COIMBATORE INSTITUTE OF TECHNOLOGY

(Government Aided Autonomous Institution Affiliated to Anna University, Chennai)

COIMBATORE - 641 014, TAMILNADU, INDIA

DIAMOND JUBILEE

(1956 - 2016)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M.E. COMPUTER SCIENCE AND ENGINEERING

Curriculum and Syllabi

Under Choice Based Credit System

(For the students admitted during 2019 - 2020 and onwards)

INDEX

COIMBATORE INSTITUTE OF TECHNOLOGY

(Government Aided Autonomous Institution Affiliated to Anna University, Chennai)

VISION AND MISSION OF THE INSTITUTE

VISION

The Institute strives to inculcate a sound knowledge in Engineering along with realized social responsibilities to enable its students to combat the current and impending challenges faced by our country and to extend their expertise to the global arena.

MISSION

The Mission of the institute is to impart high quality education and training to its students to make them world-class Engineers with a foresight to the changes and problems and pioneers to offer innovative solutions to benefit the nation and the world at large.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
COIMBATORE INSTITUTE OF TECHNOLOGY

VISION AND MISSION OF THE DEPARTMENT

VISION

To evolve as Centre of Excellence in teaching, learning, research and consultancy, integrating computer and information sciences with engineering concepts to develop products and services for the benefits of the industry and society at large.

MISSION

Mission 1 : Imparting value based technical education and entrepreneurial skills to the graduates through state of art infrastructure

Mission 2 : Educating students towards the design and development of intelligent products and services meeting global demands and standards

Mission 3 : Promoting collaborative learning and research with industry, government and international organizations for continuous knowledge transfer and enhancement

Mission 4 : Developing globally competent engineers capable of providing secure and " Out-of-the Box" computing and information technology solutions

Mission 5 : Enabling the graduates to adapt to the rapidly changing technology with strong fundamentals.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M.E. COMPUTER SCIENCE AND ENGINEERING

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1 : Build competent professionals rendering expertise to the multi-disciplinary projects for meeting the industrial and societal needs in an effective manner.

PEO2 : Create sustained learners to bring out novel ideas in addressing the research issues and challenges.

PEO3 : Develop professional skills in graduates to prepare them for immediate employment and for lifelong learning in advanced areas of computer science and related fields.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M.E. COMPUTER SCIENCE AND ENGINEERING

PROGRAMME OUTCOMES (POs)

PO1 : An ability to independently carry out research /investigation and development work to solve Practical problems.

PO2 : An ability to write and present a substantial technical report/document.

PO3 : Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M.E. COMPUTER SCIENCE AND ENGINEERING

SUBJECTS OF STUDY

Semester I

Course Code	Course Name	Category	L	T	P	C
19MCS11	Graph theory and Linear algebra	FC	3	0	0	3
19MCS12	Design and Analysis of Algorithms	PC	3	1	0	4
19MCS13	Software Engineering Methodologies	PC	3	1	0	4
19MCS14	Artificial Intelligence	PC	3	0	0	3
	Professional Elective I	PE	3	0	0	3
19MCS15	Artificial Intelligence Laboratory	LC	0	0	4	2
19MCS16	Design and Analysis of Algorithms Laboratory	LC	0	0	4	2
	TOTAL CREDITS		**15**	**2**	**8**	**21**

Semester II

Course Code	Course Name	Category	L	T	P	C
19MCS21	Probability and Statistics	FC	3	1	0	4
19MCS22	Machine Learning	PC	3	0	0	3
19MCS23	Database Engineering	PC	3	1	0	4
	Professional Elective -II	PE	3	0	0	3
	Professional Elective -III	PE	3	0	0	3
19MCS24	Machine Learning Laboratory	LC	0	0	4	2
19MCS25	Mini Project	EEC	0	0	6	3
	TOTAL CREDITS		**15**	**2**	**10**	**22**

Semester III

Course Code	Course Name	Category	L	T	P	C
	Professional Elective -IV	PE	3	0	0	3
	Professional Elective -V	PE	3	0	0	3
	Open Elective*	OE	3	0	0	3
	Python Programming	EEC	0	0	2	1
	TOTAL CREDITS		**9**	**0**	**2**	**10**

* Open Elective can be opted from same stream or from other streams.

Semester IV

Course Code	Course Name	Category	L	T	P	C
19MCS41	Project and Viva-Voce	EEC	0	0	36	18
	TOTAL CREDITS		**0**	**0**	**36**	**18**

Total Credits : 71

FOUNDATION COURSE (FC)

Course Code	Course Name	L	T	P	C	Semester
19MCS11	Graph theory and Linear algebra	3	0	0	3	1
19MCS21	Probability and Statistics	3	1	0	4	2

PROFESSIONAL CORE (PC)

Course Code	Course Name	L	T	P	C	Semester
19MCS12	Design and Analysis of Algorithms	3	1	0	4	1
19MCS13	Software Engineering Methodologies	3	1	0	4	1
19MCS14	Artificial Intelligence	3	0	0	3	1
19MCS22	Machine Learning	3	0	0	3	2
19MCS23	Database Engineering	3	1	0	4	2

LABORATORY COURSE (LC)

Course Code	Course Name	L	T	P	C	Semester
19MCS15	Artificial Intelligence Laboratory	0	0	4	2	1
19MCS16	Design and Analysis of Algorithms Laboratory	0	0	4	2	1
19MCS24	Machine Learning Laboratory	0	0	4	2	2

EMPLOYABILITY ENHANCEMENT COURSE (EEC)

Course Code	Course Name	L	T	P	C	Semester
19MCS25	Mini Project	0	0	6	3	2
19MCS41	Project	0	0	36	18	4
19MCSOC01	Python Programming	0	0	2	1	3

PROFESSIONAL ELECTIVES (PE)

Course Code	Course Name	L	T	P	C
19MCSE01	Cryptography and Network Security	3	0	0	3
19MCSE02	High Performance Computing	3	0	0	3
19MCSE03	Neural Networks	3	0	0	3
19MCSE04	Open Source systems	3	0	0	3
19MCSE05	Approximation Algorithm	3	0	3	3
19MCSE06	Internet Technologies	3	0	0	3
19MCSE07	Data Warehousing and Data Mining	3	0	0	3
19MCSE08	Business Intelligence	3	0	0	3
19MCSE09	Cloud Computing	3	0	0	3
19MCSE10	Information Security	3	0	0	3
19MCSE11	Knowledge based AI	3	0	0	3
19MCSE12	Software Metrics and Measurements	3	0	0	3
19MCSE13	Robot Human Interaction	3	0	0	3
19MCSE14	Big Data Analytics	3	0	0	3
19MCSE15	Deep Learning	3	0	0	3
19MCSE16	Bio informatics	3	0	0	3
19MCSE17	Internet of Things	3	0	0	3
19MCSE18	Web Engineering	3	0	0	3
19MCSE19	Parallel Algorithms	3	0	0	3
19MCSE20	Computer Vision	3	0	0	3
19MCSE21	Case Based Reasoning	3	0	0	3
19MCSE22	Multimedia Systems	3	0	0	3
19MCSE23	Ad Hoc Networks	3	0	0	3
19MCSE24	Wireless Sensor Networks	3	0	0	3
19MCSE25	Secure Software Engineering	3	0	0	3
19MCSE26	Service Oriented Architecture	3	0	0	3
19MCSE27	Human Computer Interaction	3	0	0	3
19MCSE28	Social Network Analysis	3	0	0	3
19MCSE29	Advanced cryptography and practices	3	0	0	3
19MCSE30	Blockchain design and their use cases	3	0	0	3

OPEN ELECTIVES (OE)

Course Code	Course Name	L	T	P	C
19MCSOE01	Optimization Techniques	3	0	0	3
19MCSOE02	Mobile Applications and Services	3	0	0	3
19MCSOE03	Soft Computing	3	0	0	3
19MCSOE04	Digital Forensics	3	0	0	3
19MCSOE05	Data Science	3	0	0	3
19MCSOE06	Introduction to Intelligent Systems	3	0	0	3

S.No.	Course Category	Credits as per semester				Category Wise Credits distribution
		I	II	III	IV	
1	FC	3	4	-	-	7
2	PC	11	7	-	-	18
3	LC	4	2	-	-	6
4	PE	3	6	6	-	15
5	OE	-	-	3	-	3
6	EEC	-	3	1	18	22
	Semester Wise Credits distribution	**21**	**22**	**10**	**18**	**71**

19MCS11 - GRAPH THEORY AND LINEAR ALGEBRA

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

The students completing the course will have

CO1 *: An insight in to the graphs in modern engineering fields.*

CO2 *: The ability to apply graph theory principles in analysing transportation networking models.*

CO3 *: An understanding on the Planar graphs and colouring on the living environment and suggest relevant interventions.*

CO4 *: To incorporate the concepts of linear systems and Matrices required for solving computer engineering problems.*

CO5 *: To familiarize the student with vector spaces and inner product spaces.*

GRAPHS

Graphs - Introduction - Isomorphism - Sub graphs - Walks, Paths, Circuits - Directed graphs - Types of directed graphs - Digraphs and binary relations - Directed paths and connectedness - Euler graphs - Hamiltonian paths and circuits - Chinese Postman Problem. **(9)**

TREES AND TRANSPORTATION NETWORKS

Connectedness - Components Trees - Properties of trees - Distance and centres in tree - Rooted and binary trees. Spanning trees - Fundamental circuits - Spanning trees in a weighted graph - cut sets - Properties of cut set - All cut sets - Fundamental circuits and cut sets - Connectivity and separability - Network flows - Maximal flow, Max-flow-Min Cut Theorem -Ford Fulkerson's rule. **(9)**

PLANAR GRAPHS AND COLORING

Chromatic number - Chromatic partitioning - Chromatic polynomial - Matching - Covering - Four color problem - Planar graphs - Different representation of a planar graph-Euler formula. **(9)**

LINEAR SYSTEMS AND MATRICES

Introduction-Linear Equations- Applications of Linear Systems - Gaussian Elimination Method- Gauss-Jordon Method, Linear Transformations, Matrix Inversion by Gauss Jacobian Method. **(9)**

VECTOR SPACES AND INNER PRODUCT SPACES

Vector Spaces-Subspaces, Null Space, Rank, Basis and Dimension, Change of Basis, Invariant Subspaces. Norms and Inner Product Spaces- Vector Norms, Matrix Norms, Inner Product Spaces, Orthogonal Vectors, Gram-Schmidt Procedure. **(9)**

TOTAL : 45

REFERENCES

1. *Narsingh Deo, "Graph Theory: With Application to Engineering and Computer Science", PHI, First Edition, 2011.*
2. *Clark J. and Holton D.A, "A First Look at Graph Theory", Allied Publishers, First Edition, 1995.*
3. *F. Harary, "Graph Theory", Narosa Publishing House, First Edition, 2001.*
4. *David C. Lay, Steven R. Lay and Judi J.McDonald, "Linear Algebra and Its Applications", Pearson, Fifth Edition, 2015*
5. *Kenneth M Hoffman and Ray Kunze, "Linear Algebra", Pearson, Second Edition, 1971.*

19MCS12 - DESIGN AND ANALYSIS OF ALGORITHMS

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Analyse the asymptotic performance of algorithms.*

CO2 : *Demonstrate a familiarity with major algorithms and data structures.*

CO3 : *Compare between different data structures. Pick an appropriate data structure for a design situation.*

CO4 : *Apply important algorithmic design paradigms and methods of analysis.*

ALGORITHM ANALYSIS

Algorithm -Analysis of Complexity- Asymptotic Notations- Mathematical Analysis of Recursive and Non Recursive Algorithms- P, NP, NP-hard and NP-Complete problems and Examples. **(7)**

DIVIDE AND CONQUER

Methodology - Finding Maximum and Minimum Element - Quick sort - Merge sort - Matrix multiplication -Convex Hull. **(8)**

GREEDY METHOD

Greedy Strategy -Bubble sort-Knapsack Problem - Minimum Spanning Trees - Single Source Shortest Path Method -Huffman Trees. **(7)**

DYNAMIC PROGRAMMING

Principle of Optimality - Knapsack Problem (Dynamic Programming Approach) - All Pairs Shortest Path - Optimal Binary Search Tree - Multistage Graphs. **(8)**

BACKTRACKING

State Space Tree - Knapsack Problem (Backtracking Approach) - The Eight Queens Problem - Sum of Subset Problem - Graph Colouring. **(7)**

BRANCH AND BOUND

Bounding Functions - 0/1 Knapsack Problem (Branch and Bound Approach) - Travelling Sales Person Problem - Assignment Problem **(8)**

TOTAL : 45 + 15 = 60

REFERENCES

1. *Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", MIT Press, England, 2009*
2. *Anany Levitin, "Introduction to the Design & Analysis of Algorithms, Prentice Hall of India, Pearson Education", New Delhi, 2011.*
3. *Steven S. Skiena, "The Algorithm Design Manual", Springer Publisher, 2nd Edition, 2012.*
4. *Jon Kleinberg and Eva Tardos, "Algorithm Design", Pearson Education, 1st Edition, 2006.*

19MCS13 - SOFTWARE ENGINEERING METHODOLOGIES

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Ability to understand, define and document user requirements*

CO2 : *Selection and Application of appropriate software design, development Methodologies and testing techniques.*

CO3 : *Ability to perform estimations, project scheduling and monitoring activities.*

CO4 : *Knowledge on configuration management, Quality Assurance Activities and Quality Standards.*

SOFTWARE PROCESS AND PROCESS MODELS

Introduction - Software Engineering Practice - Software process: A Generic Process Model - Prescriptive Process models - Unified Process.

Agile Development : Agile process - Extreme Programming, Scrum, Dynamic Systems Development Method (DSDM), Lean Software Development. Process Assessment and Improvement, Process Framework - CMM & CMMI maturity Models. **(8)**

REQUIREMENTS ENGINEERING

Requirements Engineering- Identifying stake holders-Multiple Viewpoints-Eliciting Requirements- Developing Use Cases-Building Requirements Model-Negotiating requirements-validating requirements. Requirements specification: Desirable characteristics and Components of a SRS -Structure of a SRS document. **(5)**

SOFTWARE ARCHITECTURE AND DESIGN

Software Architecture : Role of software architecture- Architectural views-Architectural Styles- Documenting architectural design. Software Design: Design Concepts -Abstraction- Modularity-Cohesion- Coupling-Open closed principle. Function Oriented Design: Dataflow diagrams & Structured charts- Structured Design Methodology. Object Oriented design: Objects and classes -Unified Modeling language (UML)- Design Methodology.

Detailed Design : Logic/Algorithm Design-State modelling of classes-Verification-Metrics.

User Interface Design : The Golden Rules-User Interface Analysis and Design- Interface Analysis- Interface Design Steps-Web App Interface Design. **(11)**

SOFTWARE TESTING

A strategic approach to software testing : Verification & Validation-Software testing Strategy Big picture- Test Strategies for conventional software: Unit testing-Integration testing. Test Strategies for OO software: Unit testing and Integration testing in the OO context. Test Strategies for Web Apps- Validation testing: Criteria-Alpha and Beta testing. System testing: Recovery test-Security test- Stress test-Performance test-deployment test and Regression testing.

Black Box Testing : Equivalence - Boundary Value - Cause effect and State based testing.

White box testing techniques: Control Flow based criteria-statement coverage, branch and condition coverage- Path testing-Data Flow testing and Mutation testing. **(9)**

MANAGING SOFTWARE PROJECTS

Software Project estimation-Decomposition techniques: Software sizing-problem based estimation- LOC based estimation-FP based estimation-Process based estimation-Empirical estimation models: COCOMO.

Project Scheduling : Basic principles-Defining the task set-Scheduling-Work Break down Structure- Time Line Charts-Tracking the Schedule. **(6)**

QUALITY MANAGEMENT & ASSURANCE

Software Configuration Management- Elements-baselines-configuration items-SCM Process.

Software Quality : McCall and ISO 9126 quality factors-Cost of quality-QC and QA-achieving software quality.

Software Quality Assurance : Elements of SQA-SQA tasks, Goals and Metrics-SQA Plan. Software Reliability-ISO 9000 Quality Standard-Informal and Formal Technical Reviews- CASE tools. **(6)**

TOTAL : 45 + 15 = 60

REFERENCES

1. *Roger S.Pressman, "Software Engineering - A Practitioner's Approach", McGraw Hill Education (India), Seventh Edition, 2014.*
2. *Pankaj Jalote, "Software Engineering-A Precise Approach", Wiley India, First Edition, 2010.*
3. *Yogesh Singh, Ruchika Malhotra, "Object-Oriented Software Engineering", PHI Learning P.Ltd, Kindle Edition, 2012.*
4. *Rajib Mall, "Fundamentals of Software Engineering", PHI Learning P. Ltd, Fifth Edition, 2018.*

19MCS14 - ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Acquire Knowledge on intelligent agents and problem solving by using various search strategies .*

CO2 : *Apply planning and reasoning algorithms for solving real life problems.*

CO3 : *Acquire knowledge on uncertain knowledge representation and various learning techniques.*

INTELLIGENT AGENTS AND PROBLEM SOLVING

Introduction- Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents. Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Avoiding Repeated States, Searching with Partial Information. **(10)**

SEARCH METHODS

Informed Search and Exploration: Informed (Heuristic) Search Strategies, Heuristic Functions, Local Search Algorithms and Optimization Problems, Local Search in Continuous Spaces, Online Search Agents and Unknown Environments, Generic Algorithms for TSP. Constraint Satisfaction Problems: Constraint Satisfaction Problems, Backtracking Search for CSPs, Local Search for Constraint Satisfaction Problems, Structure of Problems. **(9)**

PLANNING

Representing actions, situation calculus, classical planning algorithms. The Planning Problem, Planning with State-Space Search, Partial-Order Planning, Planning Graphs, Planning with Prepositional Logic, Analysis of Planning Approaches. Planning and Acting in the Real World Time, Schedules and Resources, Hierarchical Task Network Planning, Planning and Acting in Nondeterministic Domains, Conditional Planning, Execution Monitoring and Replanning, Continuous Planning, Multi-Agent Planning. **(10)**

UNCERTAIN KNOWLEDGE AND REASONING

Acting under Uncertainty, Basic Probability Notation, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Exact Inference in Bayesian Networks, Approximate Inference in Bayesian Networks, Extending Probability to First-Order Representations, Other Approaches to Uncertain Reasoning. **(10)**

LEARNING

Inductive learning for classification, decision-tree induction, neural-networks: representation and training. **(6)**

TOTAL : 45

REFERENCES

1. *Stuart Russell, Peter Norvig, "Artificial Intelligence - A Modern Approach", Pearson Publication, 3rd Edition, 2009.*
2. *Jeff Heaton, Artificial Intelligence for Humans-Fundamental Algorithms, Create space Independent Pub; 1st Edition, 2013.*
3. *Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann, International Student Edition, 1998.*

19MCS15 - ARTIFICIAL INTELLIGENCE LABORATORY

L	T	P	C
0	0	4	2

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 : *Analyze and formalize the problem as a state space graph, design heuristics and apply different search techniques in game playing and problem solving.*

CO2 : *Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.*

CO3 : *Formulate and solve problems with uncertain information using fuzzy inferences.*

CO4 : *Apply knowledge representation and natural Language processing concepts in implementing chat bot applications and semantic search.*

LIST OF EXPERIMENTS

1. Implementing state space search algorithms
   - Hill climbing algorithms
   - A* Algorithm
2. Designing a Chat bot application.
3. Information retrieval using semantic search
4. Adversarial search and Game Playing
5. Knowledge representation and inference - Predicate logic
6. Reasoning with uncertainty - Fuzzy inference
7. Solving 4-Queen problem
8. Solving travelling salesman problem

19MCS16 - DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY

L	T	P	C
0	0	4	2

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Analyze the performance of algorithms in terms of asymptotic notations.*

CO2 *: Demonstrate and have exposure in major algorithms and data structures.*

CO3 *: Apply design paradigms of algorithms and methods of analysis for writing optimized code.*

CO4 *: Synthesize efficient algorithms in real-time design situations.*

LIST OF EXPERIMENTS

1. Tree traversals - Post order(iterative/recursive)
2. Sorting - quick sort, heap sort
3. Binary search in arrays with duplicate values
4. Graph - BFS, DFS (Iterative/Recursive)
5. Single source shortest path - Dijiktra's
6. All pairs shortest path
7. Spanning trees - Prims, Kruskal's algorithm
8. Dynamic programming
    i. Longest increasing subsequence
    ii. Longest common subsequence
    iii. Matrix chain multiplication
    iv. Cutting rod problem
    v. String edit distance
    vi. Optimal binary search trees
9. Greedy - Knapsack problem
10. DAC
    i. K-way merge binary search
    ii. Finding the maximum and minimum element in an array

NOTE : Analyze the time complexity of all the experiments

19MCS21 - PROBABILITY AND STATISTICS

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon the completion of the course, students will be able to

CO1 *: Assimilate ideas of probability distributions and solve natural problems using various statistical measures,*

CO2 *: Choose appropriate method to identify and solve computer engineering problems*

CO3 *: Evaluating and discussing the concepts of sampling theory*

CO4 *: Demonstrate accurate and efficient use of parameter estimation theory concepts to solve engineering problems.*

CO5 *: Incorporate the ideas of statistical process control us that are imperative for the effective understanding of scientific problems.*

PROBABILITY AND ONE - DIMENSIONAL RANDOM VARIABLES

Methods of counting (combinatorics) - Axioms of probability- Conditional probability and independence. Moment generating functions. Discrete (integer valued) random variable- Continuous (real valued) random variables· Cumulative distribution functions and probability density functions. Distributions: Binomial, Poisson, Geometric, Uniform, normal (Gaussian), and exponential distributions, Independent random variables, Conditional distributions **(9)**

TWO DIMENSIONAL RANDOM VARIABLES AND CORRELATION

Joint Probability Distribution - Marginal Probability Distribution Function - Joint Probability Density Function-Marginal Probability Density Function-Conditional Probability Distribution Function- Conditional Probability Density Function- Covariance-Corelation. **(9)**

SAMPLING THEORY

Large sample : Testing of hypothesis about the population mean-difference between two means-Two Standard Deviations. Small sample: t-test-Testing of hypothesis about the population mean-difference between two means-F-test-Testing of hypothesis for equality of two Variances-Chi Square Test-Test for goodness of fit-Independence of Attributes. **(9)**

PARAMETER ESTIMATION

Point Estimation : Properties of Estimators, The Method of Maximum Likelihood-Single -Sample Confidence Interval Estimation: Confidence Interval on the mean of a Normal Distribution, Variance Known, Confidence Interval on the mean of a Normal Distribution, Variance Unknown-Two-Sample Confidence Interval Estimation: Confidence Interval on the Difference between Means of two Normal Distributions, Variances Known - Confidence Interval on the Difference between Means of two Normal Distributions, Variances Unknown **(9)**

STATISTICAL QUALITY CONTROL

Statistical Process Control : Introduction to Control Charts - Control Charts for Measurements - Control Charts for Individual Measurements - Control Charts for Attributes-CUSUM and EWMA Control Charts. **(9)**

TOTAL : 45 + 15 = 60

REFERENCES

1. *Sheldon M.Ross, "Introduction to Probability and Statistics for Engineers and Scientists", Kindle, Fifth Edition, 2014.*
2. *William W.Hines, Douglas C.Montgomery, David M.Goldsman and Connie M.Borror, "Probability and Statistics in Engineering", John Wiley & Sons, Fourth Edition,2008.*
3. *V.K.Rohatgi and A.K. Md.E.Saleh, "An Introduction to Probability and Statistics, Athena Scientific, Second Edition, 2008.*
4. *Dimitri P. Bertsekas and John N. Tsitsiklis, "Introduction to Probability", Athena Scientific, Second Edition, 2008.*

19MCS22 - MACHINE LEARNING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Acquire Knowledge in various learning techniques like decision tree, Analytical, Inductive and Reinforced learning.*

CO2 : *Identify and apply the appropriate machine learning techniques for classification, Pattern recognition, optimization and decision problems.*

CO3 : *Development of techniques in information science applications by applying Computational intelligence and appropriate machine learning techniques.*

INTRODUCTION

Machine learning -Examples of Machine Learning applications-Learning Associations-Classification-Regression-Unsupervised Learning-Reinforcement Learning-Supervised learning: Learning a class from Examples-Regression-Model Selection and Generalization

Case Study: Familiarity with R tool and Python programming language and libraries **(9)**

CONCEPT LEARNING AND DECISION-TREE LEARNING

Concept Learning - Concept learning Task - Concept Learning as search -Finding a maximally specific hypothesis - Version Spaces and Candidate elimination Algorithm -Inductive Bias

Decision Tree Learning - Decision Tree representation -Problems for Decision Tree Learning -Hypothesis Search space - Inductive Bias in Decision Tree Learning - Issues in Decision Tree Learning

Case Study: Implementation of decision tree algorithm for problems in Retail Domain. **(9)**

MULTILAYER PERCEPTRONS AND DEEP LEARNING

The Perceptron-Training a Perceptron-Learning Boolean Functions-Multilayer Perceptrons- MLP as Universal Approximator-Back propagation Algorithm-Training Procedures

Convolution Networks -The Convolution Operation-Pooling-Convolution and Pooling as an infinitely strong prior -Variants of the Basic Convolution Function -Structured Outputs -Data Types -Efficient Convolution Algorithms -Random and Unsupervised features

Case Study: Implementation of Back propagation algorithm for problems in financial domain. **(9)**

CLUSTERING

Similarity-Based Clustering-Unsupervised learning problems-Hierarchical Agglomerative Clustering (HAC)-Single-link, complete-link, group-average similarity- k-Means and Mixtures of Gaussians-Flat clusteringk-Means algorithms-Mixture of Gaussian model-EM-algorithm for mixture of Gaussian model

Case Study: Implementation of clustering algorithm for problems in financial/insurance/health care domain. **(9)**

REINFORCEMENT LEARNING

Introduction - learning task - Q learning - The Q function - Algorithm for Q learning -convergence - experimentation strategies - updating sequence -Non deterministic rewards and actions -Temporal difference learning -Generalizing from examples -relationship to dynamic programming

Case Study: Implementation of Q learning algorithm/reinforcement learning for problems in automotive domain/games **(9)**

TOTAL : 45

REFERENCES

1. *Ethem Alpaydin, "Introduction to Machine Learning", The MIT Press, September 2014, ISBN 978-0-262-02818-9.(Units 1,3(Multilayer Perceptrons) & 4)*
2. *Mitchell, Tom, "Machine Learning", New York, McGraw-Hill, First Edition, 2003.(Units 2,5)*
3. *Ian GoodFellow,Yoshua Bengio,Aaron Courville ,"Deep Learning",MIT Press Book (Unit 3 - Convolutional Networks), Nov. 2016*
4. *Stephen Marshland, "Machine Learning: An Algorithmic Perspective", Chapman & Hall/CRC 2009.*
5. *Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", MIT Press (MA) 2012.*

19MCS23 - DATABASE ENGINEERING

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Ability to design relational databases and develop SQL queries for practical applications.*

CO2 : *Understanding of the advanced database concepts like temporal, multimedia, spatial and Distributed databases.*

CO3 : *Ability to perform database normalization, tuning and recovery operations.*

CO4 : *Knowledge on database storage structures, indexing mechanisms and query optimization techniques*

INTRODUCTION TO DATABASE SYSTEMS

Database System Concepts and Architecture. Relational Data Model - Relational Database Constraints- Relational Algebra. Entity Relationship (ER) Model- ER to Relational Mapping. SQL: Schema Definition - Constraints - Queries - Triggers and Views - Embedded SQL - Dynamic SQL. Database Design: Functional Dependencies and Normalization for Relational Databases. **(11)**

STORAGE AND INDEXING

RAID Technology. Indexing Structures for Files- Types of Single Level Ordered Indexes-Multilevel Indexes- Dynamic Multilevel indexes using B-Trees and B+ trees- Indexes on Multiple Keys. **(9)**

QUERY AND TRANSACTION PROCESSING

Query Processing : Heuristics in Query Optimization, Selectivity and Cost Estimates in Query Optimization- Semantic Query Optimization. Database Tuning in Relational Systems.

Transaction Processing : Concepts - Desirable properties of Transactions- Charaterizing Schedules based on Recoverability-Serializability. Concurrency Control Techniques - Two Phase Locking-Timestamp Ordering - Multiversion Concurrency Control-Validation Concurrency Control. Database Recovery Techniques- Recovery Concepts- Recovery based on Deferred and Immediate updates- Shadow Paging. **(12)**

ADVANCED DATABASE MODELS AND SECURITY

Active Databases - Temporal Databases- Spatial Databases- Multimedia Databases- Deductive Databases. Security: Discretionary Access Control- Mandatory Access Control - Role-based Access Control - SQL injection-Challenges of Database Security. **(6)**

DISTRIBUTED DBMS

Distributed Database Concepts- Types of Distributed Database Systems- Distributed Database Architectures- Data Fragmentation-Replication-Allocation Techniques. Query Processing and optimization. Overview of Transaction Management- Concurrency Control and Recovery in Distributed Databases. **(7)**

TOTAL : 45 + 15 = 60

REFERENCES

1. *Ramez Elmasri and Shamkant B.Navathe, "Fundamentals of Database Systems", Pearson Education Inc, Seventh Edition, 2016.*
2. *M.Tamer Ozsu and Valduriez, "Principles of Distributed Database Systems", Springer, Third Edition, 2011.*
3. *Abraham Silberschatz, Hendry F.Korth, S.Sudharshan, "Database System Concepts", Tata Mc Graw Hill, Seventh Edition, 2011.*

19MCS24 - MACHINE LEARNING LABORATORY

L	T	P	C
0	0	4	2

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Apply various classification and clustering techniques for problems using tools like R and Python.*

CO2 *: Implement solutions for various prediction problems using tools.*

CO3 *: Design and development of game and traffic control system using reinforcement learning.*

LIST OF EXPERIMENTS

1. Study and usage of python and R tool.
2. Implement a classifier for the sales data.
3. Develop a predictive model for predicting house prices
4. Implement the FIND-S algorithm. Verify that it successfully produces the trace in for the Enjoy sport example.(Tom Mitchell Reference)
5. Implement a decision tree algorithm for sales prediction/classification in retail sector
6. Implement back propagation algorithm for stock prices prediction
7. Implement clustering algorithm for Insurance fraud detection
8. Implement clustering algorithm for identifying cancerous data
9. Apply reinforcement learning and develop a game of your own.
10. Develop a traffic signal control system using reinforcement learning technique.

NOTE : Datasets for the above exercises available in Kaggle and UCI repository mentioned below

i. https://www.kaggle.com

ii. http://archive.ics.uci.edu/ml/datasets.html

19MCS25 - MINI PROJECT

L	T	P	C
0	0	6	3

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Identification of real time problem in the field of computing.*

CO2 *: Acquire knowledge and skills in planning, scheduling, designing and implementation of the product / project using the appropriate tools.*

SCOPE OF PROJECT WORK

- Identification of real time problem in the field of computing
- Developing a mathematical model for solving the identified problem.
- Finalization of system requirements and specification.
- Proposing different solutions for the problem based on literature survey.
- Future trends in providing alternate solutions.
- Consolidated report preparation on the work done.

19MCS41 - PROJECT AND VIVA-VOCE

L	T	P	C
0	0	36	18

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Ability to identify and document the research / application oriented problem.*

CO2 *: Demonstrate learning and knowledge access techniques using Conferences, Journal papers and participation in research activities.*

CO3 *: Acquire knowledge and skills in planning, scheduling, designing and implementation of the product / project using the appropriate tools.*

CO4 *: Inculcate the practice of publishing the papers in Conferences and Journals*

SCOPE OF PROJECT WORK

- Problem Identification and scope definition.
- A statement of system / process specifications proposed to be developed.
- Identification of constraints and alternate solutions
- Scheduling of activities.
- Implementation Phase (Hardware / Software / both).
- Testing & Validation of the developed system.
- Paper presentation in the Conference / Journals
- Consolidated report preparation.

19MCSOC01 - PYTHON PROGRAMMING

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 : *Understand the fundamental concepts of python programming*

CO2 : *Apply control statements, decision making statements to solve the given problems.*

CO3 : *Usage of complex datatypes in python to develop an application.*

CO4 : *Practice problem solving using functions.*

CO5 : *Solve the real-world problems using file handling operations, modules and packages*

INTRODUCTION TO PYTHON

Python variables, Python basic Operators, Understanding python blocks. Python Data Types, Declaring and using Numeric data types: int, float etc. **(6)**

PYTHON STATEMENTS

Assignment statements, I/O statements. Control statements: if, else and else if, for loops, foreach, while loops, Loop manipulation using pass, continue, break and else. **(6)**

PYTHON COMPLEX DATATYPES

Lists : list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters. **Tuples :** tuple assignment, tuple as return value; **Dictionaries :** operations and methods; **Set :** Creating Sets, Performing Set Operations: Union, Intersect and Difference. **(6)**

FUNCTIONS

Functions : Parameters, Local and Global scope, Return values, Recursion. **(6)**

FILES, MODULES AND PACKAGES

Files : Text files, reading and writing files. Modules: import Statement, from...import Statement.

Packages : NumPy, SciPy. **(6)**

TOTAL : 30

REFERENCES

1. *John V. Guttag, "Introduction to Computation and Programming Using Python", 2nd edition, The MIT Press, 2016.*
2. *Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/ O'Reilly Publishers, 2016. (http://greenteapress.com/wp/thinkpython/)*
3. *Guido van Rossum and Fred L. Drake Jr," An Introduction to Python - Revised and updated for Python 3.2", Network Theory Ltd., 2011.*

19MCSE01 - CRYPTOGRAPHY AND NETWORK SECURITY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Ability to identify and analyze various security attacks and threats and use the fundamental knowledge on cryptographic theory in real world applications.*

CO2 : *Ability in designing suitable encryption, decryption algorithms for ensuring secure communication.*

CO3 : *Design and develop various key management and authentication techniques for trusted applications.*

CO4 : *Selection and application of suitable intrusion detection techniques in practical Applications.*

INTRODUCTION

Security Attacks - Security Services - Security Mechanisms - Basics of number theory : Prime Numbers-Euler's and Fermet's-Modular arithmetic-Euclid Algorithm - Polynomial Fields - Classical Encryption Techniques : Symmetric Cipher Model - Substitution Techniques - Transposition Techniques. Block Cipher : Cipher Principles - Modes of Operation -Data Encryption Standard - Strength of DES. Advanced Encryption Standard : Evaluation criteria for AES - AES Cipher **(12)**

PUBLIC KEY CRYPTOGRAPHY

Principles of Public key Cryptosystem - RSA Algorithm. Public Key Cryptosystems : Key Management - Diffie-Hellman Key Exchange - Elliptic Curve Arithmetic - Elliptic Curve Cryptography. **(9)**

AUTHENTICATION AND HASH FUNCTION

Authentication Requirements - Authentication Functions - Message Authentication Codes -Message Digest Algorithm (MD5) - Secure Hash Algorithm-SHA-2 - Digital Signature Standard. **(8)**

AUTHENTICATION APPLICATIONS

Kerberos - X.509 Authentication Service - Fingerprint Authentication - Public-Key Infrastructure. Electronic Mail Security : PGP-S/MIME - IP Security - Web Security. **(8)**

INTRUSION DETECTION SYSTEM

Intruders - Intrusion detection - Password Management - Malicious Software : Viruses and Related Threats - Virus Countermeasures - Distributed DoS attacks. Firewalls : Firewall Design Principles - Trusted Systems. **(8)**

TOTAL : 45

REFERENCES

1. *William Stallings, "Cryptography and Network Security - Principles and Pracices", Prentice Hall of India, Seventh Edition, 2017.*
2. *Behrouz A.Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill, Third Edition, 2017.*
3. *Atul Kahate, "Cryptography and Network Security", Tata McGraw-Hill, Fourth Edition, 2019.*
4. *Wade Trappe, Lawrence C.Washington, "Introduction to Cryptography with coding theory", Pearson, Second Edition, 2005.*
5. *Wenbo Mao, "Modern Cryptography-Theory and Practice", Pearson Education, New Delhi, 2004.*
6. *Bruce Schneier, "Applied Cryptography", John Wiley and Sons, New York, Second Edition, 20th Anniversary Edition,1995.*

19MCSE02 - HIGH PERFORMANCE COMPUTING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Understanding the basic concepts of computational programming and its applications*

CO2 *: Understanding the core of high end computers, components and their capacities*

CO3 *: Understand the need for parallel algorithms and learn on various parallel programming applications*

CO4 *: Knowing the various challenges involved in achieving high performance with the available computational systems*

INTRODUCTION

Introduction : Computational Science and Engineering: Computational Science and Engineering Applications; characteristics and requirements, Review of Computational Complexity, Performance: metrics and measurements, Granularity and Partitioning, Locality: temporal/spatial/stream/kernel, Basic methods for parallel programming, Real-world case studies. **(9)**

HIGH-END COMPUTER SYSTEMS

High-End Computer Systems: Memory Hierarchies, Multi-core Processors: Homogeneous and Heterogeneous, Shared-memory Symmetric Multiprocessors, Vector Computers, Distributed Memory Computers, Supercomputers and Petascale Systems, Application Accelerators / Reconfigurable Computing, Novel computers: Stream, multithreaded, and purpose-built **(9)**

PARALLEL ALGORITHMS

Parallel Algorithms : Parallel models: ideal and real frameworks, Basic Techniques: Balanced Trees, Pointer Jumping, Divide and Conquer, Partitioning, Regular Algorithms: Matrix operations and Linear Algebra, Irregular Algorithms: Lists, Trees, Graphs, Randomization: Parallel Pseudo-Random Number Generators, Sorting, Monte Carlo techniques. **(10)**

PARALLEL PROGRAMMING

Parallel Programming : Revealing concurrency in applications, Task and Functional Parallelism, Task Scheduling, Synchronization Methods, Parallel Primitives (collective operations), SPMD Programming (threads, OpenMP, MPI), I/O and File Systems, Parallel Matlabs (Parallel Matlab, Star-P, Matlab MPI), Partitioning Global Address Space (PGAS) languages (UPC, Titanium, Global Arrays) **(10)**

PERFORMANCE MEASUREMENT

Achieving Performance : Measuring performance, Identifying performance bottlenecks, restructuring applications for deep memory hierarchies, Partitioning applications for heterogeneous resources, using existing libraries, tools, and frameworks **(7)**

TOTAL : 45

REFERENCES

1. *Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey, 2003.*
2. *Petascale Computing: Algorithms and Applications, David A. Bader (Ed.), Chapman &Hall/CRC Computational Science Series, 2007.*

19MCSE03 - NEURAL NETWORKS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Understand the mathematical concepts of the performance surfaces and different methods for optimizations.*

CO2 *: Understand the concepts, and representation of most common neural network models.*

CO3 *: Reason about the performance of neural networks and implement neural network models for particular applications.*

INTRODUCTION TO NEURAL NETWORKS

Introduction - history-Applications-Biological inspiration -Neuron Model and Network Architecture: Objectives - notation - neuron model - Network Architectures - A layer of neurons - multiple layers of Neurons-recurrent networks - An Illustrative example **(5)**

PERCEPTRON LEARNING RULE

Perceptron Learning Rule : Perceptron architecture -Perceptron learning rule - proof of convergence - Signal and weight vector spaces: Linear vector spaces - Linear Independence-spanning a space - inner product - norm -orthogonality-vector expansions - Linear Transformations for neural networks: Linear Transformations-matrix representations-change of basis - eigen values and eigen vectors **(10)**

SUPERVISED HEBBIAN LEARNING

Supervised Hebbian learning: Linear associator-Hebb rule-pseudo inverse rule - variations of hebbian learning - performance surfaces and optimum Points : Taylor series - directional derivatives-minima -necessary conditions for Optimality-quadratic functions - Performance Optimization:steepest descent-newton's method - conjugate gradient-competitive networks:Hamming network - competitive layer -self organizing feature maps-learning vector quantization **(11)**

MULTILAYER PERCEPTRONS

Widroff - Hoff Learning : ADALINE network - MSE - LMS algorithm Analysis of convergence - back propagation: Multilayer perceptrons - back propagation algorithm - Generalization - Methods for improving generalization **(9)**

RADIAL BASIS NETWORKS

Radial basis networks: Radial basis network - training RBF networks - grossberg network: Basic non linear model - two layer competitive network - Adaptive resonance theory: Overview of adaptive resonance-Layer 1-Layer 2 -Learning Law:L1-L2 and L2-L1-Hopfield network **(10)**

TOTAL : 45

REFERENCES

1. *Neural Network Design (2nd Edition),Martin T. Hagan, Howard B. Demuth, Mark H. Beale, Orlando De Jesus, ISBN-10: 0-9717321-1-6, ISBN-13: 978-0-9717321-1-7*
2. *Make Your Own Neural Network, Tariq Rashid, 2016*
3. *Neural Networks for Pattern Recognition by Christopher M. Bishop, Springer, 2006*
4. *Neural networks and Learning Machines (3rd Edition),Simon Haykin, ISBN-13: 978-0131471399, ISBN-10: 0131471392, Prentice Hall, 2008.*

PRE-REQUISITES FOR COURSE

MATH REQUIREMENT

Calculus, linear algebra, vectors, and matrices

LANGUAGE REQUIREMENT

High level programming languages like Python.

19MCSE04 - OPEN SOURCE SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Students shall be able to understand the importance of FOSS.*

CO2 : *Ability to create and manipulate non-relational data bases.*

CO3 : *Ability to write programs using PHP, Python and manipulate SQL data base.*

CO4 : *Ability to configure and use Apache web services, acquire knowledge to develop software models using MDA.*

FOSS PHILOSOPHY AND LINUX PACKAGE

Introduction to Software Terminologies - Overview of Free/Open Source Software - Definition of FOSS & GNU - History of GNU/ Linux and the Free Software Movement , Advantages of Free Software and GNU/Linux, FOSS usage , trends and potential - global and Indian-Free Software Licenses(GPL, LGPL, AGPL). Installing software - from source code as well as using binary packages - Understanding build systems - constructing make files and using make, using autoconf and autogen to automatically generate make files tailored for different development environments. **(9)**

OPEN SOURCE NON RELATIONAL DATABASES

NoSQL definition - relational Vs non-relational database - working with NoSQL - Running MongoDB - Getting A Database Connection - Inserting Data into A Collection - Accessing Data From a Query - CouchDB-Developing with CouchDB - Example application - Deploying CouchDB. **(9)**

OPEN SOURCE PROGRAMMING LANGUAGES

PHP: Introduction - Programming in web environment - variables - constants - data types -operators - Statements - Functions - Arrays - OOP - String Manipulation and regular expression - File handling and data storage - PHP and SQL database - PHP and LDAP - PHP Connectivity - Sending and receiving E-mails - Debugging and error handling - Security - Templates. **(9)**

PYTHON

Syntax and Style - Python Objects - Numbers - Sequences - Strings - Lists and Tuples -Dictionaries - Conditionals and Loops - Files - Input and Output - Errors and Exceptions - Functions - Modules - Classes and OOP - Execution Environment. **(9)**

OPEN SOURCE TOOLS AND TECHNOLOGIES

Web Server: Apache Web server -Google Web server- Working with Web Server - Configuring and Using apache web services MDA: Introduction to MDA - Genesis of MDA - Meta Object Facility - UML -UML Profiles - MDA Applications- case studies. **(9)**

TOTAL : 45

REFERENCES

1. *Mike McGrath, "Linux in easy steps, Sixth Edition", Tata McGraw-Hill, Sixth Edition 2010.*
2. *N. B. Venkateshwarlu, "Introduction to Linux: Installation and Programming", First Edition, BS Publishers, 2006.*
3. *Steve Suchring, "MySQL Bible", John Wiley, 2007.*
4. *Steven Holzner, "PHP: The Complete Reference", TMH Edition; 2007*
5. *J.Chris Anderson, "CouchDB : Definitive Guide", First Edition, O'Reilly series, 2010.*
6 *Wesley J.Chun, "Core Python Programming", Prentice Hall, 2007*
7. *Stephen J. Mellor, Marc Balces, "Executable UMS: A foundation for MDA", Addison Wesley, 2002.*

19MCSE05 - APPROXIMATION ALGORITHM

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Understanding the basic definitions of approximation algorithms*

CO2 : *Understand and analyze basic algorithmic tools used to design approximation algorithms*

CO3 : *Learning the limits of approximation, and the basic ways of proving hardness of approximation*

UNIT I

An introduction to approximation algorithms- A deterministic rounding algorithm- Rounding a dual solution- Constructing a dual solution: the primal-dual method- A greedy algorithm- A randomized rounding algorithm. **(4)**

UNIT II

Greedy algorithms and local search- Scheduling jobs with deadlines on a single machine- The k-center problem- Scheduling jobs on identical parallel machines- The traveling salesman problem- Edge coloring.

Rounding data and dynamic programming- The knapsack problem- Scheduling jobs on identical parallel machines- The bin-packing problem **(8)**

UNIT III

Random sampling and randomized rounding of linear programs- Simple algorithms for MAX SAT and MAX CUT- Derandomization- Flipping biased coins- Randomized rounding- Non-linear randomized rounding- The prize-collecting Steiner tree problem- The uncapacitated facility location problem- Scheduling a single machine with release dates- Random sampling and coloring dense 3-colorable graphs **(9)**

UNIT IV

The primal-dual method- The set cover problem- Cleaning up the primal solution: the shortest s-t path problem- Lagrangean relaxation and the k-median problem- Cuts and metrics: The multiway cut problem and a minimum-cut based algorithm The multiway cut problem and an LP rounding algorithm **(9)**

UNIT V

Greedy and local search algorithms- A local search algorithm for the k-median problem- Minimum-degree spanning trees- dynamic programming: Euclidean traveling salesman problem- The maximum independent set problem in planar graphs- deterministic rounding of linear programs: The generalized assignment problem- Minimum-cost bounded-degree spanning trees **(8)**

UNIT VI

Approximation programs: The single-source rent-or-buy problem- The Steiner tree problem- Approximating quadratic programs- Unique games- The prize-collecting Steiner tree problem- The feedback vertex set problem in undirected graphs **(7)**

TOTAL : 45

REFERENCES

1. *David P. Williamson and David B. Shmoys. The Design of Approximation Algorithms. Cambridge University Press, 2011. http://www.designofapproxalgs.com/*
2. *Approximation Algorithms, by Vijay V. Vazirani, Springer-Verlag, Berlin, 2001*
3. *Buy-at-bulk network design. B. Awerbuch and Y. Azar. IEEE FOCS 1997.*
4. *Simpler and Better Approximation Algorithms for Network Design. A. Kumar, A. Gupta, T. Roughgarden. ACM STOC 2003*
5. *Euclidean distortion and the sparsest cut.. S. Arora, J. Lee, and A. Naor. To appear in STOC 2005.*

19MCSE06 - INTERNET TECHNOLOGIES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Understanding of the concept of the web servers and its working*

CO2 : *Acquire in depth knowledge in web services using the latest server side technologies*

CO3 : *Ability to design and develop web server applications using Node JS and Angular JS*

WEB SERVERS

Web Protocols- Working of web browser - Browser & Server Communication - Web Server Functions - Web Security - Fire Wall - Proxy Servers - Virtual Directories - MIME - HTTP Headers - Deployment using web servers. **(7)**

WEB PROGRAMMING

HTML5 Structural Elements-Images - HTML5 Form Elements and Attributes - DHTML - CSS3-Selectors-Box model-Positioning elements-Colors-Shadows-Gradients-Transitions and Transformations. **(6)**

JAVASCRIPT

Java Script - Core JavaScript - lexical structure- types-values and variables- expression and operators-statements-objects-arrays-functions- classes and moduels- pattern matching with regular expressions- java script in web browser-the window objects-scripting documents-handling events. **(8)**

ANGULARJS

An Overview of the AngularJS Life Cycle-Integrating AngularJS with Existing JavaScript and jQuery-Adding AngularJS to the Node.js Environment-Bootstrapping AngularJS in an HTML Document- Creating a Basic AngularJS Application-Using AngularJS Templates to Create Views- Implementing Directives in AngularJS Views- Implementing AngularJS Services in Web Applications **(9)**

NODE.JS

Using Events, Listeners, Timers, and Callbacks in Node.js-5 Handling Data I/O in Node.js- Accessing the File System from Node.js- Implementing HTTP Services in Node.js- implementing Socket Services in Node.js- Scaling Applications Using Multiple Processors in Node.js- Implementing Express in Node.js **(8)**

MONGODB

Understanding NoSQL and MongoDB- Manipulating MongoDB Documents from Node.js- Accessing MongoDB Documents from Node.js- Advanced MongoDB Concepts **(7)**

TOTAL : 45

REFERENCES

1. *Deitel & Deitel, "Internet & World Wide Web How to Program", Pearson Education India, fifth Edition, 2011.*
2. *David Flanagan "JavaScript: The Definitive Guide, O'Reilly Media, Inc. May 2011.*
3. *Brad Dayley "Node.js, MongoDB, and AngularJS Web Development", Addison-Wesley Professional. 2014*
4. *Brad Green, Shyam Seshadri "AngularJS", O'Reilly; 1st Edition Apr 2013.*
5. *Negrino and Smith, "Javascript for the World Wide Web", 5th Edition, Peach pit Press,2003*

19MCSE07 - DATA WAREHOUSING AND DATA MINING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Knowledge in the basic concepts of data warehousing and data mining.*

CO2 : *Ability to create large multidimensional data storage and carry out OLAP operations.*

CO3 : *Ability to apply the concepts, algorithm, techniques and tools for developing practical applications.*

DATA WAREHOUSE

Data Warehouse-Introduction-Multidimensional Data Model-Data Warehouse Architecture-Data Warehouse Implementation-From Data Warehousing to Data Mining. **(7)**

DATA MINING AND DATA PREPROCESSING

Data Mining-On What Kind of Data-Data Mining Functionalities-Classification of Data Mining Systems-Data Mining Task Primitives-Integration of a Data Mining System with a Database or Data Warehouse System-Major Issues in Data Mining. Data Preprocessing: Needs Preprocessing the Data - Data Cleaning- Data Integration and Transformation-Data Reduction- Discretization and Concept Hierarchy Generation. **(8)**

ASSOCIATION RULES

Definition-Apriori Algorithm-Partitioning Algorithm-Pincer Search -Dynamic Item Set Counting Algorithm-FP Tree Algorithm-Discussion on different Algorithms-Incremental Algorithm-Border Algorithm-Generation of Association Rules **(10)**

CLUSTERING AND CLASSIFICATION

Cluster analysis - Types of data - Categorization of major clustering methods - Partitioning - K-Means and K-Medoid algorithm - CLARA - CLARANS - Hierarchical clustering - BIRCH - Density based clustering - DBSCAN - Decision tree - Issues regarding classification and prediction - Classification by decision tree induction. **(10)**

MINING COMPLEX TYPES OF DATA

Mining Complex Types of Data : Multidimensional Analysis and Descriptive Mining of Complex-Data Objects-Mining Spatial Databases-Mining Multimedia Databases-Mining Time-Series and Sequence Data Mining Text Databases-Mining the World Wide Web. Case studies. **(10)**

TOTAL : 45

REFERENCES

1. *Jiawei Han & Micheline kamber, "Data Mining-Concepts and Techniques" Morgan Kaufmann Publishers, Third Edition, 2012.*
2. *Arun K Pujari, "Data Mining Techniques" Universities Press India Ltd., Third Edition, 2012.*
3. *Dunham, "Data Mining- Introductory and Advanced Topics", Pearson Education, New Delhi, First Edition, 2006.*
4. *Pieter Adriaans, Dolf Zantinge, "Data Mining ", Pearson Education, 2009, Delhi.*
5. *Sam Anahory, Dennis Murray, "Data Warehousing in the Real World", Pearson Education, New Delhi,2003.*
6. *George M. Marakas, "Modern Data Warehousing, Mining, & Visualization Core concepts", Pearson Education , 2003.*
7. *Paulraj Ponnaiah, "Data Warehousing Fundamentals", Wiley Publishers, Singapore, 2001.*

19MCSE08 - BUSINESS INTELLIGENCE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Ability to understand Transaction Processing, Analytical applications and describe the need for business intelligence.*

CO2 : *Demonstrate understanding of technology and processes associated with business intelligence framework*

CO3 : *Ability to identify the business metrics, KPIs and prepare enterprise reports and recommendations to achieve the business goals.*

INTRODUCTION TO BUSINESS INTELLIGENCE

Introduction to Digital Data and Its Types- Structured, Semi-Structured and Unstructured, Introduction to OLTP and OLAP (MOLAP, ROLAP, HOLAP), BI Definitions and Concepts, BI Framework. **(8)**

COMPONENTS OF BUSINESS INTELLIGENCE

Data Warehousing Concepts and Its Role in BI; BI Infrastructure Components - BI Process, BI Technology, BI Roles and Responsibilities, Business Applications of BI, BI Best Practices **(6)**

BASICS OF DATA INTEGRATION

Concepts of Data Integration, Needs and Advantages of using Data Integration, Introduction to Common Data Integration Approaches ; Meta Data - Types and Sources, Introduction to Data Quality, Data Profiling Concepts and Applications, Introduction to ETL using Kettle **(12)**

INTRODUCTION TO MULTI-DIMENSIONAL DATA MODELING

Introduction to Data and Dimension Modeling, Multidimensional Data Model, ER Modeling vs. Multi Dimensional Modeling, Concepts of Dimensions, Facts, Cubes, Attribute, Hierarchies, Star and Snowflakes Schema. Introduction to Business Metrics and KPIs, Creating Cubes using Microsoft Excel. **(10)**

BASICS OF ENTERPRISE REPORTING

A Typical Enterprise, Malcolm Bridge - Quality Performance Framework, Balanced Scorecard, Enterprise Dashboard, Balanced Scorecard vs. Enterprise Dashboard, Enterprise Reporting using MS Access / MS Excel, Best Practices in the Design of Enterprise Dashboards **(9)**

TOTAL : 45

REFERENCES

1. *RN Prasad and Seema Acharya,"Fundamentals of Business Analytics", Wiley India, 2011.*
2. *David Loshin, "Business Intelligence", Elsevier Science and Technology, Second Edition, 2012.*
3. *Mike Biere, "Business Intelligence for the Enterprise", Pearson, 2010.*

19MCSE09 - CLOUD COMPUTING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Understand the concepts of Virtualization, cloud architecture and deployment models.*

CO2 : *Ability to identify the architecture, infrastructure and delivery models of cloud computing.*

CO3 : *Ability to address the core issues of cloud computing such as security, privacy.*

CO4 : *Design Cloud Services and Set a private cloud.*

CLOUD ARCHITECTURE AND MODEL

Technologies for Network-Based System - System Models for Distributed and Cloud Computing - NIST Cloud Computing Reference Architecture. Cloud Models: Characteristics - Cloud Services - Cloud models (IaaS, PaaS, SaaS) - Public vs Private Cloud - Cloud Solutions - Cloud ecosystem - Service management - Computing on demand. **(9)**

VIRTUALIZATION

Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices -Virtual Clusters and Resource management - Virtualization for Data-center Automation. **(9)**

CLOUD INFRASTRUCTURE

Architectural Design of Compute and Storage Clouds - Layered Cloud Architecture Development -Design Challenges - Inter Cloud Resource Management - Resource Provisioning and Platform Deployment - Global Exchange of Cloud Resources. **(9)**

PROGRAMMING MODEL

Parallel and Distributed Programming Paradigms - Map Reduce , Twister and Iterative MapReduce -Hadoop Library from Apache - Mapping Applications - Programming Support - Google App Engine, Amazon AWS - Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack, Aneka, CloudSim **(9)**

SECURITY IN THE CLOUD

Security Overview - Cloud Security Challenges and Risks - Software-as-a-Service Security - Security Governance - Risk Management.

Security Monitoring - Security Architecture Design - Data Security - Application Security - Virtual Machine Security - Identity Management and Access Control - Autonomic Security. **(9)**

TOTAL : 45

REFERENCES

1. *Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.*
2. *John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.*
3. *Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH, 2009.*
4. *Kumar Saurabh, "Cloud Computing - insights into New-Era Infrastructure", Wiley India, 2011.*

19MCSE10 - INFORMATION SECURITY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Analyze and identify the security threats, attacks and device suitable security policies and standards.*

CO2 : *Ability to plan, assess and device suitable risk control strategies in practice.*

CO3 : *Ability to implement appropriate intrusion detection and prevention systems to ensure information availability.*

CO4 : *Ability to apply various national, international laws and legal frameworks emphasizing responsibility and accountability at all levels in the organization.*

INTRODUCTION, NEED, ETHICAL AND PROFESSIONAL ISSUES

Introduction to Information Security - The History of Information Security- What Is Security - Critical Characteristics of Information - NSTISSC Security Model - Components of an Information System - Securing Components - Balancing Information Security and Access - The Systems Development Life Cycle - The Security Systems Development Life Cycle. The Need for Security: Introduction - Business Needs First -Threats -Attacks. Ethics and Information Security - Codes of Ethics and Professional Organizations - Organizational Liability and the Need for Counsel. **(7)**

RISK MANAGEMENT AND INFORMATION SECURITY

Introduction - An Overview of Risk Management - Risk Identification -Risk Assessment - Risk Control Strategies - Selecting a Risk Control Strategy - Risk Management Discussion Points - Documenting Results Recommended Practices in Controlling Risk. **(6)**

POLICIES, STANDARDS, PRACTICES AND BUSINESS CONTINUITY

Introduction - Information Security Policy, Standards and Practices -The Information Security Blueprint: ISO 17799/BS 7799, ISO 27001and its controls, NIST Security Models, VISA International Security Model, Design of Security Architecture - Security Education, Training and Awareness Program - Continuity Strategies. **(9)**

SECURITY TECHNOLOGY: INTRUSION DETECTION, ACCESS CONTROL AND SECURITY TOOLS

Introduction - Intrusion Detection and Prevention Systems: IDPS Terminology, Use of IDPS, Strengths and Limitations of IDPS - Honey Pots, Honey Nets, and Padded Cell Systems - Scanning and Analysis Tools, Access Control Devices - Physical Security - Security and Personnel. **(11)**

BIOMETRIC CONTROLS AND WIRELESS NETWORKS SECURITY

Biometrics : Nature of Biometrics Identification/Authentication Techniques - Biometric Techniques - Matching and Enrollment Process in Biometrics - Benefits Over Traditional Authentication Methods. Attacks on Wireless Networks: Other Security Risks in Wireless Networks, Management and Mitigations for Wireless Networks Attacks. **(7)**

LAWS AND LEGAL FRAMEWORK

Introduction - Information Security and the Law: The Rising Need -Understanding the Laws for Information Security: A Conceptual Framework - The Indian IT Act - Laws for Intellectual Property Rights (IPR) - Health Insurance Portability and Accountability Act (HIPAA) -Gramm-Leach-Bliley Act (GLBA) - Overview of Sarbanes-Oxley (SOX) - Building Security into Software/System Development Life Cycle. **(5)**

TOTAL : 45

REFERENCES

1. *Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Course Technology, New Delhi, Fourth Edition, 2012 Reprint.*
2. *Nina Godbole, "Information Systems Security-Security Management, Metrics, Frameworks and Best Practices", Wiley India Pvt. Ltd., New Delhi, First Edition, 2009.*
3. *Faiyaz Ahamad,"Cyber Law and Information Security", Wiley dreamtech press,2013.*
4. *Thomas R.Peltier, "Information Security Fundamentals", Auerbach Publications, Revised Second Edition, 2013.*
5. *Mark Merkow and Jim Breithaupt," Information Security - Principles & Practices", Pearson Education, 2011.*

19MCSE11 - KNOWLEDGE BASED AI

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *To understand the concepts, methods, and prominent issues in knowledge-based artificial intelligence*

CO2 : *To understand the knowledge-based methods of problem solving, planning, decision-making, and learning.*

CO3 : *To establish the relationship between knowledge-based artificial intelligence and the study of human cognition.*

UNIT I

Introduction to KBAI and Cognitive Systems - Where Knowledge-Based AI fits into AI as a whole - Cognitive systems - AI and cognition - Fundamentals - Semantic Networks - Generate & Test Means-Ends Analysis - Problem Reduction - Production Systems **(9)**

UNIT II

Common Sense Reasoning - Frames - Understanding - Common Sense Reasoning - Scripts - Planning - Logic - Planning - Learning - Learning by Recording Cases - Incremental Concept Learning - Classification - Version Spaces & Discrimination Trees **(10)**

UNIT III

Analogical Reasoning - Case-Based Reasoning - Explanation-Based Learning - Analogical Reasoning **(9)**

UNIT IV

Visuospatial Reasoning - Constraint Propagation - Visuospatial Reasoning **(8)**

UNIT V

Design & Creativity - Configuration - Diagnosis - Design - Creativity - Metacognition - Learning by Correcting Mistakes - Meta-Reasoning - AI Ethics **(9)**

TOTAL : 45

REFERENCES

1. *Artificial Intelligence: Structures and Strategies for Complex Problem Solving. George Luger. Sixth Edition, Pearson Education, 2009.*
2. *Introduction to Knowledge Systems. Mark Stefik. Morgan Kauffman 1995.*
3. *Artificial Intelligence. Patrick Winston. Third Edition. MIT Press 1993. Available online*

19MCSE12 - SOFTWARE METRICS AND MEASUREMENTS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Ability to understand the basics of measurement theory and measurement scales*

CO2 : *Acquire the fundamental knowledge of various software metrics*

CO3 : *Knowledge in various data collection methods and analysis*

CO4 : *Gain basic knowledge on reliability theory and models*

FUNDAMENTALS OF SOFTWARE MEASUREMENT

Measurement: Measurement in software engineering - scope of software metrics. Basics of Measurement: representational theory of measurement-measurement and models- measurement scales and scale types - nominal scale - ordinal scale- interval scale- ratio scale- absolute scale - meaningfulness in measurement. **(7)**

GOAL BASED FRAMEWORK AND DATA COLLECTION

Classifying software measures- determining what to measure-software measurement validation. Empirical Investigation - Principles of empirical studies.

Software metrics data collection: Defining good data, data collection for incident reports, Data collection forms and reports, reliability of data collection procedures.

Analyzing software measurement data: Statistical Distributions and hypothesis testing, classical data analysis techniques, examples of simple analysis techniques, overview of statistical tests. **(9)**

MEASUREMENT OF PRODUCT ATTRIBUTES

Measuring internal product attributes: size - properties of software size - code size - design size - requirements analysis and specification size - functional size measures and estimators - Function Points - COCOMO.

Measuring internal product attributes: structure - Aspects of structural measures: structural complexity properties - length, coupling, cohesion, custom attributes properties.

Control flow structure of program units: Flow graph model and the notion of structured programs - Hierarchical measures - McCabe's cyclomatic complexity measure - code structure and test coverage measures. Design level attributes: global modularity- Tree impurity - Internal reuse - Information flow.

Object oriented structural attributes and measures: Measuring coupling and Cohesion in OO systems - OO length measures - OO reuse measurement - Design pattern use. **(12)**

MEASURING EXTERNAL PRODUCT ATTRIBUTES

Measuring external product attributes: Modeling software quality - measuring aspects of quality - Usability measures - Maintainability Measures-Security measures. **(5)**

PRODUCT AND PROCESS QUALITY METRICS

Product quality metrics, In Process quality metrics - software maintenance metrics. In-process metrics for software Testing: Test Progress S curve, Testing defect arrivals over time, Testing defect backlog over time. **(7)**

SOFTWARE RELIABILITY MEASUREMENT

Basics of reliability theory- software reliability problem - parametric reliability growth models: Jelinski-Moranda Model, other models based on Jelinski Moranda, littlewood model, littlewood-verrall model - the recalibration of software reliability growth predictions. **(5)**

TOTAL : 45

REFERENCES

1. *Norman Fenton and James Bieman, "Software Metrics - A Rigorous & Practical Approach", CRC press, Third Edition, 2014.*
2. *Stephen H Kan, "Metrics and Models in Software Quality Engineering", Pearson Education, Second Indian Reprint, New Delhi, 2007.*
3. *International Function Point Users Group, "IT Measurement - A Practical Advice from the Experts ", Pearson Education, Asia, 2002.*
4. *Roger S. Pressman," Software Engineering-A Practitioner's approach", Mc Grawhill Education(India), 7e, 2014*

19MCSE13 - ROBOT HUMAN INTERACTION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Understanding the fundamental concepts of robots , sensors and hardware systems*

CO2 : *In depth understanding of various sensors, its elements and characteristics.*

CO3 : *Understanding the integration of robot working in the real world into programming languages*

CO4 : *Understanding the theoretical aspects of robotics from the basics to advanced applications*

INTRODUCTION TO ROBOTICS

Introduction To Robotics - Robot features, sensors, manipulators - Application areas - State of Robotics research and adoption - Robotic hardware systems - Kinematics and inverse kinematics - Sensors, sensor data interpretation and sensor fusion - Path planning - Configuration spaces. **(9)**

ROBOT SENSING

Robot Sensing - Categories of sensors in robots - Range sensing: Triangulation, Structured Lighting Approach, Time-of-Flight Range Finders -Proximity Sensing: Inductive sensors, Hall-effect sensors, Capacitive sensors, Ultrasonic sensors, Optical Proximity sensors -Touch sensors: Binary sensors, Analog sensors - Force and Torque sensing: Elements of wrist sensor, Resolving forces and moments - Sensor calibration. **(10)**

ROBOT VISION

Robot Vision - Imaging geometry - Perspective transformations - Camera model - Camera calibration - Stereo imaging - Basic relationship between pixels - Preprocessing - Smoothing - Enhancement - Edge detection - Thresholding - Segmentation - Use of motion -Description - Recognition. **(9)**

ROBOT PROGRAMMING LANGUAGES

Robot Programming Languages - Characteristics of robot-level languages: Position specification, Motion specification, Sensing and flow of control, Programming support - Characteristics of task-Level languages: World modeling, Task specification, Robot program synthesis **(10)**

HUMAN-ROBOT INTERACTION

Human-Robot Interaction - Basics - Implicit vs Explicit interaction - HRI experimentation design - Intelligent interaction - Multi-agent systems Applications. **(7)**

TOTAL : 45

REFERENCES

1. *K.S.Fu, R.C.Gonzalez, C.S.G.Lee,"Robotics - Control, Sensing, Vision and Intelligence", Tata McGraw Hill, Second Edition,2008*
2. *R.K.Mittal, I.JNagrath, "Robotics and Control", Tata McGraw Hill, Second Edition, 2007*
3. *Computational Principles of Mobile Robotics. Gregory Dudek and Michael Jenkin. 2nd ed. CambridgeUniversity Press, 2010.*
4. *Fundamentals of robotic mechanical systems: theory, methods, and algorithms. Jorge Angeles. New York,Springer, 2003.*

19MCSE14 - BIG DATA ANALYTICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Ability to use Hadoop, Map Reduce Framework.*

CO2 : *Ability to identify the areas for applying big data analytics for increasing the business outcome.*

CO3 : *Contextually integrate and correlate large amounts of information to gain faster insights.*

INTRODUCTION TO BIG DATA

Introduction to Big Data Platform - Challenges of Conventional Systems - Intelligent data analysis - Nature of Data - Analytic Processes and Tools - Analysis Vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error. **(9)**

SEARCH METHODS AND VISUALIZATION

Search by simulated Annealing - Stochastic, Adaptive search by Evaluation - Evalution Strategies - Genetic Algorithm - Genetic Programming - Visualization - Classification of Visual Data Analysis Techniques - Data Types - Visualization Techniques - Interaction techniques - Specific Visual data analysis Techniques **(9)**

MINING DATA STREAMS

Introduction To Streams Concepts - Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream - Filtering Streams - Counting Distinct Elements in a Stream - Estimating Moments - Counting Oneness in a Window - Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions. **(9)**

FRAMEWORKS

MapReduce - Hadoop, Hive, MapR - Sharding - NoSQL Databases - S3 - Hadoop Distributed File Systems - Case Study- Preventing Private Information Inference Attacks on Social Networks- Grand Challenge: Applying Regulatory Science and Big Data to Improve Medical Device Innovation **(9)**

R LANGUAGE

Overview, Programming structures: Control statements -Operators -Functions -Environment and scope issues -Recursion - Replacement functions, R data structures: Vectors -Matrices and arrays -Lists -Data frames -Classes, Input/output, String manipulations. **(9)**

TOTAL : 45

REFERENCES

1. *Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.*
2. *Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012*
3. *Norman Matloff,"The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, USA, 2011.*
4. *Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2017.*
5. *Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2017.*

19MCSE15 - DEEP LEARNING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Understanding the basics concepts of deep learning.*

CO2 : *Emphasizing knowledge on various deep learning algorithms.*

CO3 : *Understanding of CNN and RNN to model for real world applications.*

CO4 : *Understanding the various challenges involved in designing deep learning algorithms for varied applications*

INTRODUCTON TO DEEP LEARNING

Introduction to Deep Learning: Basics: Biological Neuron, Idea of computational units, McCulloch-Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm. **(7)**

FEEDFORWARD NETWORKS

Feed forward Networks: Multilayer Perceptron, Gradient Descent, Back propagation, Empirical Risk Minimization, regularization, autoencoders. **(7)**

CONVOLUTIONAL NETWORKS

Convolutional Networks: The Convolution Operation - Variants of the Basic Convolution Function - Structured Outputs - Data Types - Efficient Convolution Algorithms - Random or Unsupervised Features- LeNet, AlexNet **(9)**

RECURRENT NEURAL NETWORKS

Recurrent Neural Networks: Bidirectional RNNs - Deep Recurrent Networks Recursive Neural Networks - The Long Short-Term Memory and Other Gated RNNs **(8)**

DEEP GENERATIVE MODELS

Deep Generative Models: Boltzmann Machines - Restricted Boltzmann Machines - Introduction to MCMC and Gibbs Sampling-gradient computations in RBMs - Deep Belief Networks- Deep Boltzmann Machines **(9)**

APPLICATIONS

Applications: Large-Scale Deep Learning - Computer - Speech Recognition - Natural Language Processing - Other Applications **(5)**

TOTAL : 45

REFERENCES

1. *Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.*
2. *Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning 2.1 (2009): 1127.*
3. *N.D.Lewis, "Deep Learning Made Easy with R: A Gentle Introduction for Data Science", January 2016.*
4. *Nikhil Buduma, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", O'Reilly publications, 2017.*
5. *Tariq Rashid, "Make your own neural network ", 2017.*

19MCSE16 - BIOINFORMATICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Students shall learn the basic aspects of the biological patterns, information retrieval strategies, sequence alignments and the issues in proteins and drug discovery.*

CO2 : *Knowledge about information retrieval strategies, sequence alignment and issues in proteins and drug discovery.*

CO3 : *Identify and formulate bio-informatics problems using machine learning approaches.*

BIOLOGY FOR BIOINFORMATICS

Basic concepts - cells- Archaebacteria, Bio membranes, Nucleus, Organelles, Mitochondria, Chloroplasts, Viruses, Bacteria Phage, Genetic contents of a cell - Viral Proteins - Amino acid, DNA and RNA - Forms of DNA. **(9)**

GENETIC CODE

Genome - Gene Expressions - Protein Synthesis - Transcription RNA - Processing- Capping- Splicing - Editing, Cell Signalling, DNA cloning Genomic library - cDNA library - Probes - Screening. Databases: Characteristics of Bioinformatics, Database - Categorizing, Navigating, Information Retrieval systems, Sequence Databases, Structure Databases. **(9)**

SEQUENCE ALIGNMENT

Introduction to Sequence Alignment - dotplot - dotplots and sequence alignment - Measures of Sequence similarity - Alignment of two sequences using dynamic programming algorithm - Multiple Sequence Alignment - Applications - Phylogeny - Phylogenetic trees. **(8)**

PROTEIN STRUCTURE DISCOVERY

Protein stability and folding - Applications of Hydrophobicity - Super position of structures - DALI - Evolution of protein Structures - Classification of Protein Structures - Protein structure prediction - and modelling - Assignment of protein structures to genomes - prediction of protein function - Drug Discovery and development. **(8)**

MACHINE LEARNING IN BIOINFORMATICS

Gradient descent - EM/GEM algorithms -Markov chain Monte-Carlo methods - simulated annealing - Evolutionary & genetic algorithms: ACO, B-Colony and PSO. **(11)**

TOTAL : 45

REFERENCES

1. *Orpita Bosu, Simminder Kaur Thukral, "Bioinformatics Databases, Tools and Algorithms", Oxford University Press, 2007.*
2. *Arthur M Lesk, "Introduction to Bioinformatics", Oxford University Press, India, Third Edition,2008.*
3. *Pierre Baldi and Søren Brunak, "Bioinformatics: the Machine Learning Approach", MIT Press, 1998.*
4. *David W. Mount, "Bioinformatics: Sequence and Genome Analysis", Cold Spring Harbor Laboratory Press, Second edition, 2004.*

19MCSE17 - INTERNET OF THINGS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Ability to design fully connected products by integrating Internet services and physical objects.*

CO2 : *Ability to analyze, design and develop prototypes of Internet-connected products using appropriate tools.*

CO3 : *Identifying, classifying and describing different kinds of Internet-connected product and its concepts.*

INTRODUCTION

Smart Objects - Challenges for Smart Objects - IP for Smart Objects: motivation and main challenges - Security for Smart objects - Web services for Smart Objects - Connectivity models for Smart Object Networks - Introduction to the Internet of Things: application scenarios, current solutions. **(9)**

SMART OBJECTS AND LLNS

Hardware and Software - Energy Management - Communication for Smart Objects : IEEE 802.15.4: main features, topologies, addressing and MAC frame format - Low Power and Lossy Networks (LLN): Introduction to 6LoWPAN - 6LoWPAN architecture: simple, extended and ad-hoc networks - 6LoWPAN adaptation layer -Issues in determining IPv6 links in LLNs - IPv6 addressing in 6LoWPAN- 6LoWPAN forwarding: route-over and mesh under approaches- Neighbor Discovery optimizations and extensions to the ND protocol for 6LoWPAN networks **(11)**

ROUTING IN LOW POWER AND LOSSY NETWORKS

Mesh-under and route-over solutions - Routing Requirements - Routing metrics - The IPv6 Routing Protocol for LLNs (RPL)- Protocol operation - use of destination oriented directed acyclic graphs - DODAG formation - RPL Messages **(9)**

CoAP

Interaction Model - Messages and Request/Response Model - Resource observing - Service discovery - Resource discovery - CORE Link Format **(9)**

APPLICATIONS

Case Study -Smart Cities and Urban automation - Home Automation - Building Automation - Structural Health Monitoring **(7)**

TOTAL : 45

REFERENCES

1. *J.-P. Vasseur, A. Dunkels, "Interconnecting Smart Objects with IP: The Next Internet", Morgan Kaufmann, 2010.*
2. *Z. Shelby, C, "Bormann. 6LoWPAN: The Wireless Embedded Internet", Wiley, 2009*
3. *Z. Shelby, K. Hartke, K. Hartke, "The Constrained Application Protocol (CoAP)", RFC 7252, 2014.*

19MCSE18 - WEB ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Ability to understand Web Engineering Components, Principles and Practices.*

CO2 : *Ability to analyze web engineering models and design web applications.*

CO3 : *Gain knowledge about technologies and tools for developing web applications*

WEB ENGINEERING COMPONENTS

Web Engineering - Framework - Principles - Components - Best Practices - Process Flow - Generic Action and Tasks. Web Communication: Communication Activity-Formulation- Elicitation-Identifying WebApp Increments- Negotiation. Planning: Scope-Building a WebE Team-Managing Risk-Developing a Schedule-Managing Quality-Managing Change-Tracking the Project-Outsourcing WebE work. **(9)**

MODELING AND WEB APP DESIGN

Modeling Activity: Concept-Modeling Frameworks-Modeling Languages.

Analysis Modeling for WebApps: Content Model- Interaction Model- Function Model and Configuration Model.

WebApp Design: Design goals-Design process. Interactive design: Preliminaries-Design Steps-Usability- Issues .Information Design: Information Architecture- Structuring the information space-Blueprints- Accessing Information-Wireframe Models.

Functional Design: Nature-Design process-Functional Architecture-Detailed Functional Design. **(12)**

PATTERNS, TECHNOLOGIES AND TOOLS

Design Patterns: Patterns-WebApp Patterns - Pattern Repositories.

Technologies and Tools: Issues - Implementation Tools and technologies and Development Tools and technologies. **(6)**

TESTING WEB APPLICATIONS

Testing Concepts: Dimensions of quality- Types of errors-Testing strategy-Test plan. Testing Process-Content Testing-User Interface Testing-Usability Testing-Compatibility Testing-Navigation Testing: Navigation syntax-Navigation semantics. Configuration Testing: Test the server side-Test the client side. Security and Performance Testing: WebApp Secure-WebApp Performance-Objective-Load Testing and Stress testing. **(9)**

CHANGE AND CONTENT MANAGEMENT

WebApp Change-Change Management: Need-Issues-Change Management Activity-Identify the Objects-Control a change-Manage versions. Content management - Criteria for implementing a CMS: Volume Affect CMS-Population of content creators -Change volume Affect. Changing Nature of the Web and WebApps-Evolving Web Technologies and Web 2.0: Web 2.0-Technologies Support Web 2.0-Key issues-Next for Web 2.0. **(9)**

TOTAL : 45

REFERENCES

1. *Roger Pressman and David Lowe,"Web Engineering-A Practitioners Approach", Tata McGraw Hill, First Edition, 2008.*
2. *Gerti Kappel, Brigit Proll, ,Siegfried Reich, Werner Retschitzegger, "Web Engineering", Wiley India Pvt. Ltd, 2009.*
3. *Douglas Corner," The Internet Book: Everything you need to know about Computer Networking and How the Internet Works", Prentice Hall, Fourth Edition, 2006.*
4. *Jennifer Niederst Robbins," Learning Web Design: A beginner's Guide to HTML, CSS, JavaScript and Web Graphics", O'Reilly, Fourth Edition, 2012.*

19MCSE19 - PARALLEL ALGORITHMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Knowledge on global communication functions for distributed memory using MPI*

CO2 : *Ability to develop programs for shared memory using pthreads and OpenMp*

CO3 : *Ability to develop high performance parallel application using CUDA memory and thread model.*

DISTRIBUTED-MEMORY PROGRAMMING WITH MPI

Parallel Program design - Deploying Parallel programs - MPI program execution - MPI constructs - libraries - MPI send and receive - Point-to-point and Collective communication - MPI derived data types - Performance evaluation **(9)**

SHARED MEMORY PROGRAMMING WITH PTHREADS

Pthreads : Execution - Critical Sections - Busy-Waiting - Synchronization primitives: mutexes, locks, semaphores, barriers - Cache Coherence and False Sharing using Pthreads - Matrix - Vector Multiplication using Pthreads. **(9)**

OPENMP FOR SHARED MEMORY PROGRAMMING

OpenMP Execution Model - Handling variables - The Reduction Clause - Parallel for directive clause - Looping - Scheduling loops - Producers & Consumers Problem - Cache Coherence and False Sharing **(9)**

CUDA BASICS AND THREADS

Program Structure - Device Memories and Data Transfer - Kernel Functions & Organization of Threads - Distinguishing threads using blockIdx and threadIdx variables.Synchronization and Scalability - Assigning and Scheduling Threads. **(9)**

CUDA MEMORY AND PERFORMANCE

Cuda Device memory types Strategy for reducing memory traffic - Memory as a Limiting factor to parallelism - Performance Tuning: Dynamic Partitioning, Data Prefetching, Instruction Mix, Thread Granularity. **(9)**

TOTAL : 45

REFERENCES

1. *Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan-Kauffman, 2011, reprint 2014.*
2. *David.B.Kirk, Wen-mei W,Hwu, " Programming Masively Parallel Processors - A Hands-on Approach", Elsevier, 2010.*
3. *Michael J Quinn, "Parallel programming in C with MPI and OpenMP", Tata McGraw Hill, Seventh reprint 2008.*
4. *Thomas Rauber,Gudula Runger, "Parallel Programming for Multicore and Cluster Systems", Springer, 2011.*
5. *David E.Culler, Jaswinder Pal Singh, Anoop Gupta,"Parallel Computer Architecture - A Hardware/Software Approach", Morgan Kauffman Publishers, 2011.*

19MCSE20 - COMPUTER VISION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Understand the major concepts and techniques in computer vision and image processing.*

CO2 : *Demonstrate computer vision and image processing knowledge by designing and implementing algorithms to solve practical problem.*

CO3 : *Gain knowledge in segmenting the image and perform Patten analysis.*

IMAGE PROCESSING FOUNDATIONS

Image processing techniques - classical filtering operations - thresholding techniques - edge detection techniques - corner and interest point detection - mathematical morphology - texture. **(8)**

IMAGE FORMATION AND PROCESSING

Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine and Projective. Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing. **(10)**

FEATURE EXTRACTION

Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT. **(10)**

IMAGE SEGMENTATION

Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection. **(7)**

PATTERN ANALYSIS

Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods. **(10)**

TOTAL : 45

REFERENCES

1. *Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.*
2. *Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.*
3. *Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.*
4. *K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.*
5. *R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992.*

19MCSE21 - CASE BASED REASONING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Knowledge the basic elements of case based reasoning, case representation and similarity measures.*

CO2 : *Ability to apply case retrieval, indexing and adaptation process for developing case based reasoning systems.*

CO3 : *Ability to implement case based reasoning for managing complex knowledge sources.*

BASIC CASE BASED REASONING ELEMENTS

Case-Based Reasoning- Experiences and Cases -Parts of a Case -Problems - Solution Types - Case Representations - Case Bases - Similarity and Retrieval -Reuse and Adaptation -Models of CBR. **(8)**

CASE REPRESENTATION AND SIMILARITY MEASURES

Representation Layers - Completeness and Efficiency -Flat Attribute-Value Representation-Complex Representations in General. Similarity and Case Representations -Types of Similarity Measures -The Local-Global Principle for Similarity Measures - Virtual Attributes- Similarity Measure to Use. Complex Similarities: Graph Representations and Graph Similarities- Largest Common Subgraphs- Taxonomic Similarities- Similarities for Object-Oriented Representations- Many-Valued Attributes- Similarity for Processes and Workflows. **(9)**

CASE RETRIEVAL AND INDEXING

The Retrieval Task - Retrieval Errors-Basic Retrieval Methods: Query Generation-Filtering-Sequential Retrieval -Two-Level Retrieval -Geometric Methods - Voronoi Diagrams and k-Nearest Neighbours -Geometric Approximation - Geometric Filtering-Index-Based Retrieval - kd-Trees- Integration with Decision Trees. Case Indexing- Traditional Indexing Method-Case Indexing Using a Bayesian Model, Prototype-Based Neural Network and Three-Layered Back Propagation Neural Network. **(10)**

CASE ADAPTATION AND CASE-BASE DEVELOPMENT

Rules - Adaptation Types -The Adaptation Process - Adaptation Using Several Cases - Adaptations Using the Solution Process - Quality Issues - Knowledge in the Adaptation Container. Case Based Development-Problem Formulation -Finding and Getting Data, Preprocessing - Case Acquisition- Prototypes and Evaluation The Knowledge Containers -Systematic Development of CBR Systems- Implementation Aspects -Combining CBR with Other Techniques-Maintenance. **(10)**

COMPLEX KNOWLEDGE SOURCES AND KNOWLEDGE MANAGEMENT

Textual CBR- Images- Sensor Data and Speech - Conversational CBR.Knowledge Management- Case-Based Reasoning and Knowledge Management- CBR Implementing KM Cycles. **(8)**

TOTAL : 45

REFERENCES

1. *Michael M. Richter and Rosina O. Weber, Case-based reasoning: a textbook, Springer, 2013.*
2. *S. Simon, P. Sankar, ?Foundations of Soft Case-Based Reasoning, 1st ed. Wiley-Interscience, 2004.*
3. *J. Kolodner, ?Case-Based Reasoning, San Mateo, CA: Morgan Kaufmann Publishers; 1993*
4. *I.Watson, Applying Case-Based Reasoning: Techniques for Enterprise Systems. San Francisco, CA: Morgan Kaufmann Inc. 1997.*

19MCSE22 - MULTIMEDIA SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Knowledge in learning the basic elements of multimedia and need for compression and various compression techniques used for efficient transmission of multimedia data.*

CO2 : *Knowledge about data and file format standards and analyze the importance of real time scheduling.*

CO3 : *Analyze the role of communication subsystem and the need of multimedia data transmission.*

MULTIMEDIA SYSTEM DESIGN

Elements - Applications - Multimedia system architecture - Evolving technologies for Multimedia system- Defining objects - Multimedia Data Interface standards - Multimedia databases. **(6)**

DATA AND FILE FORMAT STANDARDS

Rich Text Format - TIFF - RIFF - MIDI - JPEG DIB - AVI Indeo File Format - MPEG Standards- TWAIN: Objectives - Architecture - New WAVE RIFF file format - PDF File Format- multidimensional Index Structures: k-d Trees - Point Quad Tree - M-X Quad Tree - R Trees. **(10)**

COMPRESSION AND DECOMPRESSION

The Need for Data Compression - Types - Binary Image Compression Schemes - Color, Gray Scale and Still Video Image Compression -Video Image Compression - Audio Compression. **(10)**

DATABASE MANAGEMENT SYSTEM

Real time: Notion of real time - Real Time and multimedia. Resource management: Resources -Requirements - Components and Phases - Allocation scheme - Continuous Media Resources Model.

Process management: Earliest Deadline First - Rate Monotonic - Processor Utilizations - Scheduling of Continuous Media Task. File systems: Multimedia File System.

Database systems: Multimedia database management system-characteristics of MDBMS - Data analysis-Data structure-Operations on data - Integration in a Database model. **(9)**

MULTIMEDIA COMMUNICATION SYSTEMS AND APPLICATION

Application subsystem-Transport Subsystem-Synchronization: Introduction-Notion of synchronization-Presentation requirements-A Reference model for Multimedia Synchronization: Existing classification Approaches -The Synchronization Reference Model-Synchronization in distributed environment-Multimedia Applications for Media Communication: Video Conferencing-Teleconferencing-Multimedia applications for Media Entertainment: Virtual Reality-Interactive Video. **(10)**

TOTAL : 45

REFERENCES

1. *Steve Harrington, "Computer Graphics - A Programming Approach", McGraw Hill Book Co., Second Edition, 2007.*
2. *Ralf Steinmetz, Klara Nahrstedt, "Multimedia: Computing, Communications and Applications", Pearson Education Limited-Sixth Impression, 2009.*
3. *http://wwwimages.adobe.com/www.adobe.com/content/dam/Adobe/en/devnet/pdf/pdfs/PDF32000_2008.pdf (PDF File Format).*

19MCSE23 - ADHOC NETWORKS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Understand the fundamentals of wireless Ad Hoc networks.*

CO2 *: Acquire knowledge on the various MAC, Network and Transport layer protocols for wireless Ad Hoc networks.*

CO3 *: Acquire knowledge in the area of QoS and energy management requirements in wireless Ad Hoc networks.*

MAC PROTOCOLS

Ad Hoc Wireless Networks: Introduction - Issues in Ad Hoc Wireless Networks -Issues in Designing a MAC Protocol for Ad hoc Wireless Networks - Classification of MAC Protocols: Contention-Based - MACAW, Busy tone multiple Access Protocol, Contention-Based with Reservation Mechanisms-Distributed Packet Reservation Multiple Access Protocol, Collision Avoidance Time Allocation Protocol, Five phase Reservation protocol, Real Time Medium Access control Protocol - Contention -Based with Scheduling Mechanisms-Distributed Priority Scheduling. **(9)**

ROUTING PROTOCOL

Issues in Designing a Routing Protocol for Ad hoc Wireless Networks - Classifications of Routing Protocols: Table-Driven-DSDV, On-Demand-DSR,AODV, Hybrid - Zone routing protocol - Hierarchical Routing Protocol - Power Aware Routing Protocols **(9)**

MULTICAST ROUTING

Issues in Designing a Multicast Routing Protocol - Operation of Multicast Routing Protocols - Classifications of Multicast Routing Protocols - Tree-Based Multicast Routing Protocols - Bandwidth efficient Multicast Routing Protocol, Multicast Routing Protocol Based on zone Routing, Multicast Core Extraction Distributed Ad Hoc Routing, MAODV - Mesh-Based- On Demand Multicast Routing Protocol, Dynamic core based Multicast Routing protocols, Core Assisted Mesh Protocol, Energy efficient Multicast Routing Protocol - Multicasting with Quality of Service Guarantees - Application Dependent Multicast Routing. **(10)**

TRANSPORT LAYER AND SECURITY PROTOCOLS

Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP over Ad Hoc Wireless Networks, Secure Routing in Ad Hoc Wireless Networks **(7)**

QUALITY OF SERVICE & ENERGY MANAGEMENT

Issues and challenges in providing QoS in Ad Hoc Wireless Networks - Classifications of QoS Solutions: MAC Layer Solutions-Cluster TDMA, DBASE - Network Layer Solutions - Ticket Based Protocol, On-Demand Link-State multipath QoS Routing Protocol - QoS Frameworks for Ad Hoc Wireless Networks-INSIGNIA, INORA, SWAN- Energy Management in Ad Hoc Wireless Networks, Classification of Energy Management Schemes - Battery Management Schemes, System Power Management Schemes. **(10)**

TOTAL : 45

REFERENCES

1. *C.Siva Ram Murthy, B.S.Manoj, "Ad-Hoc Wireless Networks- Architectures and Protocols", Prentice Hall, 2012.*
2. *C.K.Toh, "Ad Hoc Mobile Wireless Networks", Pearson Education, 2009.*
3. *Carlos DE Morais Cordeiro. Dharma Prakash Agrawal, " Ad-Hoc and Sensor Networks - Theory and Applications", Second Edition, 2006.*

19MCSE24 - WIRELESS SENSOR NETWORKS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Familiarize with the architectures and functions of wireless sensor network systems and Platforms.*

CO2 : *Evaluate the performance of sensor networks and identify bottlenecks.*

CO3 : *Expose students to emerging technologies and their potential impact.*

INTRODUCTION

Basics sensor network Architecture-Generation of sensor network - challenges - hardware and software components of wireless nodes-operating environment - Applications: Home control, Building Automation, Medical applications. **(9)**

MAC PROTOCOLS

Schedule based protocols: Self-organizing MAC for Sensornets (SMACS), Low Energy Adaptive Clustering Hierarchy (LEACH) - Random Access based protocols - Sensor MAC protocol , IEEE 802.15.4 and Zigbee Reference Model - Super frame structure - Frame types - Modes of operation : Contention based channel Access, Beacon less mode. **(10)**

ROUTING PROTOCOLS

Data Dissemination and Gathering - Challenges and Design Issues - Flooding - Sensor Protocols for Information via Negotiation (SPIN) - LEACH - Power Efficient Gathering in Sensor Information System (PEGASIS) - Directed Diffusion - Geographical routing. **(11)**

TRANSPORT CONTROL PROTOCOLS

Design issues - Congestion Detection and Avoidance (CODA) - Event to Sink Reliable Transport (ESRT) Reliable Multi Segment Transport (RMST) - Pump Slowly Fetch Quickly (PSFQ) - GARUDA - Ad-hoc Transport Protocol (ATP) **(8)**

OPERATING SYSTEM AND PERFORMANCE MODELS

OS Design Issues - Features of Tiny OS , MANTIS - Performance Modeling of WSN : Performance Metrics - Basic Models: Traffic Models, Energy Models, Node model - Network models: MAC model, Routing Model, System Model. **(7)**

TOTAL : 45

REFERENCES

1. *Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology,Protocols, and Applications", Second Edition, John Wiley, 2011.*
2. *Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2010.*
3. *Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication, First Edition, 2005.*
4. *Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2007*
5. *Jun Zheng, Abbas Jamalipour, "Wireless Sensor Networks - A Networking Perspective", Wiley India, 2014.*

19MCSE25 - SECURE SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Ability to understand the various security issues encountered in software development and the properties of secure software.*

CO2 : *Gain knowledge on security principles and practices to be deployed in software requirements design, coding and testing of real-life applications.*

CO3 : *Ability to understand the features of enterprise software security framework, maturity practices and adopt them in practice.*

SECURITY: A SOFTWARE ISSUE

Introduction- the problem - Software Assurance and Software Security - Threats to software security - Sources of software insecurity - The Benefits of Detecting software security defects early. Defining Properties of Secure Software: Core properties of secure software- Influential properties of secure Software. Building a Security Assurance Case and Incorporating into the SDLC. **(9)**

REQUIREMENTS ENGINEERING FOR SECURE SOFTWARE

Introduction : Importance of Requirements engineering-Quality requirements-security requirements engineering - Requirements elicitation: Overview of several elicitation methods-Elicitation evaluation criteria.

Requirements Prioritization : Identify candidate prioritization methods- Prioritization technique comparison- Recommendations for requirements prioritization. **(7)**

SECURE SOFTWARE ARCHITECTURE AND DESIGN

Introduction - Architectural risk analysis : Software Characterization-Threat Analysis- Architectural Vulnerability Assessment-Risk Likelihood Determination-Risk Impact Determination -Risk Mitigation Planning - software security knowledge : security principles- security guidelines and attack patterns. **(11)**

SECURE SOFTWARE CODING AND TESTING

Code analysis : Common software code vulnerabilities- Source code Review- Software Security testing: Contrasting software testing and software security testing -Functional Testing-Risk based Testing- Security testing considerations throughout the SDLC: Unit testing- Testing libraries and executable files-Integration testing- System Testing. **(9)**

GOVERNANCE AND MANAGING FOR MORE SECURE SOFTWARE

Governance and security : Definitions of Security governance- Characteristics of effective security governance and management.

Adopting an Enterprise Software Security framework : Common Pitfalls-Framing the Solution-Define a Road Map.

Security and project management : Project scope- Project plan- Resources- Estimating the nature and duration of required resources- Project and product risks- measuring software security- Maturity of Practice. **(9)**

TOTAL : 45

REFERENCES

1. *Julia H. Allen, Sean Barnum et al., "Software Security Engineering: A Guide for Project Managers", Addison Wesley, 2008.*
2. *Jason Grembi, "Secure Software Development: A Security Programmer's guide", Cengage Learning, 2008.*
3. *Richard Sinn, "Software Security Technologies: A Programmatic Approach", Cengage Learning, 2008.*

19MCSE26 - SERVICE ORIENTED ARCHITECTURE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Develop and deploy simple and composite web services with SOA design principles.*

CO2 : *To understand and describe the standards and technologies of modern web service implementations.*

CO3 : *Ability to use development tools for the implementation of service oriented applications.*

UNDERSTANDING SOA

Introduction of SOA- SOA architecture fundamentals-Overview of SOA implementation methodology - SOA reference architecture - Service identification -Service specification- Service realization -Service life cycle. **(9)**

DESIGNING SOA

Business architecture - Business motivation model -Business process management and modeling -Conditional business process models - The importance of semantics in SOA- Core information modeling- Defining type. **(9)**

SERVICE ORIENTED DESIGN

Introduction to service-oriented design - WSDL related XML schema language - WSDL language -SOAP language- Service interface design tools- Steps to composing SOA-Considerations for choosing service layers -Considerations for positioning core SOA standards. **(9)**

BUSINESS PROCESS DESIGN

Service design overview- Entity centric business service design- Application service design - Task centric business service design-Service design guidelines-WS-BPEL language basics- WS coordination. **(9)**

SOA PLATFORM

WS addressing language- WS reliable messaging language-WS policy language - WS metadata exchange language- WS security language-SOA platform basics- SOA support in J2EE- SOA support in .NET. **(9)**

TOTAL : 45

REFERENCES

1. *Michael Rosen, Boris Lublinsky, Kevin T.Smith and Marc J.Balcer, "Applied SOA: Service-Oriented Architecture and Design Strategies", Wiley India Edition, 2008*
2. *Thomas Erl, "Service-Oriented Architecture: Concepts, Technology and Design", Pearson Education, 2008.*
3. *Newcomer, Lomow, "Understanding SOA with Web Services", Pearson Education, 2009.*
4. *Dan Woods and Thomas Mattern, "Enterprise SOA: Designing IT for Business Innovation", O'REILLY, 2006.*

19MCSE27 - HUMAN COMPUTER INTERACTION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Gain knowledge on the desirable features of good user interfaces and the design process*

CO2 : *Ability to design effective screens, web interfaces, system menus and navigational schemes and to identify suitable interaction devices .*

CO3 : *Ability to identify the Internationalization aspects of User Interface Design and apply them in practice.*

INTRODUCTION TO USER INTERFACES

Importance of User Interface : Definition-Importance of good design-Benefits of good design- Characteristics of Graphical and Web Interfaces: Interaction styles-The Graphical User Interfaces- Popularity of graphics - The concept of direct manipulation - Advantages/Disadvantages of Graphical systems-Characteristics of GUI- The Web User Interface-Popularity and characteristics of Web Interface- Principles of User Interface Design. **(9)**

USER INTERFACE DESIGN PROCESS

The User Interface Design Process: Designing for people-Seven Commandments-Common usability problems-measures of usability.

Know your user (or) Client: Important Human Characteristics in design- Human Considerations in the design - Human Interaction Speeds-Performance versus preference.

Understand the business function: Business definition and requirements analysis-determining basic business functions-Design Standards (or) Style Guides-Training and documentation needs. **(8)**

INTERFACE AND SCREEN DESIGN

Interface Design Goals - Screen & Web page Meaning and purpose- Organizing Elements - consistency- Starting point-Ordering Data and Content - Navigation and Flow - Visually Pleasing Composition - Distinctiveness- Focus and Emphasis - Technological considerations in Interface Design. **(8)**

DEVELOP SYSTEM MENUS AND NAVIGATION SCHEMES

Structure of Menus : Single-Sequential Linear- Simultaneous-Hierarchical-Connected-Event Trapping Menus. Functions of Menus: Navigation-Execution-displaying information-parameter input. Contents of Menus: Menu context-Menu Title-Choice Descriptions-Completion Instructions.

Formatting of Menus : Consistency-Display-Presentation-Organization-Complexity-Item arrangement- Ordering-Grouping-Selection support Menus.Phrasing the menus: Menu Titles -Menu Choice description-Menu Instruction-Intent Indicators-Keyboard short cuts. Web site Navigation- Kinds of Graphical menus. **(8)**

WINDOWS AND INTERACTION DEVICES

Window Characteristics- Components of a Window-Window Presentation Styles-Types of Windows- Organizing Window functions-The Web and the Browser.

Input Devices-Characteristics-Selection of proper input device. Output Devices-Screens-Speakers **(7)**

INTERNATIONALIZATION AND ACCESSIBILITY

International Considerations:-Localization-Cultural considerations-Words and Texts-Images and symbols- Colors, Sequence and functionality-Requirements determination and testing. Accessibility: Types of Disabilities-Accessibility Design. **(5)**

TOTAL : 45

REFERENCES

1. *Wilbert O Galitz, "The Essential Guide to User Interface Design", Wiley India Pvt., Ltd., Third Edition, 2007.*
2. *Ben Shneidermann, "Designing the User Interface", Pearson Education Asia, Fifth Edition, 2013*
3. *Alan Dix, Janet Finlay, G D Abowd and Russel Beale, "Human Computer Interaction", Pearson Education, 2004.*

19MCSE28 - SOCIAL NETWORK ANALYSIS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Understanding of the internal components of the social network.*

CO2 : *Ability to Model social network data and visualize social network.*

CO3 : *Demonstrate the ability to mine the behaviors of the users in the social network.*

INTRODUCTION

Networks-Relations and Structure- Relations and networks in the social and behavioral science- Social Network Data- Collection and application **(4)**

MATHEMATICAL REPRESENATIONS OF SOCIAL NETWORKS

Graphs Basic Definitions - Paths and Connectivity - Distance and Breadth-First Search - Network Data Sets: An Overview- Strong and Weak Ties - Triadic Closure - The Strength of Weak Ties -Tie Strength and Network Structure in Large-Scale Data - Tie Strength, Social Media, and Passive Engagement - Closure, Structural Holes, and Social Capital - Advanced Material: Betweenness Measures and Graph Partitioning **(6)**

NETWORKS IN THEIR SURROUNDING CONTEXTS

Homophily - Mechanisms Underlying Homophily: Selection and Social Influence- Affiliation - Tracking Link Formation in Online Data -Positive and Negative Relationships-Structural Balance -Characterizing the Structure of Balanced Networks -Applications of Structural Balance- A Weaker Form of Structural Balance - Advanced Material: Generalizing the Definition of Structural Balance **(6)**

INFORMATION NETWORKS AND THE WORLD WIDE WEB

The Structure of the Web -The World Wide Web - Information Networks, Hypertext, and Associative Memory - The Web as a Directed Graph - The Bow-Tie Structure of the Web - The Emergence of Web 2.0- Link Analysis and Web Search -Searching the Web: The Problem of Ranking - Link Analysis Using Hubs and Authorities - Page Rank Applying Link Analysis in Modern Web Search - Applications beyond the Web - Advanced Material: Spectral Analysis, Random Walks, and Web Search **(9)**

NETWORK DYNAMICS

Structural Models - Cascading Behavior in Networks - Diffusion in Networks - Modeling Diffusion through a Network - Cascades and Clusters - Diffusion, Thresholds, and the Role of Weak Ties - Extensions of the Basic Cascade Model - Knowledge, Thresholds, and Collective Action - Advanced Material: The Cascade Capacity **(6)**

THE SMALL-WORLD PHENOMENON

Six Degrees of Separation- Structure and Randomness - Decentralized Search -Modeling the Process of Decentralized Search - Empirical Analysis and Generalized Models - Core-Periphery Structures and Difficulties in Decentralized Search - Advanced Material: Analysis of Decentralized Search -Small Network Model **(6)**

SNA AND ONLINE SOCIAL NETWORKS

Concepts: Services such as Facebook, LinkedIn, Twitter, CouchSurfing, etc. are using SNA to understand their users and improve their functionality **(8)**

TOTAL : 45

REFERENCES

1. *Stanley Wasserman, Katherine Faust, "Social network analysis: methods and applications", Cambridge University Press, 1999(Reprint).*
2. *David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press, 2010.*
3. *Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.*

19MCSE29 - ADVANCED CRYPTOGRAPHY AND PRACTICES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Apply Symmetric and Asymmetric cipher techniques like Data Encryption Standard, RSA Encryption, and ECC to ensure the confidentiality of data.*

CO2 : *Apply suitable attacks like chosen Plain text attack, Chosen Cipher text attack, Birthday attack, and Differential analysis to cryptanalyze the cryptographic techniques.*

CO3 : *Apply Hash and MAC algorithms to ensure integrity of data.*

CO4 : *Relate the recent trends in cryptography with legacy methods.*

SYMMETRIC KEY CIPHERS

Introduction to Classical Cryptosystems -Modular Arithmetic, Euclid's Algorithm, Finite Fields -Feistel networks -Data Encryption Standard (DES), Advanced Encryption Standard (AES), Modern Block ciphers -Modes of operation of Block Ciphers -Pseudo random number generators(PRNG) -RC4 Stream Cipher. **(8)**

CRYPTANALYSIS OF SYMMETRIC KEY CIPHERS

Exhaustive search -time-space tradeoffs -linear cryptanalysis& differential cryptanalysis, Meet in the middle attack, Man-in-the-middle attack, side channel attacks, Pseudo Random Permutations (PRP) -Pseudo Random Functions (PRF) -security against chosen plaintext attacks (CPA), Chosen Cipher text attack(CCP). **(8)**

ASYMMETRIC KEY CIPHERS AND KEY MANAGEMENT

Number Theory -Primality Testing-Miller-Robin method-Chinese Remainder Theorem -The RSA Cryptosystem-Diffie-Hellman Key exchange-ECDHE - Bilinear Map-Elliptic curve Cryptosystem-Uses of Different Elliptic Curves(Edward CurveEd25519 and P256sec1)Key Management and Distribution: Distribution of Public Keys -X.509 Certificates-User Authentication: Kerberos 5. **(12)**

ASYMMETRIC KEY CIPHERS & MACS

Cryptanalysis of Asymmetric Key Ciphers : Trap door, One-way functions -Factoring Algorithms -Attacks on RSA -The Discrete Logarithm Problem (DLP). **(4)**

Hash Functions and MACs : Hash functions -Merkle-Damgard Construction, Message Authentication Codes (MACs) -MACs from collision resistance-Secure Hash Algorithms-SHA256, SHA 3-Birthday Attack, Digital Signature-ECDSA-X.509 Certificates **(7)**

RECENT TRENDS IN CRYPTOGRAPHY

Identity Based Encryption-Attribute based Encryption -Homomorphic Encryption -Provable security, Zero knowledge protocols, Authentication Encryption-AES_GCM, AES_CCM **(6)**

TOTAL : 45

REFERENCES

1. *W. Stallings, "Cryptography and Network Security: Principles and Practice", 7th Edition, Pearson Education. (Unit I, III, IV, V), 2017.*
2. *B. A. Forouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 3rd Edition, 2015.*
3. *Douglas Stinson, Mazura B. Patterson "Cryptography Theory and Practice", CRC Press, 4th Edition, 2019*
4. *https://crypto.stanford.edu/~dabo/pubs/papers/bfibe.pdf*

5. *https://www.youtube.com/watch?v=ZogQMKzoQdw*
6. *https://shaih.github.io/pubs/he-chapter.pdf*
7. *https://crypto.stanford.edu/~dabo/cryptobook/BonehShoup_0_4.pdf*

VIDEO LECTURES

1. *http://nptel.ac.in/courses/106105031/lecture by Dr. Debdeep Mukhopadhyay, IIT Kharagpur*
2. *https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-033-computer-system-engineering-spring-2009/video-lectures/ lecture by Prof. Robert Morris and Prof. Samuel Madden MIT.*

19MCSE30 - BLOCKCHAIN DESIGN AND THEIR USE CASES

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ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Understand emerging abstract models for Blockchain Technology.*

CO2 : *Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain.*

CO3 : *It provides conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.*

CO4 : *Apply hyperledger Fabric and Etherum platform to implement the Block chain Application.*

INTRODUCTION TO BLOCKCHAIN

Blockchain- Public Ledgers, Blockchain as Public Ledgers -Bitcoin, Blockchain 2.0, Smart Contracts, Block in a Blockchain, Transactions-Distributed Consensus, The Chain and the Longest Chain - Cryptocurrency to Blockchain 2.0 - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree **(7)**

BITCOIN AND CRYPTOCURRENCY

A basic crypto currency, Creation of coins, Payments and double spending, FORTH - the precursor for Bitcoin scripting, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay, Consensus introduction, Distributed consensus in open environments-Consensus in a Bitcoin network **(6)**

BITCOIN CONSENSUS

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopoly problem- Proof of Stake-Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases, Design issues for Permissioned Blockchains, Execute contracts- Consensus models for permissioned blockchain-Distributed consensus in closed environment-Paxos **(12)**

DISTRIBUTED CONSENSUS

RAFT Consensus-Byzantine general problem, Byzantine fault tolerant system-Agreement Protocol, Lamport-Shostak-Pease BFT Algorithm-BFT over Asynchronous systems, Practical Byzantine Fault Tolerance **(10)**

HYPER LEDGER FABRIC & ETHERUM

Architecture of Hyperledger fabric v1.1-Introduction to hyperledger fabric v1.1, chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity, Smart contracts, Truffle-Design and issue Crypto currency, Mining, DApps, DAO **(6)**

BLOCKCHAIN APPLICATIONS

Internet of Things-Medical Record Management System-Blockchain in Government and Blockchain Security-Blockchain Use Cases -Finance **(4)**

TOTAL : 45

REFERENCES

1. *Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.*
2. *Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.*
3. *Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015.*

19MCSOE01 - OPTIMIZATION TECHNIQUES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Formulate optimization problems.*

CO2 : *Understand and apply the concept of optimality criteria for various types of optimization problems.*

CO3 : *Solve various constrained and unconstrained problems in Single variable as well as multivariable.*

CO4 : *Apply the methods of optimization in real life situation.*

UNIT I

Engineering application of Optimization, Formulation of design problems as mathematical programming problems. **(7)**

UNIT II

General Structure of Optimization Algorithms, Constraints, the Feasible Region. **(7)**

UNIT III

Branches of Mathematical Programming: Optimization using calculus, Graphical Optimization, Linear Programming, Quadratic Programming, Integer Programming. **(11)**

UNIT IV

Optimization Algorithms like Genetic Optimization, Particle Swarm Optimization, Ant Colony Optimization etc. **(12)**

UNIT V

Recent trends : Real world applications of ant colony optimization, genetics and linear and quadratic programming. **(8)**

TOTAL : 45

REFERENCES

1. *Laurence A. Wolsey, Integer programming, Wiley Interscience, 1st Edition, 1998.*
2. *Andreas Antoniou & Wu-Sheng Lu Practical Optimization Algorithms and Engineering Applications, Springer 2007.*
3. *Edwin K., P. Chong & Stanislaw h. Zak, An Introduction to Optimization, Wiley, 4th Edition, 2013.*

19MCSOE02 - MOBILE APPLICATIONS AND SERVICES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: To understand various mobile platforms and their ecosystems like Android, iOS, and PhoneGap/WebOS.*

CO2 *: To explore emerging technologies and tools used to design and implement feature-rich mobile applications*

INTRODUCTION

Introduction to Android Development Environment, Factors in Developing Mobile Applications, Generic UI Development in Android. **(9)**

MORE ON UIs

VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodal UIs., Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Working with a Content Provider. **(9)**

COMMUNICATIONS VIA NETWORK AND THE WEB

State Machine, Correct Communications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony. **(9)**

NOTIFICATIONS AND ALARMS

Performance, Performance and Memory Management, Android Notifications and Alarms, Graphics, Performance and Multithreading, Graphics and UI Performance, Android Graphics. **(9)**

ANDROID APPLICATIONS

Packaging and Deploying, Performance Best Practices, Android Field Service App, Location Mobility and Location Based Services Android. **(9)**

TOTAL : 45

REFERENCE

1. *Wei-Meng Lee, Beginning Android™ 4 Application Development, John Wiley & Sons, 2012.*

19MCSOE03 - SOFT COMPUTING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completion of course, students would be able to:

CO1 *: Identify and describe soft computing techniques and their roles in building intelligent machines*

CO2 *: Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.*

CO3 *: Apply genetic algorithms to combinatorial optimization problems.*

CO4 *: Evaluate and compare solutions by various soft computing approaches for a given problem.*

INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS

Evolution of Computing : Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics. **(7)**

FUZZY LOGIC

Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making. **(8)**

NEURAL NETWORKS

Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks. **(10)**

LEARNING ALGORITHMS

Supervised Learning, Reinforcement Learning, Unsupervised Learning, Advances in Neural networks. **(10)**

GENETIC ALGORITHMS

Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning : Machine Learning Approach to Knowledge Acquisition. **(10)**

TOTAL : 45

REFERENCES

1. *Jyh:Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, Neuro:Fuzzy and Soft Computing , Prentice:Hall of India, 2003.*
2. *George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic:Theory and Applications , Prentice Hall, 1995.*

19MCSOE04 - DIGITAL FORENSICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Provides an in-depth study of the rapidly changing and fascinating field of computer forensics.*

CO2 : *Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.*

CO3 : *Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools*

CO4 : *E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics*

DIGITAL FORENSICS SCIENCE

Forensics science, computer forensics, and digital forensics. **(5)**

COMPUTER CRIME

Computer Crime - Investigative process, holistic approach to cyber-forensics. **(5)**

CYBER CRIME SCENE ANALYSIS

Various methods to search and seizure electronic evidence, retrieved and un-retrieved communications, documentation procedure of criminal investigation. **(9)**

EVIDENCE MANAGEMENT & PRESENTATION

Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause. **(10)**

COMPUTER FORENSICS

Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case. **(7)**

NETWORK FORENSICS

Open-source security tools for network forensic analysis, requirements for preservation of network data. Mobile forensics : Mobile forensics techniques & tools. **(9)**

TOTAL : 45

REFERENCES

1. *John Sammons, The Basics of Digital Forensics, Elsevier, Second Edition, 2014.*
2. *John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications, Second Edition, 2002.*

19MCSOE05 - DATA SCIENCE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Provide with the knowledge and expertise to become a proficient data scientist.*

CO2 *: Demonstrate an understanding of statistics and machine learning concepts that are vital for data Science.*

CO3 *: Produce Python code to statistically analyse a dataset.*

CO4 *: Critically evaluate data visualisations based on their design and use for communicating stories from data.*

INTRODUCTION TO CORE CONCEPTS AND TECHNOLOGIES

Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications. **(6)**

DATA COLLECTION AND MANAGEMENT

Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources **(7)**

DATA ANALYSIS

Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance,Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes. **(11)**

DATA VISUALISATION

Introduction, Types of data visualisation,Data for visualisation:Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings. **(10)**

APPLICATIONS AND RECENT TRENDS

Applications of Data Science,Technologies for visualisation, Bokeh (Python) Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science. **(11)**

TOTAL : 45

REFERENCES

1. *Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly, Oct 2014.*
2. *Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press, 2014.*

19MCSOE06 - INTRODUCTION TO INTELLIGENT SYSTEMS

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ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: to introduce Artificial Intelligence (AI) with emphasis on its use to solve real world problems*

CO2 *: To explore the essential theory behind methodologies for developing systems that demonstrate intelligent behaviour*

BIOLOGICAL FOUNDATIONS TO INTELLIGENT SYSTEMS I

Artificial neural networks, Back-propagation networks, Radial basis function networks, and recurrent networks. **(10)**

BIOLOGICAL FOUNDATIONS TO INTELLIGENT SYSTEMS II

Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks **(10)**

SEARCH TECHNIQUES

Search Methods Basic concepts of graph and tree search. Three simple search methods: breadth-first search, depth-first search, iterative deepening search. Heuristic search methods: best-first search, hill-climbing search. **(10)**

KNOWLEDGE REPRESENTATION

Knowledge representation and logical inference Issues in knowledge representation. Structured representation, such as frames, and scripts, semantic networks and conceptual graphs. Formal logic and logical inference. Knowledge-based systems structures, its basic components. Ideas of Blackboard architectures. **(10)**

LEARNING ALGORITHMS

Reasoning under uncertainty and Learning Techniques on uncertainty reasoning such as Bayesian reasoning, statistical learning and induction learning - Definition. **(5)**

TOTAL : 45

REFERENCES

1. *Luger G.F. and Stubblefield W.A. (2008). Artificial Intelligence: Structures and strategies for Complex Problem Solving. Addison Wesley, 6th edition.*
2. *Russell S. and Norvig P. (2009). Artificial Intelligence: A Modern Approach. Prentice-Hall, 3rd edition.*