correcting spelling errors, minimum edit distance.

Word Level Analysis: Unsmoothed n-grams, evaluating n-grams, smoothing, interpolation and backoff – word classes, part-of-speech tagging, rule-based, stochastic and transformation-based tagging, issues in pos tagging, hidden markov and maximum entropy models.

MODULE-2

Syntactic Analysis: Context free grammars, grammar rules for english, treebanks, normal forms for grammar, dependency grammar, syntactic parsing, ambiguity, dynamic programming parsing, shallow parsing, probabilistic CFG, probabilistic CYK, probabilistic lexicalized CFGs, feature structures, unification of feature structures**.**

MODULE-3

Semantics and Pragmatics: Requirements for representation, first-order logic, description logics, syntax-driven semantic analysis, semantic attachments, word senses, relations between senses, thematic roles, selectional restrictions, Word Sense Disambiguation(WSD), WSD using supervised, dictionary & thesaurus, bootstrapping methods, word similarity using thesaurus and distributional methods.

Speech fundamentals: articulatory phonetics, production and classification of speech sounds; acoustic phonetics, acoustics of speech production, review of digital signal processing concepts, short-time fourier transform, filter- bank and LPC methods.

MODULE-4

Speech-Analysis and Speech Modeling: Features, feature extraction and pattern comparison techniques: speech distortion measures, mathematical and perceptual, log spectral distance, cepstral distances, weighted cepstral distances and filtering, likelihood distortions, spectral distortion using a warped frequency scale, lpc, plp and mfcc coefficients, time alignment and normalization, dynamic time warping, multiple time, alignment paths. Hidden markov models: markov processes, HMMS – evaluation, optimal state sequence, viterbi search, baum-welch parameter re-estimation, implementation issues.

COURSE OUTCOMES:

CO 1. Learn the fundamentals of NLP andUnderstand the use of CFG and PCFG in NLP

CO 2. Understand the role of semantics of sentences and pragmatic

CO 3. Introduce Speech Production and Related Parameters of Speech.

CO 4. Show the Computation and use of Techniques such as Short Time Fourier Transform,Linear Predictive Coefficients and other Coefficients in the Analysis of Speech.

REFERENCE BOOKS:

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, OReilly Media, 2009.
3. Lawrence Rabiner And Biing-Hwang Juang, "Fundamentals Of Speech Recognition", Pearson Education, 2003.
4. Daniel Jurafsky and James H Martin, "Speech And Language Processing – An Introduction To Natural Language Processing, Computational Linguistics, And Speech Recognition", Pearson Education, 2002

MCPE2006 COMPILER DESIGN (3-0-0)

Course Objectives: Upon successful completion of this course, students will be able to:

- Understand the Fundamental Principles and analyze Lexical Structure
- Implement Syntax Analysis, perform Semantic Analysis and design and generate suitable intermediate representations
- Apply Optimization Techniques and design Code Generators
- Utilize Compiler Construction Tools and develop a Foundational Understanding for Language Processors

Module I

Introduction, Phases of a compiler, Compiler construction tools. A simple one-pass compiler. Lexical Analysis: The role of the lexical analyzer. Input buffering. Specification of tokens: regular expressions. Recognition of tokens: finite automata (NFA and DFA). Conversion from regular expression to NFA. Conversion from NFA to DFA. Minimization of DFA. Design of a lexical analyzer generator (e.g., Lex/Flex concepts).

Module II

Introduction to Syntax Analysis, Role of the parser. Context-Free Grammars (CFG). Derivations, parse trees, ambiguity. Eliminating ambiguity. Top-Down Parsing, Recursive descent parsing. LL(1) grammars: conditions for LL(1). First and Follow sets. Construction of LL(1) parsing table. Error recovery in top-down parsing. Bottom-Up Parsing, Shift-reduce parsing. Handles and handle pruning. LR parsers: SLR, Canonical LR, LALR. Construction of LR parsing tables (conceptual overview for SLR).

Module III

Semantic Analysis: Syntax-Directed Translation (SDT): introduction to SDT schemes. Attribute grammars: synthesized attributes, inherited attributes. Dependency graphs. Type checking: type systems, static vs. dynamic checking. Symbol tables: structure, organization, operations. Run-time environment: storage organization, activation records, stack allocation. Intermediate Code Generation: Intermediate languages: three-address code (quadruples, triples, indirect triples). Postfix notation. Syntax trees.

Module IV

Code Optimization Introduction to optimization: principal sources of optimization.Basic blocks and flow graphs. Data flow analysis. Local optimizations: common subexpression elimination, dead code elimination, constant folding, strength reduction. Loop optimization: code motion, induction variable elimination. Peephole optimization. Code Generation: Issues in the design of a code generator. The target machine. Run-time storage management. Basic blocks and flow graphs (revisit). Simple code generator. Register allocation and assignment. Instruction selection.

Course Outcomes (COs):

Upon successful completion of this course, students will be able to:

CO 1: Analyze the phases of a compiler and design a lexical analyzer for a given programming language.
CO 2: Apply various parsing techniques to construct a parser for a given grammar.
CO 3: Develop syntax-directed translation schemes to perform semantic analysis and intermediate code generation.
CO 4: Apply different code optimization techniques to improve the efficiency of the generated code.

Text Book:

1. A.V. Aho, R. Sethi & J.D. Ullman “Compilers Principles Techniques and Tools” Pearson Education

Reference Books:

1. Kenneth C. Louden “Compiler Construction Principles & Practice “Cengage Learning Indian Edition

MCPE2007 Soft Computing (3-0-0)

Course Objectives:

1. To introduce the fundamental concepts of Soft Computing Techniques.
2. To understand the feasibility of applying a soft computing methodology for a particular problem.
3. To develop and understanding of Neural Networks, Fuzzy System and Genetic Algorithm.
4. To explore advanced topics such as Hybrid systems, GA based Backpropagation Networks and Fuzzy Backpropagation Networks.

MODULE - I

Introduction:

What is Soft Computing? Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing.**Neural Networks:**What is Neural Network, Learning rules and various activation functions, Single layer Perceptrons, Back Propagation networks, Architecture of Backpropagation(BP) Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications.

MODULE - II

Fuzzy Systems: Fuzzy Set theory, Fuzzy versus Crisp set, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification. **Genetic Algorithm:** History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization.

MODULE - III

Hybrid Systems:

Sequential Hybrid Systems, Auxiliary Hybrid Systems, Embedded Hybrid Systems, Neuro-Fuzzy Hybrid Systems, Neuro-Genetic Hybrid Systems, Fuzzy-Genetic Hybrid Systems.

MODULE - IV

GA based Backpropagation Networks:GA based Weight Determination, K - factor determination in Columns, **Fuzzy Backpropagation Networks:**LR type Fuzzy numbers, Fuzzy Neuron, Fuzzy BP Architecture, Learning in Fuzzy BP, Application of Fuzzy BP Networks.

Course Outcomes: Upon successful completion of this course, students should be able to:

CO1: Apply the techniques of soft computing and foster their abilities in designing and implementing soft computing-based solutions for real-world engineering problems.

CO2: Analyze neural networks to pattern recognition, classification and regression problems to evaluate solutions by various soft computing approaches.

CO3: Apply and design fuzzy logic and reasoning to handle uncertainty and solve engineering problems.

CO4: Examine and formulate genetic algorithm to combinatorial optimization problems

Text Book:

1. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S.Rajasekaran, G. A. Vijayalakshami, PHI.

Reference Books:

1. Genetic Algorithms: Search and Optimization, E. Goldberg.
2. Neuro-Fuzzy Systems, Chin Teng Lin, C. S. George Lee, PHI.

MCPE2008 DATA MINING AND DATA WAREHOUSE (3-0-0)

Course Objectives:

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

MODULE I

Data Warehousing and Business Analysis: - Data warehousing Components –Building a Data warehouse –Data Warehouse Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

MODULE II

Data Mining: - Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation- Architecture of A Typical Data Mining Systems- Classification of Data Mining Systems.

Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.

MODULE III

Classification and Prediction: - Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

MODULE IV

Cluster Analysis: - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High-Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.Mining Object, Spatial, Multimedia, Text and Web Data:Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web.

Course Outcomes: Upon successful completion of this course, students should be able to:

CO1: Understand the functionality of the various data mining and data warehousing component
CO2: Appreciate the strengths and limitations of various data mining and data warehousing models
CO3: Perform classification and prediction of data for analyzing various data
CO4: Describe different methodologies used in data mining and data ware housing
CO5: Apply technical knowhow of the Data Mining principles and techniques for real time applications

BOOKS:

1. Jiawei Han, Micheline Kamber and Jian Pei“Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2011.
2. Alex Berson and Stephen J. Smith “Data Warehousing, Data Mining & OLAP”, Tata McGraw – Hill Edition, Tenth Reprint 2007.
3. K.P. Soman, Shyam Diwakar and V. Ajay “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.
4. G. K. Gupta “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall of India, 2006.
5. Pang-Ning Tan, Michael Steinbach and Vipin Kumar “Introduction to Data Mining”, Pearson Education, 2007.

MCPE2009 ADVANCED COMPUTER ARCHITECTURE (3-0-0)

Course Objectives:
This course examines the techniques and underlying principles that are used to design high-performance computers and processors. Particular emphasis is placed on understanding the trade-offs involved when making design decisions at the architectural level. A range of processor architectures are explored and contrasted. In each case we examine their merits and limitations and how ultimately the ability to scale performance is restricted.

Module-I
Principles of Processor Performance, RISC and CISC Architectures, Pipelining fundamentals, PipelineHazards, Superscalar Architecture, Super Pipelined Architecture,VLIW Architecture.

Module-II
Basic Multiprocessor Architecture: Flynn's Classification, UMA, NUMA, Distributed MemoryArchitecture, Array Processor, Vector Processors, Associative Processor, Systolic architecture.Interconnection Networks: Static Networks, Network Topologies, Dynamic Networks.

Module-III
Hierarchical Memory Technology: Data and Instruction caches, Multi-level caches, Cache memorymapping policies, Cache Coherence, Cache Performance, Virtual memory, Page replacement techniques,Memory Inter leaving, Memory Management hardware.

Module-IV
Data Flow Computer Architecture: Static Data flow computer, Dynamic Data flow computer, Clustercomputers, Distributed computing, Cloud computing.

Course Outcomes (CO):
After successful completion of the course the student will be able to:
CO1: Understand background of processor performance and different processor architectures.
CO2: Understand the multiprocessor system taxonomy.
CO3: Understand the cache performance and memory hierarchy.
CO4: Understand the advanced computer architecture systems.

Books:

1. K. Hwang and F. A. Briggs, Computer Architecture and Parallel Processing, McGraw Hill.
2. David A. Patterson and John L. Hennessy, Computer Organization and Design, Elsevier.
3. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach,Morgan Kaufmann
4. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill.
5. Computer Architecture: Parhami, Oxford University Press

MCPE2010 BLOCKCHAIN TECHNOLOGY (3-0-0)

Course Objectives

This course is designed to:

- Understand how block chain systems (mainly Bit coin and Ethereum) work and to securely interact with them,
- Illustrate how to setup Ethereum tools.
- Explain the key vocabulary and concepts used in Blockchain for Business,
- Design, build, and deploy smart contracts and distributed applications.
- Integrate ideas from block chain technology into their own projects.

Module-I

Introduction to Blockchain, Concept of blockchain, History, Fundamentals of Blockchain, Characteristics of blockchain, Architecture of blockchain, transactions & chaining blocks, Public, private and Hybrid Blockchains, Distributed ledger Technologies, DLT decentralized applications and databases.

Module-II

Distributed decentralized databases, Decentralization, Hashing, Message authentication code & Secure hash Algorithms (SHA-1 & version 3), Distributed hash tables, hashing in blockchain mining, consensus approach, consensus algorithms & Byzantine agreement methods,

Module-III

Ethereum History, Ethereum virtual machine(EVM), Ethereum clients, addresses, key pairs, transaction, languages and wallets, Smart contact characteristics, Absolute and immutable, Contractual confidentiality, Cryptography primitives, Symmetric & Asymmetric cryptography.

Module-IV

Working with bitcoin, Merkle trees, Bitcoin block structure, Addresses, transactions, networks, clients, wallets and payments, Bitcoin supply, Mining Bitcoin blockchain, blocks validation and identification, blocks creation, Ming Hardware & Software, Bitcoin management and swarm. Blockchain in insurance, healthcare, blockchain in cloud computing, Artificial intelligence

Course Outcomes(CO):

After successful completion of the course student will be able to

CO1: Understand how blockchain systems (mainly Bitcoin and Ethereum)
CO2: Develop familiarity of smart contracts and decentralized application
CO3: Applications and implementation strategies
CO4: Blockchain vertical solutions, Use cases & Allied technologies

Text Books:

1. Blockchain Technology concepts and application, Wiley Publication.

Reference Books:

1. Blockchain for Enterprise Application Developers, Wiley Publication.
2. Bitcoin and Cryptocurrency Technologies, Arvind Narayanan, Princeton Publication.

MCPE2011 Operations Research (3-0-0)

Course Objectives:

1. To introduce students to the foundational concepts and techniques of operations research.
2. To develop problem-solving and analytical modelling skills.
3. To apply mathematical modelling and algorithms to optimize real-life computing and operational problems.

Module I (9 hours)
Linear Programming- Concept, Formulation, Graphical and Simplex Method, Artificial initial solution, special cases, Duality, Dual Simplex Method.

Module II: (8 hours)
Assignment Problem: Hungerian Method, **Transportation Problem**: Initial Basic solution using NWC rule, least cost and VAM, Optimal solution using MODI**. Integer Programming**-Cutting Plane, Branch & Bound.

Module-III(10 hours)
Dynamic Programming- Characteristics, Knapsack Problem, **Queuing Theory-** Basic Structure, Exponential distribution, Birth-and-Death Model, M/M/I Queue. **Game Theory**-Two-person Zero Sum game, saddle point determination, Dominance Property, Pure and mixed strategy, Solving 2x2, 2xn and mx2 games.

Module IV: (8 hours)
Sequencing- n jobs 1 machine, n-jobs 2machines, n-jobs m machines, two jobs m- machines, **Non-Linear** Programming: Unconstrained Optimization problem, Lagrange Multiplier method, Kuhn-Tucker conditions.

Course Outcomes: Upon successful completion of this course, students should be able to:

CO1: Formulate and solve linear programming problems using graphical, simplex methods and dual simplex method.
CO2: Solve the specialized LP problems like transportation and assignment using optimization techniques.
CO3: Solve IPP and apply basics of queuing theory to understand the service system.
CO4: Analyze the real life conflict situations using Game Theory and Implement decision-making and Sequencing models using OR tools in various applications.

BOOKS:

1. 1.Operations Research: An Introduction, Author: Hamdy A. Taha, Publisher: Pearson Education, Edition: 10th Edition or latest
2. Introduction to Operations Research, Authors: Frederick S. Hillier and Gerald J. LiebermanPublisher: McGraw Hill Education, Edition: Latest
3. Operations Research, Author: Kanti Swarup, P.K. Gupta, and Man Mohan, Publisher: Sultan Chand & Sons
4. Operations Research: Principles and Practice, Authors: Ravindran, Phillips, and Solberg, Publisher: Wiley India,
5. Operations Research Theory and Applications, Author: J.K. Sharma, Publisher: Macmillan

CSPE2013 SOFTWARE TESTING AND QUALITY ASSURANCE (3-0-0)

Course Objectives:

1. The objective of this course is to impart understanding of techniques for software testing and quality assurance.
2. To help students to develop skills that will enable them to construct software of high quality - software that is reliable, and that is reasonably easy to understand, modify and maintain.
3. Introduce, Understand and learn features and working of various tools of software testing and apply different software artifacts.

MODULE-1 (8 Hour)

Introduction to Software Testing: Introduction, Software Testing Process, Objectives, Software testing life cycle, Concept of testing, types of errors, Stubs and drivers, verification and validation, Definition of a Bug, Role of a Software Tester, Software Testing Axioms, Software Testing Terms and Definitions, Code inspection and code walkthrough, Testing of component based software system, Energy efficient testing.

MODULE-2 (12 Hour)

Software testing methods, Fundamentals of Software Testing: Test case design, Testing Strategies and Techniques, Structural and Functional testing, Strategic approach to software testing, Unit Testing, Integration testing , System Testing, White box testing and its types, Black box testing and its types, Static Black Box and Dynamic Black Box Testing Techniques. Special Types of Testing: Configuration Testing, Compatibility Testing, Graphical User Interface Documentation Testing, Security Testing, Test planning, Budgeting and Scheduling.

MODULE-3 (8 Hour)

Software testing Metrics, Different types of metrics, Defect Management, Defect Management Process and Metrics related to defects, Configuration and Compatibility Testing.Testing Tools: Benefits of Automation Testing, Random Testing, Bug Bashes and Beta Testing. Test Planning: Test Planning, Test Cases, Bug life cycle.

MODULE-4 (7 Hour)

Software Quality Assurance: Definition of Quality, Testing and Quality Assurance at Workplace, Test Management and Organizational Structure, Software Quality Assurance Metrics, Six Sigma, Organizational Structure: CMM (Capability Maturity Model), ISO 9000, Software Engineering Standards.

Course Outcomes:

CO1. Understand and apply knowledge of key concepts of software testing, quality and testing tools.
CO2. Design test cases and Develop test suite, write test scripts, set environmental variables for carrying out the various levels of testing manually or automatically.
CO3. Manage software defects and risks within software project.
CO4. Understand software quality and software Engineering Standards

Reference Books:

1. Kshirsagar Naik and Priyadarshi Tripathy, Software Testing & Quality Assurance- Theory and Practice, Wiley Student edition
2. William E. Perry, Effective Methods for Software Testing, WILLEY, 3rd Edition
3. Alan C. Gillies, “Software Quality: Theory and Management”, International Thomson Computer Press, 1997.

4. M G Limaye, Software Testing, Tata McGraw-Hill Education, 2009

HSHS2003 ENTREPRENEURSHIP DEVELOPMENT (2-0-0)

Course Objectives:

1. To develop a knowledge on basic concepts of entrepreneurship.
2. To develop a knowledge on affecting parameters of entrepreneurship and it policies.
3. To create a knowledge on preparation of entrepreneurship methodology.
4. To get a knowledge on applications of entrepreneurship.
5. To know about effective management of entrepreneurship in small scale Industries.

Module - I:

Entrepreneurship: Concept of Entrepreneurship and intrapreneurship, Types of Entrepreneur, Nature and Importance, Entrepreneurial Motivation and Achievement, Entrepreneurial Personality & Traits and Entrepreneurial Skills.

Module - II:

Entrepreneurial Environment, Identification of Opportunities, Converting Business opportunities into reality. Start-ups and business incubation, Skill Development. Setting up a Small Enterprise. Issues relating to location, Environmental Problems and Industrial Policies and Regulations.

Module - III:

Basics of Accounting, Terms: Assets, Liabilities, Equity, Revenue, Expense, Working capital, Marketing Mix and STPHRM: Concepts and Function, Labour Laws- Factories Act, Organizational support services – Central and State Government, Incentives and Subsidies.

Module - IV:

Sickness of Small-Scale Industries, Causes and symptoms of sickness, cures of sickness, Role of Banks and Government in reviving sick industries.

Course Outcomes:

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

CO1: Apply the knowledge of entrepreneurship qualities and skills to startup a business.
CO2: Apply the knowledge of entrepreneurship policies to startup a business.
CO3: Prepare a feasibility report and evaluation criteria for an entrepreneurship.
CO4: Analyze marketing strategies of entrepreneurship.
CO5: Apply preventive measures to be followed for effective management of entrepreneurship.

Recommended Books:

1. Entrepreneurship Development and Management, Vasant Desai, HPH
2. Entrepreneurship Management, Bholanath Dutta, Excel Books
3. Entrepreneurial Development, Sangeeta Sharma, PHI
4. Entrepreneurship, Rajeev Roy, Oxford University Press

FOR ADMISSION BATCH 2024-25
MASTER IN COMPUTER APPLICATION
SECOND YEAR (FOURTH SEMESTER)

Sl. No.	Category	Course Code	Course	Contact Hrs. L-T-P	Credit	University Marks	Internal Evaluation
Subject (Theory)							
1.	PE	MCPE2013	Deep Learning	3-0-0	3	100	50
		MCPE2014	Distributed Systems				
		MCPE2015	Computer Graphics and Animation				
		MCPE2016	Software Project Management				
		MCPE2017	Network Security				
		-	**Any one Online Course of 25-40 Hours from NPTEL MOOC Pool from the specified List-1.**			-	-
`	PE	MCPE2018	Image Processing	3-0-0	3	100	50
		MCPE2019	Real-Time Systems				
		MCPE2020	Multimedia Technology				
		MCPE2021	Research Methodology and IPR				
		MCPE2022	Cyber Security and Cyber Laws				
		-	**Any one Online Course of 25-40 Hours from NPTEL MOOC Pool from the specified List-2.**			-	-
Subject (Practical / Sessional)							
3.	PSI	MCPS2202	Comprehensive Viva – Voce		2	-	100
4.	PSI	MCPS2203	Industrial / Research Project	0-0-16	8	-	400
Total				**6-0-16**	**16**	**200**	**600**

List-1		**List-2**	
Course Code	**Course**	**Course Code**	**Course**
MCNT2201	Mobile Computing	MCNT2211	Big-Data Analytics
MCNT2202	Introduction to Data Science	MCNT2212	Advanced Computer Networks
MCNT2203	Internet-of-Things	MCNT2213	Cloud Computing
MCNT2204	Wireless Sensor Networks.	MCNT2214	Simulation and Modelling
MCNT2205	Information System Design	MCNT2215	Cloud Computing
MCNT2206	Advanced Database Management Systems	MCNT2216	Distributed Operating System
MCNT2207	E-Commerce and ERP	MCNT2217	Management Information System
-		MCNT2218	Intelligent Data Analysis
-		MCNT2219	Computer Based Optimization Techniques

Note: Click here to view/download the syllabus of the subjects.

MCPE2013 DEEP LEARNING (3-0-0)

Module I

Fundamentals of Deep Networks – Defining Deep Learning, What Is Deep Learning? Common Architectural Principles of Deep Networks: Parameters, Layers, Activation Functions, Loss Functions, Hyper parameters

Module II

Building Blocks of Deep Networks – Restricted Boltzmann Machine, Autoencoders, Variational Autoencoders. Major Architectures of Deep Networks: Unsupervised pretrained networks, Deep Belief Networks, Generative Adversarial Networks.

Module III

Convolutional Neural Networks (CNNs) – The Convolution Operation, Motivation, Pooling, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuro-scientific Basis for Convolutional Networks, Applications.

Module IV

Sequence Modeling – Recurrent and Recursive Nets – Unfolding Computational Graphs, Recurrent Neural Networks, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Long Short-Term Memory and Other Gated RNNs, Applications

Deep Learning applications – Computer Vision, Speech Recognition, Natural Language Processing, Other Applications.

Course Outcomes:

At the end of the course, the student will be able to:

1. Understand the fundamental concepts of Deep learning.
2. Apply concepts of deep networks to analyze various architectures.
3. Apply deep learning models to build applications in various domains.
4. Analyze the given problem and apply suitable deep learning algorithm.

Text Books

1. Josh Patterson and Adam Gibson, — Deep learning: A practitioner's approachll, O'Reilly Media, First Edition, 2017. 2.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, — Deep Learningll, MIT Press, 2016.

Reference Books

1. Deep learning, Amit Kumar Das,Saptarsi Goswami, Pabitra Mitra, Amlan Chakrabarti, First Edition,2021, Pearson
2. Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms, Nikhil Buduma, O_Reilly, Shroff Publishers, 2019.
3. Deep learning Cook Book, Practical recipes to get started Quickly, Douwe Osinga, O_Reilly, Shroff Publishers, 2019.
4. Deep learning Illustrated A Visual Interactive Guide to Artificial Intelligence,Jon Krohn,Grant Beyleveld,Aglae Bassens,First Edition,2020, Pearson.

MCPE2014 DISTRIBUTED SYSTEMS (3-0-0)

Course Objectives

The objective of the course is to:

- To have a broad and up-to-date coverage of the principles and practice in the area of Distributed Systems.
- To understand the heterogeneous systems such as computers, mobile phones, other devices and Internet) and their functionalities.

Module – I

Definition of a distributed systems, Examples, Resource sharing and the Web, Challenges, System models, Architectural and fundamental models, Networking Interprocess communication, External data representation and marshalling, Client-server and Group communication.

Module – II

Distributed objects and remote invocation, Communication between distributed objects, Remote procedure call, Events and notifications - The operating system layer, Protection, Processes and Threads, Communication and invocation, OS Architecture. Security techniques, Cryptographic algorithms, Access control, Digital signatures, Cryptography pragmatics, Needham-Schroeder, Kerberos, Securing electronics transaction, IEEE 802.11 WiFi.

Module – III

Operating System Issues: Distributed file systems - Name services, Domain name system, Directory and discovery services, Peer to peer systems, Napster file sharing system, Peer to peer middleware routing overlays – Clocks, Events and process states Clock Synchronization - Logical clocks Global states - Distributed debugging - Distributed mutual exclusion - Elections - Multicast communication.

Module – IV

Distributed Transaction Processing: Transactions - Nested transactions - Locks - Optimistic concurrency control - Timestamp ordering - Flat and nested distributed transactions - Atomic commit protocols - Concurrency control in distributed transactions - Distributed deadlocks - Transaction recovery - Overview of replication, Distributed shared memory and Web services. Synchronous network model - Algorithms: leader election, maximal independent set, Asynchronous system model: I/O automata, operations on automata, fairness - Asynchronous shared memory model - Mutual exclusion: model, the problem, stronger conditions, lockout-free mutual exclusion algorithms, lower bound on the number of registers - Asynchronous network model - Asynchronous network algorithms: leader election in a ring and an arbitrary network.

Course Outcomes:

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

- Developing skill set in developing a distributed system.
- Designing and evaluation of algorithms and protocols for various distributed systems.

Textbooks:

George Coulouris, Jean Dollimore, and Tim Kindberg, " Distributed Systems Concepts and Design", 5th ed., Pearson Education, 2011.

Andrew S. Tanenbaum, Maartenvan Steen, "Distributed Systems Principles and Paradigms", 2nd ed., Pearson Education, 2006.

Nancy A. Lynch, "Distributed Algorithms", Hardcourt Asia Pvt. Ltd., Morgan Kaufmann, 2000.

MCPE2015 COMPUTER GRAPHICS AND MULTIMEDIA (3-0-0)

Course Objectives

- This course aims at teaching students about algorithms involved in 2D and 3D computer graphics and animation.
- It gives a clear foundation of the graphic operations performed on 2D objects.
- It enables the students to create 3D realistic objects and generate 2D, 3D animations.

Module 1

An Introduction Graphics System : Computer Graphics and Its Types, Application of computer graphics, Graphics Systems : Video Display Devices, Raster Scan Systems, Random Scan Systems, Graphics Monitors and Work Stations, Input Devices, Hard Copy Devices, Graphics Software.

Module 2

Output Primitives and Attributes of Output Primitives : Output Primitive Points and Lines,Line Drawing Algorithms, Circle Generating Algorithms, Scan-Line Polygon Fill Algorithm, Inside-Outside tests, Boundary-Fill Algorithm, Flood Fill Algorithm, Cell Array, Character Generation, Attributes of Output Primitives : Line Attributes, Color and Grayscale Levels, Area fill Attributes, Character Attributes, Bundled Attributes, Anti-aliasing.

Module 3

Two-dimensional Geometric Transformations : Basic Transformations, Matrix Representation and Homogeneous Coordinates, Composite Transformations,Reflection and Shearing. Two-Dimension Viewing : The viewing Pipeline, Window to view port coordinate transformation, Clipping Operations, Point Clipping, Line Clipping,Polygon Clipping, Text Clipping, Exterior Clipping. Three-Dimensional Concepts : Three Dimensional Display Methods, 3D Transformations, Parallel Projection and Perspective Projection.

Module 4

Multimedia : Introduction to Multimedia : Classification of Multimedia, Multimedia Software, Components of Multimedia – Audio : Analog to Digital conversion, sound card fundamentals, Audio play backing and recording Video, Text : Hypertext, Hyper media and Hyper Graphics, Graphics and Animation :Principle of animation, Types of Animation, deformation,character of animation,Key frame Vs. Procedural Animation, Methods of Controlling Animation, Morphing, Authoring Process and Tools.

Course Outcomes

CO1: Understand the basic shapes, 2D and 3D viewing in computer graphics.
CO2: Perform geometric transformations on objects.
CO3: Apply graphics algorithms for rendering objects and surfaces.
CO4: Create 3D objects in the graphics environment and render the scene using open-source tools.

Text Books:

1. Donald Hearn & M. Pauline Baker, “Computer Graphics with OpenGL”, Third Edition, 2004, Pearson Education, Inc. New Delhi.
2. Ze-NianLi and Mark S. Drew, “Fundamentals of Multimedia”, First Edition, 2004, PHI Learning Pvt. Ltd., New Delhi.

MCPE2016 SOTWARE PROJECT MANAGEMENT (3-0-0)

Course Objectives:

- This course describes the key aspects of a software project.
- It introduces the basic principles of Engineering Software Projects. Most, if not all, student's complete projects as part of assignments in various courses undertaken. These projects range in size, subject and complexity but there are basic project essentials that need to be understood and practiced for successful team project outcomes.
- The course provides an understanding of the purpose, methods and benefits of process management by exposing the student to the concepts, practices, processes, tools and techniques used in process management for software development.

Module 1 (8 Hour)

PROJECT CONCEPTS AND ITS MANAGEMENT: Project life cycle models, ISO 9001 model, Capability Maturity Model, Project Planning, Project tracking, Project closure. Software Management Process Framework: Phases, Artifacts, Workflows, Checkpoints, Project Organization and Responsibilities.

Module 2 (6 Hour)

COST ESTIMATION: Problems in Software Estimation, Algorithmic Cost Estimation Process, Function Points, SLIM (Software Life cycle Management), COCOMO II (Constructive Cost Model), Estimating Web Application Development.

Module 3 (6 Hour)

SOFTWARE QUALITY MANAGEMENT: Software Quality Factors, Software Quality Components, Software Quality Plan, Software Quality Metrics, Software Quality Costs, Software Quality Assurance Standard, Certification and Assessment.

SOFTWARE MANAGEMENT AND METRICS: Software Configuration Management

Module 4 (10 Hour)

Risk Management: Risk Assessment: Identification / Analysis / Prioritization – Risk Control: Planning / Resolution / Monitoring, Failure Mode and Effects Analysis (FMEA), Defect Management, Cost Management. PROJECT EVALUATION AND EMERGING TRENDS: Strategic Assessment, Technical Assessment, Cost Benefit Analysis, Cash Flow Forecasting, Cost Benefit Evaluation Technique, Software Effort Estimation.

Course Outcome:

1. To understand Software Project Models and Software Management Concepts.
2. To understand the various methods of Cost Estimation.
3. To Study about Software Quality Management.
4. To understand Software Risk management and Project Evaluation.

BOOKS

1. Roger S.Pressman, "Software Engineering- A Practitioner's Approach", 7th Edition ,McGraw Hill, 2010.
2. Daniel Galin, "Software Quality Assurance: from Theory to Implementation", AddisonWesley, 2003.
3. Pankaj Jalote, "Software Project Management in Practice", Pearson, 2002.

MCPE2017 NETWORK SECURITY (3-0-0)

Course Objective:
This course provides an essential study of network security issues and methods in networking systems.

Module 1: Introduction to Network security, Model for Network security, Model for Network access security, Real-time Communication Security: Introduction to TCP/IP protocol stack, Implementation layers for security protocols and implications, IPsec: AH and ESP, IPsec: IKE.

Module 2: Media- Based-Vulnerabilities, Network Device Vulnerabilities, Back Doors, Denial of Service (DoS), Spoofing, Man-in-the-Middle, and replay, Protocol -Based Attacks, DNS Attack, DNS Spoofing, DNS Poisoning, ARP Poisoning, TCP/IP Hijacking, Virtual LAN (VLAN), Demilitarization Zone (DMZ) , Network Access Control (NAC), Proxy Server, Honey Pot, Network Intrusion Detection Systems (NIDS) and Host Network Intrusion Prevention Systems Protocol Analyzers, Internet Content Filters, Integrated Network Security Hardware.

Module 3: Authentication: Kerberos, X.509 Authentication Service, Scanning: Port Scanning, Port Knocking-Advantages, Disadvantages. Peer-to-peer security. Electronic Mail Security: Distribution lists, Establishing keys, Privacy, source authentication, message integrity, non-repudiation, proof of submission, proof of delivery, message flow confidentiality, anonymity, Pretty Good Privacy (PGP)

Module 4: Firewalls and Web Security: Packet filters, Application-level gateways, Encrypted tunnels, Cookies. Assignments on the latest network security techniques, Security applications in wireless sensor networks and wireless Communication networks.

Course Outcome:
Students can get knowledge about the network security, implementation and requirements after the successful completion of the course

Text Book:
William Stallings, “Cryptography and Network Security – Principles and Practices”, Prentice Hall of India, Third Edition, 2003.

References:

1. Saadat Malik, Saadat Malik. “Network Security Principles and Practices (CCIE Professional Development)”. Pearson Education. 2002. (ISBN: 1587050250).
2. Cisco: Fundamentals of Network Security Companion Guide (Cisco Networking Academy Program).
3. Mark Ciampa “Security + Guide to Network Security Fundamentals/Edition 3” Cengage Learning publisher, ISBN-10: 1428340661, ISBN-13: 978-1428340664.

MCPE2018 IMAGE PROCESSING (3-0-0)

Course Objectives

- To learn the fundamentals of image processing and various transformations applied in an image.
- To learn image enhancement techniques.
- To understand image restoration.
- To impart knowledge on different compression techniques.

Module I

Introduction: Introduction to Digital Image Processing, Characteristics of Digital Image, Basic relationship between pixels, Image sampling and quantization, Color models, Basic Geometric Transformations.

Module II

Filtering in the Frequency Domain: preliminary concepts,2D DFT and its properties, basic Filtering in the Frequency Domain, image smoothing and sharpening.

Image Restoration and Reconstruction: Image restoration/degradation model, noise models, restoration in the presence of noise only, estimating the degradation function.

Module III

Color Image Processing: Color Models, Color Transformation, Wavelets and Multi-resolution processing: multiresolution expansions, wavelet transforms in one and two dimension.

Module IV

Image Compression: Fundamentals, Error-free compression: variable length coding, LZW coding. Lossy compression: lossy predictive coding

Morphological Image Processing: Erosion and Dilation, opening and closing.

Course Outcomes: Upon completion of this course, the students will be able to:

CO1 Compare various image enhancement techniques
CO2 Construct the image from the degraded image
CO3 Analyze and use appropriate image compression techniques
CO4 Suggest proper image feature for classification problems
CO5 Apply the theory and algorithms that are widely used in digital image processing

Textbooks:

1. Rafael C. Gonzalez, Richard E Woods, “Digital Image Processing”, Fourth Edition, Pearson Education, 2018.

Reference Books:

1. A.K. Jain, “Fundamentals of Digital Image Processing”, PHI, New Delhi, 1995.
2. S E Umbaugh, “Digital Image Processing and Analysis: Application with MATLAB and CVIP Tools”,Third Edition, Taylor & Francis, CRC Press, 2018.
3. Frank Y. Shih, “Image Processing and Pattern Recognition”, Wiley – IEEE Press, 2010.

MCPE2019 REAL-TIME SYSTEMS (3-0-0)

Module I: Fundamentals of Real-Time Systems
Definition and characteristics of Real-Time Systems, Hard vs Soft Real-Time Systems, Real-Time workloads and task types, Task parameters: WCET, deadlines, release time, period, jitter, Real-Time system design issues, Performance metrics, Modeling Real-Time systems, Real-Time taxonomy

Module II
Preemptive and Non-Preemptive scheduling, Clock-driven scheduling,Table-driven scheduling,
Priority-driven scheduling: Rate Monotonic Scheduling (RMS), Deadline Monotonic Scheduling, EDF Scheduling, Schedulability analysis, Multiprocessor scheduling basics, Priority inversion & priority inheritance protocol.

Module III
Inter-task communication models: Message-based communication, Shared memory communication, Mutual exclusion in real-time systems, Priority ceiling protocol (PCP), Deadlock, starvation, and bounded blocking, Clock synchronization — physical and logical clocks, Communication delays and timing constraints

Module IV
Real-Time Memory, OS Support & Case Studies: Real-Time Operating Systems basics, Real-Time Kernel requirements, Task control blocks, Interrupt handling, Timing services, Real-Time I/O handling, DMA control, Real-Time Memory Management: Contiguous allocation, Paging issues, Fragmentation, Real-Time OS case study examples: VxWorks, POSIX real-time extensions

Course Outcomes:
At the end of the course, the student will be able to:
1. Understand the characteristics, constraints, and modeling of real-time systems.
2. Ability to analyze and determine schedulability using classical algorithms.
3. Understand real-time resource sharing, synchronization, and communication models.
4. Learn OS-level support, memory issues, interrupt management, and system-level integration.

Text Books
1. Real-Time Systems: Theory and Practice, *Rajib Mall, Pearson Education*.

Reference Books
1. Real-Time Systems, Jane W. Liu, Pearson
2. Real-Time Systems, Krishna & Shin, McGraw-Hill
3. Real-Time Concepts for Embedded Systems, Qing Li & Caroline Yao, Elsevier/Morgan Kaufmann

MCPE2020 MULTIMEDIA TECHNOLOGY (3-0-0)

Course Objectives:

The objective of the course is to:

- Introduce various aspects of multimedia components like Images, audio, sound and computer graphics.
- Provide hands-on training in the use of Image Editing tools with software.
- Gain hands-on experience through a series of practical skill building tasks and exercises.

Module I:

Multimedia- Definitions, Use of Multimedia, Introduction To Making Multimedia: The Stages of a Multimedia Project, Need, Creativity, Organization, Communication. Text-About Fonts and Faces, Cases, Serif Versus Sans Serif, Using Text in Multimedia, Computers and Text, Font editing and design tools, Hypermedia and Hypertext. Designing for the World Wide Web-Developing for the Web, Text for the Web, Images for the Web, Sound for the Web, Animation for the Web.

Module II:

Images: Making Still Images, Bitmaps, Vector Drawing, 3-D Drawing and Rendering, Color, Understanding Natural Light and Color, Computerized Color, Color Palettes, Image File Formats.

Module III:

Image Editing software: selection tools, working with layers, masks and channels, correcting and enhancing photographs, typographic design and vector drawing, working with 3D images, producing files for the web.

Module IV:

Animation-Principles of Animation, Animation by Computer, Animation Techniques, Animation File Formats, Making Animations that Work, a Rolling Ball, a Bouncing Ball, Creating an Animated Scene; Installing and using animation software (Flash or Blender), adding animation, tweening, morphing; Interactive navigation-working with sound and video.

Course Outcomes:

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

CO1 Critically analyze the key components of multimedia technologies including text, graphics, voice, video and animation and the broad principles associated with multimedia concepts used in computer graphics.

CO2 Create vector and typographic designs and apply masking effect to images and create an animation using the tools panel.

CO3 Design an image using image editing tools and apply effectively.

CO4 Create animated sequence with titles applying the principles of animation.

CO5 Apply acquired knowledge in the field of multimedia for the good cause like advertisement in practice and independently continue to expand knowledge in this field.

Textbook:

Tay Vaughan,Multimedia: Making it Work (Seventh Edition) (2010). McGraw Hill.

MCPE2021 RESEARCH METHODOLOGY AND IPR (3-0-0)

Course Overview

This course provides foundational and advanced knowledge on research methodology and intellectual property rights. It trains students in scientific research processes, data analysis, research ethics, and protection of intellectual assets.

Course Objectives

- Understand the fundamentals and process of scientific research.
- Develop skills in research design, data collection, and analysis.
- Gain exposure to various statistical tools used in hypothesis testing.
- Understand the concepts of IPR including patents, trademarks, copyrights, and designs.

Module 1: Introduction to Research Methodology
Definition, objectives, and significance of research.
Types of research: Qualitative, Quantitative, Fundamental, Applied.
Research ethics and plagiarism.
Literature review, identification of research gaps, and citation styles.

Module 2: Research Design and Hypothesis Formulation
Research design: need, features, and components.
Variables: dependent, independent, control variables.
Experimental designs: CRD, RBD, Latin Square, Factorial Design.
Hypothesis: formulation, types, and characteristics.

Module 3: Data Collection and Statistical Analysis
Primary and secondary data collection methods.
Sampling: need, principles, and sampling techniques.
Statistical analysis: measures, tests (mean, variance, chi-square testing).
Hypothesis testing: Type I & II errors, level of significance.

Module 4: Intellectual Property Rights
Introduction to IPR and its need in academia and industry.
Patents: types, criteria, filing procedures, rights and limitations.
Trademarks and industrial designs: registration, protection, infringement.
Copyright: scope, rights, limitations, infringement and remedies.

Suggested Activities

Writing a research proposal.
Literature survey and analysis of research papers.
Sampling and hypothesis testing exercises.
Case studies on IPR violations.

Textbook

1. C. R. Kothari, “Research Methodology: Methods and Techniques”, New Age International Publishers.

Reference Books

1. N. Pandey & K. Dharni, “Intellectual Property Rights”, PHI Learning.
2. Ranjit Kumar, “Research Methodology: A Step-by-Step Guide”, SAGE Publications.
3. Neeraj Pandey, “Basics of Intellectual Property Rights”, PHI Learning.

MPE2022 CYBER SECURITY & CYBER LAWS (3-0-0)

Course Objectives:

The objectives of the course are to:

- To understand basic cyber security concepts, network fundamentals, and cryptographic techniques.
- To identify common cyber threats, attacks, and system vulnerabilities.
- To learn essential defense and mitigation methods used to protect systems.
- To gain foundational skills in cyber forensics, including data acquisition and analysis.
- To understand cyber laws, the IT Act 2000, and legal and ethical issues related to emerging technologies.

Module I

Cyber Security Fundamentals: Network and security concepts, Information Assurance fundamentals, Basic cryptography, Symmetric and Asymmetric encryption, Public key encryption, Domain Name System (DNS), Firewalls, Virtualization, and Radio-Frequency Identification (RFID).

Module II

Threats and Vulnerabilities: Types of threats: Malware, Phishing, Ransomware, Adware, Spyware, Trojans, Viruses, Worms, Man-in-the-Middle attacks, Scareware, Distributed Denial-of-Service (DDoS) attacks, Rootkits, and Click-fraud. Vulnerabilities-Shellcode, Integer overflow vulnerabilities, Buffer overflows, and SQL injection.

Defense and Mitigation Measures: Anti-virus scanners, static and dynamic analysis methods, anti-analysis techniques, detecting and preventing obfuscation, and identifying run-time attacks.

Module III

Cyber Forensics: Memory and network forensics for Windows and Linux internals, forensic tools, OS hardening, RAM dump analysis, data acquisition and extraction, volatility analysis for OS artifacts and related information, Automated malicious code analysis.

Module IV

Cyber Laws and Legal Framework: Cybercrime and the global legal landscape, IT Act 2000 and its amendments, limitations of the IT Act 2000, cybercrimes and punishments, legal and ethical aspects related to new technologies: AI/ML, IoT, Blockchain, Darknet, and Social Media, cyber laws of other countries, and relevant case studies.

Course Outcomes:

At the end of the course, the student will be able to:

1. Understand the fundamentals of cyber security.
2. Identify and evaluate cyber security threats and vulnerabilities.
3. Apply suitable security techniques and policies to protect systems and information.
4. Recognize common design trade-offs in developing secure information systems.
5. Use cyber laws and standards to improve information security and system protection.

Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives - N. K. Ghosh, McGraw-Hill.
2. Cryptography and Network Security: Principles and Practice - William Stallings, Pearson.
3. Computer Security: Principles and Practice - William Stallings & Lawrie Brown, Pearson.

Reference Books:

1. Practical Malware Analysis - Michael Sikorski & Andrew Honig, No Starch Press.
2. Incident Response & Computer Forensics - Jason Luttgens, Matthew Pepe & Kevin Mandia, McGraw-Hill.
3. The Art of Memory Forensics - Michael Hale Ligh, Andrew Case, Jamie Levy & AAron Walters, Wiley.
4. Cyber Law in India - Farooq Ahmad.
5. Network Security Essentials - William Stallings, Pearson.