SCHOOL OF ENGINEERING AND TECHNOLOGY

SRI PADMAVATI MAHILA VISVAVIDYALAYAM

(Women's University)

TIRUPATI – 517 502, Andhra Pradesh

Accredited by NAAC with "A" Grade

M.TECH – SCHEME and SYLLABUS - R19

Department of Computer Science and Engineering

Effective from 2019-20 under CBCS

SCHOOL OF ENGINEERING AND TECHNOLOGY
SRI PADMAVATHI MAHILA VISVAVISYALAYAM
SCHEME OF INSTRUCTION AND EVALUATION OF M.TECH (CSE)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
I YEAR – I SEMESTER (2019-20)

THEORY

S.No	Course Code	Course Title	Hours per Week			Credits	Evaluation					Total Marks
							Internal (30 Marks)			External (70 Marks)		
							Assignment	Test				
			L	T	P		Max. Marks	Duration (Hrs)	Max. Marks	Duration (Hrs)	Max. Marks	
1	19MCST01	Mathematical Foundations of Computer Science	3	0	0	3	5	2	25	3	70	100
2	19MCST02	Advanced Data Structures	3	0	0	3	5	2	25	3	70	100
3	19MCST03	Wireless and Mobile Networks	3	0	0	3	5	2	25	3	70	100
4		Elective – 1	3	0	0	3	5	2	25	3	70	100
5	19MBST01	Research Methodology and IPR	2	0	0	2	5	2	25	3	70	100

PRACTICALS

S.No	Course Code	Course Title	Hours per Week			Credits	Evaluation					Total Marks
							Internal (40 Marks)			External (60 Marks)		
							Continuous Evaluation	Test				
			L	T	P		Max. Marks	Duration (Hrs)	Max. Marks	Duration (Hrs)	Max. Marks	
6	19MCSP01	Advanced Data Structures Lab	0	0	4	2	20	2	20	3	60	100
7	19MCSP02	Wireless and Mobile Networks Lab	0	0	4	2	20	2	20	3	60	100
		Total	**14**	**0**	**8**	**18**						**700**

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
I YEAR – II SEMESTER (2019-20)

THEORY

S.No	Course Code	Course Title	Hours per Week			Credits	Evaluation					Total Marks
							Internal (30 Marks)			External (70 Marks)		
							Assignment	Test				
			L	T	P		Max. Marks	Duration (Hrs)	Max. Marks	Duration (Hrs)	Max. Marks	
1	19MCST04	Advanced Algorithms	3	0	0	3	5	2	25	3	70	100
2	19MCST05	Soft Computing	3	0	0	3	5	2	25	3	70	100
3		Elective – II	3	0	0	3	5	2	25	3	70	100
4		Elective – III / MOOCs	3	0	0	3	5	2	25	3	70	100

PRACTICALS

S.No	Course Code	Course Title	Hours per Week			Credits	Evaluation					Total Marks
							Internal (40 Marks)			External (60 Marks)		
							Continuous Evaluation	Test				
			L	T	P		Max. Marks	Duration (Hrs)	Max. Marks	Duration (Hrs)	Max. Marks	
5	19MCSS01	Term Paper cum Seminar	0	0	4	2	40	-	-	-	60	100
6	19MCSP03	Advanced Algorithms Lab	0	0	4	2	20	2	20	3	60	100
7	19MCSP04	Soft Computing Lab	0	0	4	2	20	2	20	3	60	100
		Total	**12**	**0**	**12**	**18**						**700**

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SCHEME OF INSTRUCTION AND EVALUATION OF M.TECH (CSE)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
II YEAR – I SEMESTER (2019-20)

THEORY												
S.No	**Course Code**	**Course Title**	**Hours per Week**			**Credits**	**Evaluation**					**Total Marks**
							Internal (30 Marks)			**External (70 Marks)**		
							Assignment	**Test**				
			L	**T**	**P**		**Max. Marks**	**Duration (Hrs)**	**Max. Marks**	**Duration (Hrs)**	**Max. Marks**	
1		Elective – IV	3	0	0	3	5	2	25	3	70	100
2		Open Elective	3	0	0	3	5	2	25	3	70	100
PRACTICALS												
S.No	**Course Code**	**Course Title**	**Hours per Week**			**Credits**	**Evaluation**					**Total Marks**
							Internal (40 Marks)			**External (60 Marks)**		
							Continuous Evaluation	**Test**				
			L	**T**	**P**		**Max. Marks**	**Duration (Hrs)**	**Max. Marks**	**Duration (Hrs)**	**Max. Marks**	
3	19MCSV01	Comprehensive Viva	0	0	0	2	40	-	-	-	60	100
4	19MCSJ01	Project Work Phase –I	0	0	20	10	100	-	-	-	-	100
		Total	**6**	**2**	**20**	**18**						**400**

***As per Regulations – R19, 14.4, Table 2**

SCHOOL OF ENGINEERING AND TECHNOLOGY
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
II YEAR – II SEMESTER (2019-20)

S.No	Course Code	Course Title	Credits	Internal Evaluation		External Evaluation		Total
				Guide	Internal Committee	External Dissertation	Viva	
1	19MCSJ02	Project Work Phase – II	16	20	20	30	30	100

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LIST OF ELECTIVES (2019-20)

ELECTIVE – I

S. No	Course Code	Course Title
1	19MCST06	Digital Forensics
2	19MCST07	Wireless Sensor Networks
3	19MCST08	Introduction to Intelligent Systems

ELECTIVE – II

S. No	Course Code	Course Title
1	19MCST09	Data Science
2	19MCST10	Internet of Things
3	19MCST11	Block Chain Technologies

ELECTIVE – III

S. No	Course Code	Course Title
1	19MCST12	Machine Learning
2	19MCST13	GPU Computing
3	19MCST14	Cloud Computing

ELECTIVE – IV

S. No	Course Code	Course Title
1	19MCST15	Big Data Analytics
2	19MCST16	Cyber Security
3	19MCST17	Deep Learning

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

2019-20

LIST OF OPEN ELECTIVES OFFERED BY CSE TO OTHER DEPARTMENTS(2019-20)

S. No	Course Code	Course Title
1	19MCST18	Information Retrieval Systems

LIST OF OPEN ELECTIVES OFFERED BY OTHER DEPARTMENTS TO CSE (2019-20)

S. No	Course Code	Course Title	Offering Department
1	19MBST02	English For Research Paper Writing	BS&H
2	19MBST03	Business Analytics	
3	19MEET19	Solar Energy Utilization	EEE
4	19MMET22	Advanced Operations Research	ME
5	19MECT22	Advanced Embedded Systems	ECE

19MCST01: MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Credits – 3 **Sessional Marks: 30**
L:T:P::3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following:

1. Propositional function, quantifiers, rules of inference.
2. Binary relations, posets, Hasse diagram, lattice, Functions, and pigeonhole principle.
3. Algebraic structures like groups and elementary combinatorics.
4. How to generate various types of functions recursively and solve them.
5. Various concepts in graphs like its representation, planar graphs, graph coloring and trees.

Course Outcomes

After successful completion of course the student should be able to

CO1. Know how to represent various statements using quantifiers, relations, functions, permutations and combinations, groups, graphs and trees

CO2. Use logical notations to formulate and reason about fundamental mathematical concepts such as sets, relations, functions and algebraic structures

CO3. Analyse the growth of functions and real world problems using various concepts like recurrence relations, graph coloring, etc.

CO4. Apply mathematical logic to solve problems, pigeonhole principle to solve real time problems,

CO5. Model and solve real world problems using graphs and trees.

UNIT I

Predicates: Propositional Function – The concept, Quantifiers and First-Order Logic, The Universal Quantifier, The Existential quantifier, universal and existential statements – equivalent forms, bound variable, negation of quantified statements, contrapositive, converse and inverse for universal conditional statements, generalized Demorgan's laws, ambiguity – an Instance, negations of multiple – quantified statements, formulas in predicate calculus, additional rules of inference, proof techniques, fallacies in the proof, automated theorem proving – A brief note

UNIT II

Relations: Binary relations, displaying relations, arrow diagram of a relation, the inverse of a relation, n-Ary relations, domain and range of a relation, composition of relations, properties of relations, representing relations, partition, partial ordered relations, digraphs of posets, hasse diagram, lattice, digraph and emergence of structure

Functions: Definition, properties of Functions, one-to-one functions, onto functions, inverse functions, the pigeonhole principle, generalized pigeonhole principle statement, composition of functions, growth of functions.

UNIT III

Algebraic Structures: An Introduction to groups – Mathematical structure, binary operation, properties of mathematical structures, some important theorems, composition table, semigroups, isomorphism, groups, some special groups, integral powers of an element, subgroups, Euler function, quotient group, homomorphism of groups.

Elementary Combinatorics: Principles of Counting, Permutation, combinations, binomial theorem, the principle of Inclusion and exclusion, derangements: Everything misplaced.

UNIT IV

Recurrence Relation: Generating Functions, Sequences, Recurrence Relation, solving recurrence relations, solving linear homogeneous recurrence relation with constant coefficients, the non-homogeneous recurrence relation, solving recurrence relations using generating functions, Catalan numbers – outcome of a special nonlinear recurrence relation, recursive functions.

UNIT V

Graph Theory: Graphs: An Introduction, Special Graphs, Subgraph, Degree of a Vertex – The Concept, Given a Degree Sequence – How to Draw the Graph? Adjacency Matrices, Incidence Matrices, Isomorphism of Graphs, Paths and Circuits, Euler Paths, Hamiltonian Circuit, the Travelling Salesman Problem, Shortest Path Problem, Matching

Planar Graphs, Coloring, Trees: Planar Graphs, Graph Coloring, Trees, Preorder and Postorder traversals

Text Books

1. John Vince, "Foundation Mathematics for Computer Science, A Visual Approach", Springer, 2015.
2. JayantGanguly, "Mathematical Foundations for Computer Science Engineers", PHI, 2011.

Reference Books

1. K. Trivedi, "Probability and Statistics with Reliability, Queuing, and Computer Science Applications", Wiley, 2016.
2. M. Mitzenmacher and E. Upfal, "Probability and Computing: Randomized Algorithms and Probabilistic Analysis", Cambridge University Press, 2005.
3. Alan Tucker, "Applied Combinatorics", 6th Edition,Wiley 2012.

Web References

1. https://nptel.ac.in/courses/106/106/106106094/

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	-	-	-	L	M	-	L	-	-
CO2	-	-	L	-	H	-	-	-	M
CO3	M	-	L	L	-	-	M	-	-
CO4	L	-	L	-	H	-	H	-	L
CO5	L	-	L	L	H	-	H	-	L

19MCST02:ADVANCED DATA STRUCTURES

Credits –3 **Sessional Marks: 30**
L:T:P::3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following:

1. Understand the data structures and techniques of algorithm analysis.
2. Solve problems using different data structures and compare their performance and tradeoffs.
3. Demonstration of linked data structures such as linked lists and binary trees.
4. Comprehend graph algorithms such as shortest path and minimum spanning tree.
5. Learn advanced data structures such as balanced search trees, hash tables, priority queues

Course Outcomes

After successful completion of course the student should be able to

CO1. Demonstration of hash tables including collision avoidance and resolution schemes.
CO2. Analyze how to balance binary search tree and AVL trees using rotation methods.
CO3. Solve problems using graph algorithms, including single-source and all-pairs shortest paths, and minimum spanning tree algorithms.
CO4. Apply all binary heap trees to form a large binomial queue for large data structures creation.
CO5. Reconstructs such applications that take the advantage of a trees ability to quickly search for, insert, and delete entries into the dictionary.

UNIT I

Overview of Data Structures: Algorithm analysis: Algorithms; Performance analysis: Time complexity and space complexity, asymptotic notation: Big Oh, omega and theta notations, complexity analysis examples; Data structures: Linear and non-linear data structures, ADT concept, linear list ADT, stack and queue ADTs, array and linked list representations; Circular queue: Insertion and deletion, de queue ADT, priority queue ADT, implementation using heaps, insertion into a max heap, deletion from a max heap, singly linked lists, doubly linked lists, circular linked list.

UNIT II

Dictionaries and Hashing: Dictionaries: Linear list representation, operations insertion, deletion and searching, hash table representation, hash functions, collision resolution, separate chaining, open addressing, linear probing, quadratic probing, double hashing, rehashing, extendible hashing

UNIT III

Graphs: Graph terminology, graph ADT, representations, graph traversals; Search methods: DFS and BFS; Applications of Graphs: Minimum cost spanning tree using Kruskal's algorithm, Dijkstra's algorithm for single source shortest path problem.

UNIT IV

Trees: Ordinary and binary trees terminology, properties of binary trees, binary tree ADT, representations, recursive and non-recursive traversals, threaded binary trees.

UNIT V

Search Trees: Binary search tree, AVL trees, Red-Black and Splay Trees; B trees, R trees: Nearest neighbor query, join and range queries; Comparison of search trees; Text compression: Huffman coding and decoding; Pattern matching: KMP algorithm.

Text Books

1. M. A. Weiss, Addison Wesley, "Data Structures and Algorithm Analysis in Java", 3rd Edition,Pearson Education, 2012.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, PHI, 2010.

Reference Books

1. M. T. Goodrich, R. Tomassia, "Data structures and Algorithms in Java", 3rd Edition,Wiley India, 2011.
2. S. Lipschutz, "Data Structures", 1st Edition,Tata McGraw Hill Education, 2008.
3. Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, "Fundamentals of Computer Algorithms", 2nd Edition, Universities Press Private Limited, India, 2008.

Web References

1. https://nptel.ac.in/courses/106/106/106106127/

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	L	-	H	-	L	-	H	-	-
CO2	H	L	-	M	M	-	H	M	-
CO3	L	L	-	H	-	-	-	-	H
CO4	-	-	-	-	H	-	H	-	-
CO5	-	-	H	M	M	-	H	-	L

19MCST03: WIRELESS AND MOBILE NETWORKS

Credits –3 **Sessional Marks: 30**
L:T:P::3:0:0 **University Exam Marks: 70**

Course objective

To expose the students to the following:

1. Various wireless networks.
2. Routing algorithms in wireless adhoc networks and advanced technologies in wireless networks.
3. Communication process in mobile networks.
4. Technologies like mobile IP, GPRS and GSM.
5. How to handle security in adhoc networks.

Course outcomes

After successful completion of course the student should be able to

CO1. Learn the components of mobile and wireless communication.
CO2. Understand the mobile and wireless technologies.
CO3. Compare different types of case studies in mobile and wireless networks.
CO4. Design a simple mobile and wireless application.

UNIT I

Introduction: Introduction to Wireless Networks, Various Generations of Wireless Networks, Virtual Private Networks-Wireless Data Services, Common Channel Signaling, Various Networks for Connecting to the Internet, Blue tooth Technology, Wifi-WiMax-Radio Propagation mechanism, PathlossModeling and Signal Coverage

Wireless Local Area Networks: Introduction-WLAN topologies-IEEE 802.11 Standards, MAC Protocols,Comparison of 802.11 a,b, g and n Standards, HIPER LAN, ZigBee 802.15.4, Wireless Local Loop

UNIT II

Wireless Adhoc Networks: Basics of Wireless Networks, Infrastructured Versus Infrastructureless Networks – Properties of Wireless, AD hoc Networks, Types of Ad Hoc Networks, Challenges in AD Hoc Networks –Applications of Wireless AD Hoc Networks

Routing Protocols for Ad Hoc Networks: Introduction-Proactive Routing Protocols-Reactive Routing protocols-Hybrid Routing Protocols-QoS Metrics-Energy impact issues in Routing.

Other Wireless Technologies: Introduction, IEEE 802.15.4 and Zigbee, General Architecture, Physical Layer, MAC layer, Zigbee, WiMAX and IEEE 802.16, Layers and Architecture, Physical Layer, OFDM Physical layer.

UNIT III

Mobile Communications: Introduction to cellular concept, Frequency Reuse, Handoff, GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services, Introduction to mobile computing, novel applications, limitations, and architecture.

UNIT IV

Mobile Data Networks: Location/mobility management, Mobile IP, Dynamic routing protocols, Location-based protocols, Emerging topics: sensor networking, Data-Oriented CDPD network, GPRS and higher data rates, Short messaging service in GSM.

UNIT V

Security in Ad Hoc Networks: Introduction- Security Attacks, Intrusion Detection System, Intrusion Prevention system, Intrusion Response system, Wired Equivalent Privacy(WEP) - A Security Protocol for Wireless Local Area Networks (WLANs), Security in MANETs.

Text Books

1. Dr.Sunil Kumar,S.Manvi,Dr Mahabaleshwar,S.Kakkasageri, "Wireless and Mobile Networks Concepts and protocols",Wiley,2016.
2. G. SasibhusanRao, "Mobile Cellular Communications", Pearson Publications, 2013.

Reference Books

1. KavethPahlavan, K. Prasanth Krishnamurthy, "Principles of Wireless Networks", Pearson Publications, Asia, 2002.
2. Misra, Sudip; Woungang, Isaac; Misra, Subhas Chandra, "Guide to Wireless Ad Hoc Networks: Series: Computer Communications and Networks", Springer, 2009.

Web References

1. http://www.cse.wustl.edu/~jain/refs/wir_book.htm
2. https://nptel.ac.in/courses/106/105/106105160/

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	-	-	-	H	-	-	H	-	-
CO2	-	L	-	H	-	-	H	-	-
CO3	-	L	-	-	-	-	H	-	-
CO4	L	L	-	-	H	-	-	-	H

19MCST06: DIGITAL FORENSICS

Credits – 3 **Sessional Marks: 30**
L:T:P::3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following:

1. Fundamentals and importance of digital forensics.
2. Techniques and procedures that enable to perform a digital investigation.
3. Digital investigation such as preservation, analysis and acquisition of artifacts that reside in hard disks and random access memory.
4. Open-source forensics tools to perform digital investigation and understand the underlying theory behind these tools.
5. The current research in computer forensics.

Course Outcomes

After successful completion of course the student should be able to

CO1. Explain and properly document the process of digital forensics analysis.
CO2. Gain an understanding of the tradeoffs and differences between various forensic tools.
CO3. Describe the representation and organization of data and metadata within modern computer systems.
CO4. Understand the inner workings of file systems.
CO5. Create disk images, recover deleted files and extract hidden information
CO6. Define research problems and develop effective solutions

UNIT I

Introduction: Introduction, What Is Forensic Science?What Is Digital Forensics?Uses of Digital Forensics, Locard's Exchange Principle, Organizations of Note, Role of the Forensic Examiner in the Judicial System, Bits, Bytes, and Numbering Schemes, File Extensions and File Signatures, Storage and Memory, Computing Environments, Basic Computer Function—Putting it All Together.

Labs and Tools: Forensic Laboratories, Policies and Procedures, Quality Assurance, Digital Forensic Tools, Accreditation.

UNIT II

Collecting Evidence: Crime Scenes and Collecting Evidence, Documenting the Scene, Chain of Custody, Cloning, Live System versus Dead System, Hashing,

Windows System Artifacts: Deleted Data, Hibernation File (Hiberfile.sys), Registry, Print Spooling, Metadata, Thumbnail Cache, Most Recently Used (MRU), Restore Points and Shadow Copy, Link Files.

Antiforensics: Hiding Data, Password Attacks¸ Steganography, Data Destruction

UNIT III

Legal: The Fourth Amendment, Criminal Law—Searches without a Warrant, Searching with a Warrant, Electronic Discovery (eDiscovery), Expert Testimony.

Internet and E-Mail: Internet Overview, Web Browsers—Internet Explorer, E-Mail, Social Networking Sites.

UNIT IV

Network Forensics: Social Engineering, Network Fundamentals, Network Security Tools, Network Attacks, Network Evidence and Investigations

Mobile Device Forensics: Cellular Networks, Operating Systems, Cell Phone Evidence, Cell Phone Forensic Tools, Global Positioning Systems (GPS)

UNIT V

Challenges and Concerns: Introduction, Standards and Controls, Cloud Forensics (Finding/Identifying Potential, Evidence Stored in the Cloud), What Is Cloud Computing?, The Benefits of the Cloud, Cloud Forensics and Legal Concerns, Solid State Drives (SSD), How Solid State Drives Store Data, The Problem: Taking out the Trash, Speed of change

Text Books

1. John Sammons, "The Basics of Digital Forensics, The primer for getting started in digital forensics",Second Edition, Elsevier, 2015

Reference Books

1. Debra Littlejohn Shinder and Ed Tittel, "Scene of Cyber Crime: Computer forensics handbook",Syngress, 2002.
2. Charles. P. Pfleeger, Shari. LawrencePfleeger and Jonathan Margulies,"Security in Computing", Fifth Edition, Prentice Hall, 2015
3. John R. Vacca, "Network and System Security",Second Edition, Syngress, 2013.

Web References

1. https://www.jdfsl.org/

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	-	-	-	H	-	-	M	-	-
CO2	-	H	-	-	-	-	-	-	-
CO3	-	-	H	-	-	-	-	-	-
CO4	-	-	-	H	-	-	H	-	-
CO5	M	-	-	-	-	-	-	-	-
CO6	H	-	-	-	-	-	H	-	-

19MCST07: WIRELESS SENSOR NETWORKS

Credits – 3 **Sessional Marks: 30**
L:T:P::3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following:

1. Basics of wireless sensor networks and various sensor network architecture
2. Different types of Sensors and Sensing Techniques.
3. MAC protocols and Case studies.
4. Knowledge on Routing protocols of Sensor Networks
5. Security issues.

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand fundamental concepts in the area of Wireless Sensor Networks
CO2. Illustrate the MAC Protocols for Wireless Sensor Networks and case study
CO3. Analyze the concept of Routing techniques
CO4. Identify the Security challenges and issues in sensor networks with real time applications

Unit I

Introduction to Wireless Sensor Networks: Motivations, Applications, History and Design factors, Performance Metrics, Anatomy of Sensor Node

Sensor Network Architecture: Layered, Clustered, OSI Based, Cross Layer Architecture.

Unit II

Sensing Techniques: Types of Sensors, Sensing Coverage, High-Level Sensors, Human as a Sensor, Actuators, sensor calibration, Detecting Errors

Designing and Deploying WSN Applications: Early WSN Deployments, General Problems, General Testing & Validation, Requirements Analysis, Top-Down Design Process, Bottom-up Implementation Process.

Unit III

Medium Access Control Protocols for WSN: Introduction, Fundamentals, Performance Requirements,Schedule-Based Protocols, Random Access-Based Protocols, Sensor-MAC Case Study.

Unit IV

Scheduling and Data Management: Survey on Data Routing in Wireless Sensor Networks, Data Centric Protocols: SPIN, Directed Diffusion, REAR, Rumor Routing

Hierarchical Routing: LEACH, Energy Efficient Weight-Clustering Algorithm in WSN, Self-Organizing Protocol

Location-Based Protocols, **QoS-Aware Protocols:** SPEED, MSPEED, Real-Time Power-Aware Routing.

Unit V

Security: Fundamentals of Network Security, Challenges of Security in Wireless Sensor Networks, Security Attacks in Sensor Networks, Protocols and Mechanisms for Security, IEEE 802.15.4 and ZigBee Security.

Text Book

1. Anna Forster, "Introduction to Wireless Sensor Networks", Wiley-IEEE Press,2016.

Reference Books

1. KazemSohraby, Daniel Minoli and TaiebZnati, "Wireless Sensor Networks:Technology, Protocols, and Applications", John Wiley & Sons, Inc., 2007.
2. Takahiro Hara,Vladimir I. Zadorozhny, and Erik Buchmann, "Wireless Sensor Network Technologies for the Information Explosion Era", springer 2010.
3. W. Dargie and C. Poellabauer, "Fundamentals of Wireless Sensor Networks –Theory and Practice", John Wiley & Sons, Inc., 2010.

Web References

1. http://www.cse.wustl.edu/~jain/refs/wir_book.htm
2. https://nptel.ac.in/courses/106/105/106105160/

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	L	-	-	H	-	-	-	M	H
CO2	H	-	-	M	-	-	H	L	M
CO3	M	-	L	H	-	-	H	-	M
CO4	M	-	-	M	H	L	H	-	H

19MCST08: INTRODUCTION TO INTELLIGENT SYSTEMS

Credits –3 **Sessional Marks: 30**
L:T:P::3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following:

1. Different issues involved in trying to define and simulate intelligence.
2. Specific, well known Artificial Intelligence methods, algorithms and knowledge representation schemes.
3. Different techniques which will help them build simple intelligent systems based on AI/IA concepts.

Course Outcomes

After successful completion of course the student should be able to

CO1. Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents.
CO2. Choose an appropriate problem-solving method and knowledge-representation scheme.
CO3. Analyze and formalize the problem (as a state space, graph, etc.) and select the appropriate search method.
CO4. Build simple intelligent systems or classical toy problems using different AI techniques.

UNIT I

Evolution of ModernComputational Intelligence: Introduction, Roots ofArtificial Intelligence,ModernArtificial Intelligence, Meta-modern AI

Problem Solvingby Search: TreeBasedSearch**,** Terminology**,** GraphSearch**,** SearchMethodsClassification, Uninformed SearchMethods, BreadthFirst Search, DepthFirst Search, Backtracking Search, Depth Bounded,DepthFirst Search, Iterative Deepening DepthFirstSearch**,** Branch and Bound, Bidirectional Search.

UNIT II

Informed(Heuristic) Search: Introduction, Heuristics, BestFirst Search, GreedySearch, A*Search, ComparisonsandRemarks, A*Variants,Iterative DeepeningA*(IDA*),Simplified Memory BoundedA*(SMA*),Recursive Best-FirstSearch(RBFS),D*Algorithm

IterativeSearch: Introduction, HillClimbing**,** SimulatedAnnealing

AdversarialSearch: Introduction**,**MIN-MAXAlgorithm**,**Designing theUtilityFunction,Alpha-betaPruning.

UNIT III

Knowledge RepresentationandReasoning: PropositionalLogic,First Order PredicateLogic(FOPL), PredicateCalculus, FOPLAlphabet, Resolution in Propositional Logicand FOPL, Resolution inPropositionalLogic, ResolutioninFOPL.

Rule-Based ExpertSystems: Introduction**,** Elements of aRule-BasedSystem**,** Rules, Types of Rule-BasedExpert Systems, Types ofExpertSystems.

Managing Uncertainty in Rule BasedExpertSystems: BayesianTheory, Classical ProbabilityTheory, Bayes' Rules, BayesianReasoning, BayesianNetworks.

UNIT IV

FuzzyExpertSystems: Introduction, FuzzySets, RepresentingFuzzySets, Operations withFuzzySets, Proprieties ofFuzzySets, DeMorgan'sLaws, Defuzzyfication, MamdaniFuzzyModel, SugenoFuzzyModel, TsukamotoFuzzyModel
MachineLearning: Introduction, Terminology, LearningSteps, LearningSystemsClassification
ArtificialNeuralNetworks: Neural NetworksTypes, the Perceptron, Multi-layer Perceptron
Advanced ArtificialNeuralNetworks: JordanNetwork, ElmanNetwork, HopfieldNetwork, SelfOrganizingNetworks.

UNIT V

EvolutionaryAlgorithms: How to Build anEvolutionaryAlgorithm? GeneticAlgorithms
SwarmIntelligence: ParticleSwarmOptimization, ParametersofPSO, AntColoniesOptimization, AntSystem
HybridIntelligentSystems: Models of Hybrid ComputationalIntelligenceArchitectures, Neuro-fuzzySystems, Evolutionary NeuralNetworks(EANN), HybridEvolutionaryAlgorithms

Text Book

1. CrinaGrosan and Ajith Abraham, "Intelligent Systems: A Modern Approach", Springer, 2011.

Reference Books

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Third Edition, Pearson Education, India, 2015.
2. Elaine Rich, Kevin Knight, Shivshankar B Nair, "Artificial Intelligence", Third Edition, Tata McGraw Hill Education Pvt Ltd., 2008.
3. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill Publication, 2008.

Web References

1. https://dblp.org/db/series/isrl/index

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	M	-	-	-	H	-	M	-	H
CO2	M	-	-	-	H	-	H	-	H
CO3	H	-	-	-	-	-	H	-	-
CO4	H	-	-	-	-	-	-	-	M

19MCSP01: ADVANCED DATA STRUCTURES LAB

Credits –2 **Sessional Marks: 40**
L:T:P::0:0:4 **University Exam Marks: 60**

Course Objectives

To expose the students to the following:

1. Device linear and non-linear data structures.
2. Analyse various algorithms based on their time complexity.
3. Choose appropriate data structure and algorithm design method for a specific application.
4. Identify suitable data structure to solve various computing problems.

Course Outcomes

After successful completion of course the student should be able to

CO1. Identify and implement the appropriate data structure for a given problem.
CO2. Demonstrate collision resolution techniques like linear probing, quadratic probing and double hashing/rehashing.
CO3. Perform Stack operations to convert infix expression into post fix expression and evaluate the post fix expression.
CO4. Differentiate graph traversal techniques Like Depth First Search, Breadth First Search.
CO5. Classify shortest path to other vertices using various algorithms.

LIST OF PROGRAMS

1. Write a program to implement a 3-stacks of size ‘m’ in an array of size ‘n’ with all the basic operations such as IsEmpty(i), Push(i), Pop(i), IsFull(i) where ‘i’ denotes the stack number (1,2,3), m n/3. Stacks are not overlapping each other. Leftmost stack facing the left direction and other two stacks are facing in the right direction.
2. Write a program to implement 2 overlapping queues in an array of size ‘N’. There are facing in opposite direction to each other. Give IsEmpty(i), Insert(i), Delete(i) and IsFull(i) routines for ith queue
3. Write a program to implement Stack ADT using Linked list with the basic operations as Create(), IsEmpty(), Push(), Pop(), IsFull() with appropriate prototype to a functions.
4. Write a program to implement Queue ADT using Linked list with the basic functions of Create(),IsEmpty(), Insert(), Delete() and IsFull() with suitable prototype to a functions.
5. Write a program to store k keys into an array of size n at the location computed using a hash function, loc = key % n, where k<=n and k takes values from [1 to m], m>n. To handlethe collisions use the following collision resolution techniques,
   a) Linear probing
   b) Quadratic probing
   c) Random probing
   d) Double hashing/rehashing
   e) Chaining
6. Implement the above program 5 using hash function from Division methods.
7. Write a program for Binary Search Tree to implement following operations:
   a) Insertion
   b) Deletion
   a. Delete node with only child
   b. Delete node with both children

c) Finding an element
d) Finding Min element
e) Finding Max element
f) Left child of the given node
g) Right child of the given node
h) Finding the number of nodes, leaves nodes, full nodes, ancestors,descendants.

8. Write a program to implement Inorder Threaded Binary Tree with insertion and deletion operation.
9. Write a program to implement Preorder Threaded Binary Tree with insertion and deletionoperation.
10. Write a program to implement Postorder Threaded Binary Tree with insertion and deletionoperation.
11. Write a program to traverse given Inorder Threaded Binary Tree in inorder, preorder and postorderfashion.
12. Write a program to traverse given Postorder Threaded Binary Tree in inorder, preorder andpostorder fashion.
13. Write a program to transform BST into Threaded Binary Tree.
14. Write a program for AVL Tree to implement following operations: (For nodes as integers)
    a. Insertion: Test program for all cases (LL, RR, RL, LR rotation)
    b. Deletion: Test Program for all cases (R0, R1, R-1, L0, L1, L-1)
    c. Display: using set notation.
15. Write a program to implement Red-Black trees with insertion and deletion operation for the giveninput data as Strings
16. Write a program using function which computes the balance factor of any given node in a BST.
17. Write a program to transform BST into AVL trees and also count the number rotationsperformed.
18. Write a program to implement insertion, deletion, display and search operation in m-way B tree(i.e. a non-leaf node can have atmost m children) for the given data as integers (Testthe program for m=3, 5, 7).
19. Write a program to generate minimum spanning tree in a connected, undirected weighted graphusingKuruskal's algorithm with disjoint set data structures.
20. Write a program to generate minimum spanning tree in a connected, undirected weighted graphusingPrims's algorithm with disjoint set data structures.
21. Write a program to find single-source shortest path in a weighted directed graph using Bellman-Ford algorithm
22. Write a program to implement Dijkstra's algorithm for single-source shortest path in a weighteddirected graph using fibonacci heap.
23. Write a program to find all-pairs shortest path using Floyd-Warshall algorithm.
24. Write a program to perform string matching using Knuth-Morris-Pratt algorithm.
25. Write a program to perform string matching using Boyer-Moore algorithm.

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	-	-	H	-	-	-	H	-	-
CO2	L	-	H	-	M	-	H	M	-
CO3	M	-	H	-	-	-	-	-	H
CO4	-	-	-	M	M	-	H	-	M
CO5	-	-	-	-	H	L	H	-	M

19MCSP02: WIRELESS AND MOBILE NETWORKS LAB

Credits –2 **Sessional Marks: 40**
L:T:P::0:0:4 **University Exam Marks: 60**

Course Objectives

To expose the students to the following:

1. Demonstrate local area network using network simulator.
2. Analyze various network performance metrics
3. Choose appropriate protocol to stimulate Wi-Fi
4. Learn to set up a Bluetooth Network using network simulator.

Course Outcomes

After successful completion of course the student should be able to

CO1. Get familiar with the various network simulators like ns2 and QualNet.
CO2. Learn to model and simulate various network topologies
CO3. Evaluate MAC and network protocols using network simulation software tools.
CO4. Develop new MAC and network protocols and simulate them in the network simulators.

LIST OF EXPERIMENTS

1. Basics of Network Simulation
   Introduction | Platform required to run network simulator | Backend Environment of Network Simulator | Basics of Tcl Programming for NS-2 | Agents and applications | Tracing
2. Simulating a Local Area Network
   Local Area Network | LAN Topologies | MAC Protocols | Taking turns | Ethernet | Ethernet Frame Structure | Ethernet Versions | Simulating a LAN using Network Simulator 2
3. Measuring Network Performance
   Network Performance Evaluation | Performance Evaluation Metrics | Parameters Affecting the Performance of Networks | Performance Evaluation Techniques | Network Performance Evaluation using NS-2
4. Simulating a Wi-Fi Network
   Wi-Fi Networks | IEEE 802.11 Standards | Hardware Requirements for Wi-Fi | How to connect to the Wi-Fi Networks? | Advantages of Wi-Fi | Limitations | MAC Protocols | Use of RTS/CTS to Exchange Data | Issues in Wi-Fi Networks | The Hidden Terminal Problem | Solution of Hidden Terminal Problem | Exposed Terminal Problem | Solution to the Exposed Terminal Problem | Simulating a Wi-Fi using Network Simulator 3
5. Simulating a WiMAX Network
   WiMAX Network | Standards | Comparison of Wi-Fi and WiMAX | How WiMAXworks ? | Limitations of WiMAX | Modulation Shemes | Here some terminology,expression and table are given below | Difference between low symbol rate and high symbol rate | WIMAX module for NS-2 | How to download and install patch for WIMAX? | Addressing Format in ns2 | The Default address format | The Hierarchical address format | Wireless (New) Trace File Format | Description of New Trace File Format | Wireless Trace File Format
6. Simulating a Mobile Adhoc Network

Ad Hoc Network | Mobile Ad-hoc NETwork (MANET) | Routing | Routing in MANET | Routing protocols for MANET | Destination-Sequenced Distance-Vector (DSDV) algorithm: | Dynamic source routing (DSR) | Application of MANET | Advantages | Disadvantages | Simulating a MANET using Network Simulator 2

7. Simulating a Wireless Sensor Network
   Wireless Sensor Networks | Basic Characteristics of WSNs | Operating Systems for WSNs | Differences with Mobile Ad hoc Networks | Types of Wireless Sensor Networks | Routing protocols for WSNs | Clusters and Cluster heads in WSNs | The LEACH Protocol | Operation of LEACH | Discussions on LEACH | Applications of WSNs | Simulating a WSN using Network Simulator 2
8. Setting up a Bluetooth Network
   Bluetooth Network | Who started Bluetooth? | Bluetooth vs Wi-Fi | Bluetooth – Power Classes | Bluetooth - Versions | How does Bluetooth work? | Networking of Bluetooth | How to connect Bluetooth? | Simulating Bluetooth Network with NS-2
9. Setting up a ZigBee Network
   ZigBee Network | IEEE 802.15.4 and ZigBee | ZigBee vs. Bluetooth | Features & Characteristic of ZigBee Technology | Application of ZigBee Technology | Component of IEEE 802.15.4 LR-WPAN | Network Topologies | ZigBee Architecture | The Superframe structure | Nodes Configuration | Energy Model
10. Simulate the different type of internet traffic such as FTP and TELNET over a network and analyze the throughput.
11. Apply TCP agent between n0 to n3 and UDP n1 to n3. Apply relevant applications over TCP and UDP agents changing the parameters and determine the number of packets sent by TCP/UDP.
12. Simulate an Ethernet LAN using n nodes (6), change error rate and data rate and compare the throughput.
13. Simulate an Ethernet LAN using n nodes and set multiple traffic nodes and determine the collision across different nodes.
14. Implement three nodes point – to – point network with duplex links between them. Set thequeue size, vary the bandwidth and find the number of packets dropped.
15. Implement transmission of ping messages/trace route over a network topology consisting of 6nodes and find the number of packets dropped due to congestion.
16. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestionwindow for different source / destination.
17. Implement simple ESS and with transmitting nodes in wire-less LAN by simulation anddetermine the performance with respect to transmission of packets.
18. Implement and study the performance of GSM on NS2/NS3 (Using MAC layer) or equivalentEnvironment.
19. Implement and study the performance of CDMA on NS2/NS3 (Using stack called Call net) or equivalent environment.
20. Write a TCL script to simulate a file transfer with using ns 2:Consider a client and a server. The server is running a FTP application (over TCP). Theclient sends a request to download a file of size 10 MB from the server. Write a script tosimulate this scenario. Let node #0 be the server and node #1 be the client. TCP packetsize is 1500 B. Assume typical values for other parameters.

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	L	-	-	H	-	-	H	-	-
CO2	-	-	-	H	-	-	H	-	-
CO3	-	-	-	-	H	-	-	-	H
CO4	M	-	-	-	H	-	-	-	H

19MCST04: ADVANCED ALGORITHMS

Credits –3 **Sessional Marks: 30**
L:T:P::3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following:

1. Fundamental design analysis and implementation of basic data structure.
2. Basic concepts in the specification and analysis of programs.
3. Principles for good program design, especially the uses of data abstraction.
4. Significance of algorithms in the computer field.
5. Various aspects of algorithms development and qualities of a good solution.

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand a wide range of advanced algorithmic problems and variants

CO2. Design and analyzenew algorithms for any problem

CO3. Develop advanced algorithm analysis skills for analyzing the approximation ratio of randomized algorithms.

CO4. Apply advanced algorithmic concepts to solve real-world problems.

UNIT I

Sorting: Review of various sorting algorithms, topological sorting.

Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortestpath in edge-weighted case (Dijkstra's), depth-first search and computation ofstrongly connected components, emphasis on correctness proof of the algorithmand time/space analysis, example of amortized analysis.

UNIT II

Matroids: Introduction to greedy paradigm, algorithm to compute a maximumweight maximal independent set. Application to MST, Graph Matching: Algorithm to compute maximum matching. Characterizationof maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path

UNIT III

Flow-Networks: Maxflow–mincut theorem, Ford-Fulkerson Method to computemaximum flow, Edmond-Karp maximum-flow algorithm, Matrix Computations: Strassen's algorithm and introduction to divide andconquer paradigm, inverse of a triangular matrix, relation between the timecomplexities of basic matrix operations, LUP-decomposition.

UNIT IV

Shortest Path in Graphs: Floyd-Warshall algorithm and introduction todynamic programming paradigm. More examples of dynamic programming, Modulo Representationof integers/polynomials:Chinese RemainderTheorem, Conversion between base-representation and modulo-representation.

Extension to polynomials Application: Interpolation problem, Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring. Fast Fourier Transform algorithm,Schonhage-Strassen Integer Multiplication algorithm.

UNIT V

Linear Programming: Geometry of the feasibility region and Simplexalgorithm
NP-completeness: Examples, proof of NP-hardness and NP-completeness. One or more of the following topics based on time and interest, Approximation algorithms,Randomized Algorithms,Interior Point Method,Advanced Number Theoretic Algorithm,Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

Text Books

1. Thomson H. Cormen, Charles E. Leiserson, Rivest, Stein, "Introduction to Algorithms", Third Edition, The MIT Press, 2009
2. Kleinberg and Tardos, "Algorithm Design", Pearson, 2005

Reference Books

1. M.T. Goodrich, R. Tamassia and D.Mount, "Data Structures and Algorithms in C++", Second Edition, John Wiley& Sons, Inc., India, 2011
2. J. Hubbard, "Schaum's outlines of Data structures with C++", McGraw Hill Education, 2017.
3. Mark. A. Weiss, "Data structures and Algorithm Analysis in C++", Fourth Edition, PHI, 2013.

Web References

1.https://nptel.ac.in/courses/106/106/106106131/

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	M	-	-	H	-	-	-	-	H
CO2	L	-	L	L	H	-	-	-	M
CO3	L	-	-	-	H	-	-	L	H
CO4	L	-	H	-	L	-	-	-	H

19MCST05: SOFT COMPUTING

Credits –3 **Sessional Marks: 30**
L:T:P::3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following:

1. Fuzzy logic and its applications.
2. Artificial neural networks and its applications.
3. Single-objective optimization problems using GAs.
4. Multi-objective optimization problems using Evolutionary algorithms (MOEAs).
5. Provide the mathematical background for carrying out the optimization associated with neural network learning
6. Applications of Soft computing to solve problems in varieties of application domains

Course Outcomes

After successful completion of course the student should be able to

CO1. Demonstrate knowledge in Artificial Neural Networks, Supervised Learning Networks, Unsupervised Learning Networks, Fuzzy sets, relations and measures, Genetic Operators
CO2. Analyze neural network architectures, Fuzzy systems and Genetic algorithms.
CO3. Design soft computing solutions for real life computational problems.
CO4. Use soft computing techniques to solve complex computational problems.
CO5. Create algorithms using soft computing techniques.
CO6. Apply contextual knowledge to solve problems related to societal issues like Business Intelligence, Forecasting.

UNIT I

Soft Computing: Neural networks, Application scope of neural networks, Hybrid systems, Soft computing, Applications of soft computing.

Artificial Neural Networks: Fundamentals, Evolution, Basic Models, Terminologies, Hebb network.

UNIT II

Perceptron Networks: Theory, Perceptron learning rule, Architecture, Flowchart for training process, Perceptron training algorithm for single and multiple output classes, Perceptron network testing algorithm.

Back-Propagation Networks: Theory, Architecture, Flow chart for training process, Training algorithm, Learning factors of backpropagation networks, Testing algorithm for back-propagation networks.

UNIT III

Unsupervised Learning Networks: Fixed weight competitive nets, Kohonen self-organizing feature maps, learning vector quantization, Counter-propagation networks, Adaptive response theory network.

UNIT IV

Classical Sets and Fuzzy Sets: Classical sets- Operations, Properties, Function mapping; Fuzzy sets- Operations, Properties.

Classical Relations and Fuzzy Relations: Cartesian product of relation, Classical relations, Fuzzy relations, Tolerance and equivalence relations, Non-interactive fuzzy sets.

UNIT V

Fuzzy Arithmetic and Fuzzy Measures: Fuzzy arithmetic, Extension principle, Fuzzy measures, Measures of fuzziness.
Genetic Algorithms: Genetic operators, working principle, Fitness function, reproduction.

Text Book

1. S. N. Sivanandan and S. N. Deepa, "Principles of Soft Computing", Third Edition, Wiley India Pvt Ltd, 2011.

Reference Books

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun and EijiMizutani, "Neuro-Fuzzy and Soft Computing: A Compot", Pearson Education India, 2015
2. S. Rajasekaran and G. A. VijayalakshmiPai, "Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications", PHI Learning Private Ltd, 2003.

Web References

1. https://nptel.ac.in/courses/106/105/106105173/

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	M	-	L	H	-	-	-	-	L
CO2	-	L	-	M	-	-	H	-	-
CO3	-	L	-	-	H	-	L	-	H
CO4	H	-	-	-	-	-	H	-	-
CO5	-	-	-	-	H	-	H	-	-
CO6	H	-	-	-	-	-	M	-	-

19MCST09: DATA SCIENCE

Credits – 3 **Sessional Marks: 30**
L:T:P :: 3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following:

1. Generalizable extraction of knowledge from data.
2. Engineering effective solutions.
3. Basic machine learning algorithms.
4. Building recommendation systems.
5. Considerate concepts on Graphs.

Course Outcomes

After successful completion of course the student should be able to

CO1. Describe what Data Science is and the skill sets needed to be a data scientist, the Data Science Process and how its components interact.
CO2. Explain in basic terms what Statistical Inference means.
CO3. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data.
CO4. Use R to carry out basic statistical modeling and analysis and APIs and other tools to scrap the web and collect data.
CO5. Apply basic tools(plots, graphs, summary statistics) to carry out EDA and apply EDA and the Data Science process in a case study.

UNIT I

Introduction: What is Data Science? Big Data and Data Science hype, getting past the hype now?Datafication current landscape of perspectives, Skill sets needed, Statistical Inference, Populations and samples, Statistical modeling, probability, distributions, fitting a model, Introduction to R.

UNIT II

Exploratory Data Analysis and the Data Science Process, Basic tools (plots, graphs and summary statistics) of EDA,Philosophy of EDA, The Data Science Process, Case Study: Real Direct (online real estate firm).

Three Basic Machine Learning Algorithms: Linear Regression, k-Nearest Neighbors (k-NN) K-means.

UNIT III

Spam Filters, Naive Bayes, and Wrangling, Thought Experiment: Learning by Example, Naive Bayes, **Fancy It Up:** Laplace Smoothing, Comparing Naive Bayes to k-NN, Sample Code in bash, Scraping the Web: APIs and Other Tools, Jake's Exercise: Naive Bayes for Article Classification.

Logistic Regression: Thought Experiments, Classifiers, M6D Logistic Regression Case Study, Media 6 Degrees Exercise.

UNIT IV

Recommendation Systems: Building a User-Facing Data Product, Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system

UNIT V

Mining Social-Network Graphs, Social networks as graphs, Clustering of graphs, direct discovery of communities in graphs, Partitioning of graphs, Neighbourhood properties in graphs, Data Visualization, Basic principles, ideas and tools for data visualization

Data Science and Ethical Issues: Discussions on privacy, security, ethics, A look back at Data Science.

Text Book

1. Cathy O'Neil and Rachel Schutt. "Doing Data Science, Straight Talk from the Frontline", O'Reilly Media, 2013.

Reference Books

1. Jure Leskovek, AnandRajaraman and Jeffrey Ullman, "Mining of Massive Datasets", Second Edition,Dreamtech Press. 2016.
2. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective (Adaptive Computation and Machine Learning Series", MIT Press, 2012.
3. Foster Provost and Tom Fawcet,"Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking", O'Reilly Media, 2013.

Web References

1. https://nptel.ac.in/courses/106/106/106106179/

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	-	-	H	M	L	-	M	H	-
CO2	-	-	-	H	-	-	H	-	-
CO3	L	-	-	H	M	-	-	H	-
CO4	M	L	H	-	-	-	-	-	H
CO5	-	L	-	-	H	M	H	-	-

19MCST10: INTERNET OF THINGS

Credits –3 **Sessional Marks: 30**
L:T:P::3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following:

1. Introduction to IoT.
2. IoT Market perspective.
3. Learning concepts of Python.
4. Understand State of the Art – IoT Architecture
5. Emphasis of Real World IoT Design Constraints, Industrial Automation and Commercial Automation Building in IoT.

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand the vision of IoT from a global context.
CO2. Determine the Market perspective of IoT.
CO3. Use of Devices, Gateways and Data Management in IoT.
CO4. Building state of the art architecture in IoT.
CO5. Application of IoT in Industrial and Commercial Building Automation and Real-World Design Constraints.
CO6. Use cloud infrastructure for IoT applications

UNIT I

Introduction to Internet of Things: Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics,Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

UNIT II

IoT and M2M: Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

UNIT III

Introduction to Python: Language features of Python, Data types, data structures, Control of flow, functions,modules, packaging, file handling, data/time operations, classes, Exception handling,Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib

UNIT IV

IoT Physical Devices and Endpoints: Introduction to Raspberry PI-Interfaces (serial, SPI, I2C)Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

UNIT V

IoT Physical Servers and Cloud Offerings: Introduction to Cloud Storage models and communication APIs,Webserver – Web server for IoT, Cloud for IoT, Python web application framework,Designing a RESTful web API

Text Books

1. ArshdeepBahga and Vijay Madisetti, "Internet of Things - A Hands-on Approach", Orient Blackswan Private Limited - New Delhi, University Press, 2015.
2. Matt Richardson and Shawn Wallace, "Getting Started with Raspberry Pi", O'Reilly, Maker Media Inc, 2013.

Reference Books

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
2. Michael Miller, "The Internet of Things", First Edition, Pearson, 2015.
3. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6:The Evolving World of M2M Communications", Wiley, 2013.

Web References

1. https://nptel.ac.in/courses/106/105/106105195/

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	-	-	M	-	H	-	H	-	M
CO2	H	-	-	-	-	-	M	-	-
CO3	M	-	-	-	H	-	M	-	-
CO4	-	-	-	-	H	-	M	-	L
CO5	M	-	-	-	H	-	H	-	-
CO6	-	-	-	H	M	-	M	H	-

19MCST11: BLOCK CHAIN TECHNOLOGIES

Credits –3 **Sessional Marks: 30**
L:T:P::3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following:

1. Block chain Technology and its applications
2. Testing environments of various types of organizations.
3. Dealing Multiple Clients.

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand basic concepts of block chain technology and its platforms
CO2. Develop various types of environments in block chain technology
CO3. Provide security prospects in an organization.
CO4. Analyse different cryptographic protocols for multiple computations.

UNIT I

Introduction to Block chain: The story of a transaction: From Transactions to Blocks, Blocks and Distributed Consensus Design Primitives Protocols, Security, Consensus, Permissions, Privacy Block chain Architecture and Design Basic crypto primitives of Hash, Signature, Hash chain to Block chain Basic mechanisms, Introduction to major block chain platforms.

UNIT II

Development environments in block chain: Requirements for the consensus protocols, Proof of Work, Scalability aspects of Block chain consensus protocols, Permission Block chains Design goals Consensus protocols for Permission Block chains. Block chain deployment, Mining and forking, Segregated Witness Block chain architectures-Abstract Architecture, Introduction to major block chain platforms.

UNIT III

Block chain in Multitude of clients in Ethereum: Production and test networks in Ethereum, Public, private and development deployments. Solidity in depth, Building blocks popular contracts already in deployment. Consensus protocols for Permissioned Block chains
Hyperledger FabricI: Decomposing the consensus process, Hyperledger fabric components, Chain code Design and Implementation.
Hyperledger Fabric II: Beyond Chain code: fabric SDK and Front End Hyperledger composer tool.

UNIT IV

Block chain in Financial Software and Systems Settlements: KYC, Capital markets, Insurance Block chain in trade/supply chain, Provenance o Block chain for Government: Digital identity, land records and other kinds of record keeping between government entities, public distribution system / social welfare systems. Conceptual distinction between a payment system and a decentralized applications platform, Differences in their architectures from security-first aspect to a rich feature set, Future roadmap for them, following their own paths with probable interconnections.

UNIT V

Block chain Cryptography: Privacy and Security on Block chain, Research aspects: Secure cryptographic protocols on Block chain. Secured Multi-party Computation. Block chain for science making better use of the data-mining network. Considerations for production deployment a) Quality of decentralized applications in Code patterns, Security other smart contract platforms, Discussion of future prospects.

Text Books

1. Robert C. Hackney,"Lawyer's Guide to Blockchain Technology: What it is and how it will disrupt the practice of law", Four Palms Management Company, 2017.
2. Stephen Fleming, "Blockchain Technology & Microservices Architecture: A Non-Programmer's Handbook", 2018

Reference Book

1. Andreas Antonopoulos, "Mastering Bitcoin", O'Reilly Publishing, 2015.

Web References

1. https://nptel.ac.in/courses/106/105/106105184/

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	M	-	-	-	-	H	H	-	-
CO2	M	-	-	-	-	H	H	-	-
CO3	-	-	-	-	M	-	-	-	M
CO4	L	-	-	M	M	-	H	-	-

19MCST12: MACHINE LEARNING

Credits – 3 **Sessional Marks: 30**
L:T:P::3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following:

1. Underlying machine learning theories.
2. Machine learning problems corresponding to differentapplications.
3. Machine learning algorithms along with theirstrengths and weaknesses.
4. Machine learning algorithms to solve problems of moderatecomplexity

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand what is learning and why it is essential to the design ofintelligent machines.
CO2. Design genetic algorithms of real-world applications.
CO3. Demonstrate various machine learning algorithms in a widerange of real-world applications.
CO4. Acquire knowledge deep learning and be able to implement deep learningmodels for language, vision, speech, decision making, and more

UNIT I

Introduction: Learning Problems, Perspectives and Issues,Concept Learning ,Version Spaces and Candidate Eliminations, Inductive bias, Decision Tree learning, Representation,Algorithm,Heuristic Space Search.

UNIT II

Neural Networks and Genetic Algorithms: Neural Network Representation,Problems,Perceptrons,Multilayer Networks and Back Propagation Algorithms, Advanced Topics, Genetic Algorithms, Hypothesis Space Search, Genetic Programming Models of Evalution and Learning.

UNIT III

Bayesian and Computational Learning: Bayes Theorem, Concept Learning, Maximum Likelihood,Minimum Description LengthPrinciple Bayes Optimal Classifier, Gibbs Algorithm, Naïve Bayes Classifier,Bayesian Belief Network,EM Algorithm, Probability Learning, Sample Complexity,Finite and Infinite Hypothesis Spaces,Mistake Bound Model.

UNIT IV

Instant Based Learning: K- Nearest Neighbour Learning, Locally weighted Regression, Radial Bases Functions,CaseBased Learning.

Advanced Learning: Learning Sets of Rules,Sequential Covering Algorithm, Learning Rule Set,First OrderRules, Sets of First Order Rules, Induction on Inverted Deduction,Inverting Resolution, Analytical Learning,Perfect Domain Theories, Explanation Base Learning,FOCL Algorithm,Reinforcement Learning Task, Q-Learning,Temporal Difference Learning

UNIT V

Analytical Learning and Reinforced Learning: Perfect Domain Theories, Explanation Based Learning, Inductive Analytical Approaches, FOCL (First Order Combined Learner) Algorithm, Reinforcement Learning, Task, Q-Learning, Temporal Difference Learning

Text Book

1. Tom M. Mitchell,"Machine Learning", McGraw Hill Education, 2017

Reference Book

1. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC, 2014.

Web References

1. https://nptel.ac.in/courses/106/106/106106202/

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	M	-	-	H	-	-	H	M	-
CO2	-	L	-	M	H	-	M	-	H
CO3	L	-	H	-	-	M	M	-	H
CO4	M	-	H	-	-	-	H	M	-

19MCST13: GPU COMPUTING

Credits – 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following:

1. Parallel programming with Graphics Processing Units (GPUs).
2. Different types of memory and its operation
3. Synchronization, Functions, support and streams
4. Various case studies

Course Outcomes

After successful completion of course the student should be able to

CO1. Learn concepts in parallel programming.
CO2. Develop programs on GPUs debugging and profiling parallel programs.
CO3. Analyse case studies like image processing,Graph algorithms, Simulations, Deep Learning in the field of parallel computing.
CO4. Know about synchronization and functions of GPU computing environments.

UNIT I

Introduction: Heterogeneous Parallel Computing,Architecture of a Modern GPU,Why More Speed or Parallelism,Speeding Up Real Applications,Parallel Programming Languages and Models,Overarching Goals,History of GPU Computing: Evolution of Graphics Pipelines, The Era of Fixed-Function Graphics Pipelines, Evolution of Programmable Real-Time Graphics, Unified Graphics and Computing Processors, GPGPU: An Intermediate step, GPU Computing Scalable GPUs, RecentDevelopments, Future Trends

UNIT II

Memory: Memory hierarchy, global, local /shared, private / local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory,Multi-dimensional Arrays, Memory Allocation, Memory copyingacross devices, Programs with matrices, Performance evaluation with differentmemories

UNIT III

Synchronization: Memory Consistency, Barriers (local versus global), Atomics, Memory fence, Prefix sum, Reduction, Programs for concurrent Data Structures such as Worklists, Linked-lists, Synchronization across CPU and GPU

Functions: Device functions, Host functions, Kernels functions, usinglibraries (suchas Thrust), and developing libraries.

UNIT IV

Support: Debugging GPU Programs. Profiling, Profile tools, Performanceaspects

Streams: Asynchronous processing, tasks, Task-dependence, overlapped datatransfers, Default Stream, Synchronization with streams. Events, Event-based-Synchronization - Overlapping data transfer and kernel execution, pitfalls

UNIT V

Case Studies: Image Processing, Graph algorithms, Simulations, Deep Learning.

Text Book

David B. Kirk, Wen-meiW.Hwu, "Programming Massively Parallel Processors: A Hands-on Approach", MorganKaufman, 2010.

Reference Book

1. Shane Cook, "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs", Morgan Kaufman,2012.

Web References

1. https://www.nvidia.com/en-us/about-nvidia/ai-computing/

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	-	H	-	-	L	H	M
CO2	L	-	-	L	H	-	M	-	H
CO3	H	-	-	L	-	-	M	-	-
CO4	-	-	H	L	-	-	L	H	-

19MCST14: CLOUD COMPUTING

Credits –3 **Sessional Marks: 30**
L:T:P::3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following:

1. Fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges;
2. Knowledge of the basic ideas and principles in data center design; cloud management techniques and cloud security mechanisms
3. Virtualization techniques that serve in offering software, security concepts
4. Things related to the cloud computing architectures.

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.

CO2. Apply fundamental concepts in cloud infrastructures to understand the tradeoffs in power, efficiency and cost, and then study how to leverage and manage single and multiple datacenters to build and deploy cloud applications that are resilient, elastic and cost-efficient.

CO3. Discuss system, network and storage virtualization and outline their role in enabling the cloud computing system model.

CO4. Analyze various cloud managing mechanisms and cloud fundamental architectures

UNIT I

Fundamental Cloud Computing : Understanding Cloud Computing,Origins and Influences, Basic Concepts and Terminology,Goals and Benefits, Risks and ChallengesFundamental Concepts and Models: Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models

UNIT II

Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology, Web Technology, Multitenant Technology, Containerization ,Fundamental Cloud Security: Basic Terms and Concepts, Threat Agents, Cloud Security Threats, Additional Considerations

UNITIII

Cloud Computing Mechanisms:Cloud Infrastructure Mechanisms, Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud Usage Monitor, Resource Replication, Ready-Made Environment, Specialized Cloud Mechanisms: Automated Scaling Listener, Load Balancer, SLA Monitor, Pay-Per-Use Monitor, Audit Monitor, Failover System, Hypervisor, Resource Cluster, Multi-Device Broker, State Management Database

UNIT IV

Cloud Management Mechanisms: Remote Administration System, Resource Management System, SLA Management System, Billing Management System, Cloud Security Mechanisms: Encryption, Hashing, Digital Signature,Public Key Infrastructure (PKI),

Identity and Access Management (IAM), Single Sign-On (SSO), Cloud-Based Security Groups, Hardened Virtual Server Images

UNIT V

Cloud Computing Architecture: Fundamental Cloud Architectures, Workload Distribution Architecture, Resource Pooling Architecture, Dynamic Scalability Architecture, Elastic Resource Capacity Architecture, Service Load Balancing Architecture, Cloud Bursting Architecture, Elastic Disk Provisioning Architecture, Redundant Storage Architecture

Text Book

1. Thomas Erl, "Cloud Computing: Concepts, Technology & Architecture", Prentice Hall, 2013.

Reference Books

1. KamalkanthHiran, RuchiDoshi, TemitayoFagbola, MehulMahrishi, "Cloud computing: Master the Concepts, Architecture and Applications with Real world examples and Case studies", BPB publication,2019.
2. RajkumarBuyya, James Broberg, AndrzejGoscinski,"Cloud computing principles paradigms",Wiley publications, 2013.
3. KailashJayaswal, JagannathKallakurchi, Donald J. Houde, Deven Shah, "Cloud computing Black book",Kogent Learning Solutions Inc, Dreamtech Press,2014.

Web References

1. https://nptel.ac.in/courses/106/105/106105167/

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	-	L	-	H	-	-	H	-	-
CO2	L	-	-	M	H	-	M	-	H
CO3	-	L	L	H	-	-	H	-	-
CO4	H	L	-	-	-	-	H	-	-

19MCSS01: TERM PAPER CUM SEMINAR

Credits – 2 **Sessional Marks: 40**
L:T:P::0:0:4 **University Exam Marks: 60**

Course Objectives

To expose the students to the following:
1. Identify, understand and discuss current, real-world issues.
2. Improve oral and written communication skills.
3. Explore an appreciation of the self in relation to its larger diverse social and academic contexts.
4. Apply principles of ethics and respect in interaction with others.

Course Outcomes

After successful completion of course the student should be able to
CO1. Acquire in-depth knowledge in the chosen seminar topic.
CO2. Analyse critically the chosen seminar topic for arriving at conclusions.
CO3. Understand the impact of seminar output in the context of environmental sustainability.
CO4. Improve communication skills
CO5. Prepare and present a seminar report
CO6. Develop skills for continuous learning to improve knowledge and competence in the chosen field of seminar.

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	-	M	H	-	-	-	H	-
CO2	L	-	-	L	M	-	H	L	-
CO3	-	-	-	-	L	L	-	-	H
CO4	-	-	-	-	-	H	-	M	-
CO5	-	H	-	-	-	M	-	-	L
CO6	-	-	M	-	-	-	-	M	-

19MCSP03: ADVANCED ALGORITHMS LAB

Credits – 2 **Sessional Marks: 40**
L:T:P::0:0:4 **University Exam Marks: 60**

Course Objectives

To expose the students to the following:

1. The fundamental design, analysis, and implementation of basic data structures.
2. Basic concepts in the specification and analysis of programs.
3. Principles for good program design, especially the uses of data abstraction

Course Outcomes

After successful completion of course the student should be able to

CO1. Design and analyze programming problem statements.
CO2. Choose appropriate data structures and algorithms
CO3. Understand the ADT/libraries and use it to design algorithms for a specific problem.
CO4. Realize the necessary mathematical abstraction to solve problems.
CO5. Demonstrate various advanced algorithms concepts

LIST OF PROGRAMS

1. Review of Sorting Algorithms a) Bubble sort d) Merge sort g) Binary tree sort b) Insertion sort e) Heap sort c) Quick sort f) Radix sort
2. Write a program for a) Linear search b) Binary search
3. Implement Dijkasra's Algorithm
4. Write programs to implement the following using arrays and linked lists a) List ADT
5. Write programs to implement the following using an array. a) Stack ADT b) Queue ADT
6. Write a program that reads an infix expression and converts the expression to postfix form. (Use stack ADT).
7. Write a program to implement circular queue ADT using an array.
8. Write a program that uses both a stack and a queue to test whether the given string is a palindrome or not.
9. Write programs to implement the following using a singly linked list. a) Stack ADT b) Queue ADT
10. Write programs to implement the deque (double ended queue) ADT using a) Array b) Singly linked list c) Doubly linked list.
11. Write a program to implement priority queue ADT.
12. Write a program to perform the following operations: a) Construct a binary search tree of Elements. b) Search for a key element in the above binary search tree. c) Delete an element from the above binary search tree.
13. Write a program to implement all the functions of a dictionary (ADT) using Hashing.
14. Write a program to implement Dijkstra’s algorithm for Single source shortest path problem.
15. Write programs that use recursive and non-recursive functions to traverse the given binary tree in a) Preorder b) Inorder c) Postorder.
16. Write a program to perform the following operations: a) Insertion into a B-tree b) Searching in a B-tree
17. Write programs for the implementation of bfsanddfs for a given graph.
18. Write a Program for Strassen's algorithm
19. Write a Program for Maxflow-mincut theorem

20. Write a Program for Edmond's Blossom algorithm to compute augmenting path.
21. Write a Program for Edmond-Karp maximum-flow algorithm.
22. Write a Program for Floyd-Warshall algorithm
23. Write a Program for Schonhage-Strassen Integer Multiplication algorithm
24. Write a Program for Chinese Remainder Theorem
25. Write a Program for LUP-decomposition

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1	L	L	-	H	H	-	M	-	H
CO2	-	L	M	M	-	-	M	-	L
CO3	M	L	-	H	H	-	M	-	H
CO4	L	L	-	H	-	-	M	H	-
CO5	-	L	-	M	M	-	M	-	H

19MCSP04: SOFT COMPUTING LAB

Credits – 2 **Sessional Marks: 40**
L:T:P::0:0:4 **University Exam Marks: 60**

Course Objectives

To expose the students to the following:

1. Fuzzy concepts, Neural networks with back propagation and without preparation
2. The operations of genetic algorithms
3. Practice on crisp partitions

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand the difference between learning and programming and explorepractical applications of Neural Networks (NN).

CO2. Analyse and appreciate the applications which can use fuzzy logic.

CO3. Comprehend the basics of genetic algorithm, use of GA operators and itsapplications.

CO4. Understand the basics of genetic algorithm, use of GA operators and its applications.

LIST OF PROGRAMS

1. Write a Program to implement Fuzzy Operations.
2. Write a Program to implement Fuzzy Relations (Max-min Composition)
3. Write a Program to implement Simple Neural Network (McCulloh-Pitts model)
4. Write a Program to Generate ANDNOT function using McCulloch-Pitts neural net.
5. Write a Program to Generate XOR function using McCulloch-Pitts neural net.
6. Write a Program to implement Supervised Learning Algorithm
7. Write a Program to implement Unsupervised Learning Algorithm
8. Write a Program to implement Simple Genetic Application
9. Write a Program to implement Perceptron net for an AND function with bipolar inputs and targets.
10. Write a Program to calculate the weights for given patterns using hetero associative neural net.
11. Write a Program to implement to store vector in an auto-associative net. Find weight matrix & test the net with input
12. Write a Program to implement to store the vector, find the weight matrix with no self-connection. Test this using a discrete Hopfield net.
13. Write a Program to implement FIS Editor.
14. Write a Program to Use Fuzzy toolbox to model tip value that is given after a dinner based on quality and service.
15. Write a Program of Perceptron Training Algorithm.
16. Write a Program to Implement Hebb's Rule
17. Write a Program to Implement Of Delta Rule
18. Write a Program for Back Propagation Algorithm
19. Write a Program to Implement Logic Gates

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	-	L	-	H	-	-	H	-	H
CO2	H	L	-	-	-	-	H	-	-
CO3	M	-	-	-	H	-	H	-	M
CO4	L	-	-	H	M	-	H	-	L

19MCST15: BIG DATA ANALYTICS

Credits – 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Basics of Hadoop, Map-reduce.
2. Analytics – Concepts, Data preparation – merging, managing missing numbers sampling, Datavisualisation, Basic statistics
3. Handling an analytics project on BigData
4. Bigdata for business intelligence.

Course Outcomes

After successful completion of course the student should be able to

CO1. Describe Big Data and its importance with its applications
CO2. Differentiate various big data technologies like Hadoop,MapReduce, Pig, Hive, Hbaseand No-SQL.
CO3. Apply tools and techniques to analyze Big Data.
CO4. Design a solution for a given problem using suitable Big Data Techniques

UNIT I

Introduction to Big Data: Big Data and its Importance, Four V's of Big Data, Drivers for Big Data, Introduction to Big Data Analytics, Big Data Analytics applications
Big Data Technologies: Hadoop's Parallel World, Data discovery, Open source technology for Big Data Analytics, cloud and Big Data, Predictive Analytics, Mobile Business Intelligence and Big Data, Crowd Sourcing Analytics, Inter- and Trans-Firewall Analytics - Information Management.

UNIT II

Processing Big Data: Integrating disparate data stores, Mapping data to the programming framework, Connecting and extracting data from storage, Transforming data for processing,subdividing data in preparation for Hadoop Map Reduce

UNIT III

Hadoop Map-Reduce: Employing Hadoop Map Reduce, Creating the components of Hadoop Map Reduce jobs, Distributing data processing across server farms, Executing Hadoop Map Reduce jobs,Monitoring the progress of job flows, The Building Blocks of Hadoop Map Reduce, Distinguishing Hadoop daemons, Investigating the Hadoop Distributed File System.

UNIT IV

Big Data Tools and Techniques: Installing and Running Pig, Comparison with Databases, Pig Latin, User Define Functions, Data Processing Operators, Installing and Running Hive, Hive QL, Tables, Querying Data, User-Defined Functions, Oracle Big Data

UNIT V

Advanced Analytics Platform: Real-Time Architecture, Orchestration and Synthesis Using Analytics Engines, Discovery using Data at Rest, Implementation of Big Data Analytics, Big Data Convergence, Analytics Business Maturity Model

Text Books

1. Michael Minelli, Michehe Chambers, AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business", Wiley CIO Series, 2013.
2. AravindSathi, "Big Data Analytics: Disruptive Technologies for Changing the Game", IBM Corporation, 2012.

Reference Books

1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, 2015.
2. Paul Zikopoulos, Chris Eaton, Dirk Deroos, Tom Deutusch, George Lapis, "Understanding Big data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill Education, 2017.
3. VigneshPrajapati, "Big Data Analytics with R and Hadoop", Packt Publishing 2013.

Web References

1. https://nptel.ac.in/courses/106/104/106104189/

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	-	-	L	-	M	H	L	-
CO2	H	L	-	M	-	-	-	H	-
CO3	L	-	-	H	-	M	M	H	-
CO4	L	L	-	-	H	M	-	-	H

19MCST16: CYBER SECURITY

Credits – 3 **Sessional Marks: 30**
L:T:P :: 3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Instigate cyber threats and cyber security and to facilitate the awareness in the times of growing cyber-crime episodes.
2. Learning how cyber security is going to help to understand the implications of cybercrime.
3. Facilitating an idea about the legal perspectives and laws related to cybercrimes in Indian context.
4. Familiarize how to apply security and privacy methods in development of modern applications and in organizations to protect people and to prevent cybercrimes.

Course Outcomes

After successful completion of course the student should be able to

CO1. Analyze various aspects of Cyber security, Cyber-crimes and its related laws in Indian and Globalact.

CO2. Understand how cyber security is going to help the implications of cybercrime.

CO3. Examine the legal perspectives and laws related to cybercrimes in Indian context.

CO4. Apply security and privacy methods in development of modern applications and in organizations to protect people and to prevent cybercrimes.

UNIT I

Introduction to Cyber Crimes: Introduction, Definition, Origin, Cyber Crime and Information Security, Cyber Criminals, Classifications of Cyber Crimes, The Legal Perspectives and Indian Perspective, Cyber Crime and Indian ITA 2000, Global Perspective on Cyber Crimes.

Cyber Offenses: Introduction, Criminals Planning on Attacks, Social Engineering, Cyber Stalking, Cyber Café and Crimes, Botnets.

UNIT II

Tools and Methods used in Cyber Crime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan horses and Backdoors, Steganography, DoS and DDoS attacks. Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft).

UNIT III

Cyber Crimes and Cyber Security-Legal Perspectives: Introduction, Cyber Crime and the legal landscape around the world. Cyber Laws in Indian Context, The Indian IT Act, Challenges to Indian Law and Cyber Crime Scenario in India, Consequences of not addressing the weakness in IT Act, Digital Signatures and the Indian IT Act, Cyber Crime and Punishment, Cyberlaw, Technology and Students in India Scenario.

UNIT IV

Cyber Security-Organizational Implications: Introduction, Cost of Cyber Crimes and IPR issues, Web Threats for Organizations - Evils and Perils, Security and Privacy Implications from Cloud Computing, Social Media Marketing-Security Risks and Perils for Organizations.

UNIT V

Cyber Security-Organizational Implications: Social Computing and Associated Challenges for Organizations, Protecting People's Privacy in Organization, Organizational Guidelines for Internet Usage, Safe Computing and Usage Policy, Incident Handling and Best Practices, Media and Asset Protection.

Textbooks

1. Nina Gobole, SunitBelapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives",1st edition,Wiley India, 2011.

Reference Books

1. Robert Bird, Jonathan J. Darrow, Gerald R. Ferrera, Jacqueline Klosek, Margo E. K. Reder, Stephen D. Lichtenstein, Jeffrey Aresty,"Cyber Law: Text and Cases", 3rd Edition,Cengage Learning, 2012.
2. VivekSood, "Cyber Law Simplified", Tata McGraw-Hill, 2017.
3. Prashant Mali, "Cyber Law and Cyber Crimes Simplified",4th Edition, Cyber Infomedia, 2017.

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	-	-	L	-	-	H	-	-
CO2	-	-	-	H	-	-	H	-	-
CO3	H	-	-	-	-	-	H	L	-
CO4	L	-	-	H	M	-	H	-	M

19MCST17: DEEP LEARNING

Credits –3 **Sessional Marks: 30**
L:T:P::3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following:

1. Solve a wide range of problems in Computer Vision and Natural Language Processing.
2. The building blocks used in these Deep Learning based solutions
3. Feedforward neural networks, convolutional neural networks, recurrent neural networks and attention mechanisms.
4. Various optimization algorithms such as Gradient Descent, Nesterov Accelerated Gradient Descent, Adam, AdaGrad and RMSProp which are used for training such deep neural networks.

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand architectures used for solving various vision and NLP task

CO2. Identify which are more appropriate for various types of learning tasks in various domains

CO3. Devise deep learning algorithms and solve real-world problems.

CO4. Select deep learning methods which meet the needs of industry and society.

UNITI

History of Deep Learning, Deep Learning Success Stories, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm

UNITII

Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feedforward Neural Networks, Representation Power of Feedforward Neural Networks.

UNITIII

Feedforward Neural Networks, Back Propagation, Gradient Descent(GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Eigenvalues and Eigenvectors, Eigenvalue Decomposition.

UNITIV

Principle Component Analysis and its interpretations, Singular Value Decomposition, Auto encoders and relation to PCA, Regularization in auto encoders, Denoising auto encoders, Sparse auto encoders, Contractive auto encoders.

UNITV

Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and typing, Injecting noise at input, Ensemble methods, Dropout. Greedy Layerwise Pre-Training, Better activation functions, Better weight initialization methods, Batch Normalization.

Text Books

1. Ian Goodfellow, YoshuaBengio, Aaron Courville,"Deep Learning (Adaptive Computation and Machine Learning Series)", The MIT Press, 2016.

Reference Books

1. Rajiv chopra, "Deep Learning- A practical Approach",Khanna publishing,2018.

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1	H	M	M	-	-	-	H	M	-
CO2	-	-	L	M	-	L	M	-	-
CO3	H	-	L	-	H	M	M	-	H
CO4	-	L	-	-	H	M	M	L	M

19MCSV01: COMPREHENSIVE VIVA

Credits – 2 **Sessional Marks: 40**
L:T:P::0:0:0 **University Exam Marks: 60**

Course Objectives

To expose the students to the following:

1. To assess the overall knowledge of the student in the Computer Science and Engineering acquired over 3 semesters of study in the postgraduate program.

Course Outcomes

After successful completion of course the student should be able to

CO1. Demonstrate Knowledge in the program domain.
CO2. Present his views cogently and precisely.
CO3. Exhibit professional etiquette suitable for career program.

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	-	-	H	-	-	-	M	-	L
CO2	-	H	-	-	-	M	-	-	H
CO3	-	-	L	-	-	H	-	L	-

19MCSJ01: PROJECT WORK PHASE – I

Credits – 10 **Sessional Marks: 40**
L:T:P::0:0:20 **University Exam Marks: 60**

Course Objectives

To expose the students to the following:

1. A glimpse into real world problems and challenges that need IT based solutions.
2. Create very precise specifications of the IT solution to be designed.
3. Introduce to the vast array of literature available of the various research challenges in the field of IT.
4. Characteristics of several domain areas where IT can be effectively used.
5. Use all concepts of IT in creating a solution for a problem.
6. How to improve the team building, communication and management skills of the students.

Course Outcomes

After successful completion of course the student should be able to

CO1. Acquire in-depth knowledge in the core and/or interdisciplinary area of project topic.
CO2. Undertake research and solve real world problems in the project domain.
CO3. Apply appropriate techniques, resources and modern software tools necessary for implementing the project work.
CO4. Use project results for sustainable development of the society.
CO5. Engage in continuous learning to improve knowledge and competence in the chosen subject area of project.
CO6. Function effectively as individual and a member in the project team.

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	-	M	H	-	-	-	H	-
CO2	H	-	-	M	-	-	-	H	-
CO3	-	-	-	H	-	-	H	-	-
CO4	-	-	-	-	L	L	-	-	H
CO5	-	-	M	-	-	-	-	M	-
CO6	M	-	-	-	-	H	-	-	L

19MCSJ02: PROJECT WORK PHASE – II

Credits – 16 **Sessional Marks: 40**
L:T:P::0:0:32 **University Exam Marks : 60**

Course Objectives

To expose the students to the following:

1. A glimpse into real world problems and challenges that need IT based solutions.
2. Create very precise specifications of the IT solution to be designed.
3. Introduce to the vast array of literature available of the various research challenges in the field of IT.
4. Characteristics of several domain areas where IT can be effectively used.
5. Use all concepts of IT in creating a solution for a problem.
6. How to improve the team building, communication and management skills of the students.

Course Outcomes

After successful completion of course the student should be able to

CO1. Acquire in-depth knowledge in the core and/or interdisciplinary area of project topic.
CO2. Undertake research and solve real world problems in the project domain.
CO3. Apply appropriate techniques, resources and modern software tools necessary for implementing the project work.
CO4. Use project results for sustainable development of the society.
CO5. Engage in continuous learning to improve knowledge and competence in the chosen subject area of project.
CO6. Function effectively as individual and a member in the project team.

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	-	M	H	-	-	-	H	-
CO2	H	-	-	M	-	-	-	H	-
CO3	-	-	-	H	-	-	H	-	-
CO4	-	-	-	-	L	L	-	-	H
CO5	-	-	M	-	-	-	-	M	-
CO6	M	-	-	-	-	H	-	-	L

19MCST18: INFORMATION RETRIEVAL SYSTEMS

Credits – 3 **Sessional Marks: 30**
L:T:P::3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following:

1. Concepts and algorithms in IRS
2. Data/file structures those are necessary to design, and implement Information retrieval (IR) systems.
3. Cataloguing, Indexing, Automatic Indexing.
4. Various search algorithms and retrieval techniques.

Course Outcomes

After successful completion of course the student should be able to

CO1. Apply IR principles to locate relevant information large collections of data
CO2. Devise different document clustering algorithms
CO3. Implement retrieval systems for web search tasks.
CO4. Design an Information Retrieval System for web search tasks.

UNIT I

Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses. Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities

UNIT II

Cataloging and Indexing: History and Objectives of Indexing, Indexing Process, Automatic Indexing, Information Extraction Data Structure: Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram Data Structures, PAT Data Structure, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models

UNIT III

Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages Document and Term Clustering: Introduction to Clustering, Thesaurus Generation, Item Clustering, Hierarchy of Clusters

UNIT IV

User Search Techniques: Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the INTERNET and Hypertext Information Visualization: Introduction to Information Visualization, Cognition and Perception, Information Visualization Technologies

UNIT V

Text Search Algorithms: Introduction to Text Search Techniques, Software Text Search Algorithms, Hardware Text Search Systems.

Multimedia Information Retrieval: Spoken Language Audio Retrieval, Non-Speech Audio Retrieval, Graph Retrieval, Imagery Retrieval, Video Retrieval.

Text Book

1. Gerald J. Kowalski, Mark T. Maybury, "Information Storage and Retrieval Systems – Theory and Implementation", Second Edition, Springer 2013.

Reference Books

1. Frakes, W.B., Ricardo Baeza-Yates, "Information Retrieval Data Structures and Algorithms", Prentice Hall, 2007.
2. Robert Korfhage,"Information Storage & Retrieval", John Wiley & Sons, 2006.
3. RichardoBaeza-Yates, BethierRibeiro-Neto,"Modern Information Retrieval", Addison Wesley, 2009.

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO–PO–PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	-	-	-	H	-	H	H	-	-
CO2	-	-	H	-	-	-	L	-	H
CO3	M	-	-	-	H	-	-	-	H
CO4	L	-	-	-	H	-	M	-	H