Sri Sri University

FACULTY OF SCIENCE

DOCS-Department of Computer Science

M.Sc. in Computer Science with specialization in Data Science (2020-22)
LOCF Based

MASTER OF SCIENCE DEGREE
COURSE M.Sc. COMPUTER
SCIENCE WITH SPECIALIZATION
IN DATA SCIENCE

UNDER SRI SRI UNIVERSITY
(With effect from 2020)

Preamble

Education is the key to development of any society. Role of higher education is crucial for securing right kind of employment and also to pursue further studies in best available world class institutes elsewhere within and outside India. Quality education in general and higher education in particular deserves high priority to enable the young and future generation of students to acquire skill, training and knowledge in order to enhance their thinking, creativity, comprehension and application abilities and prepare them to compete, succeed and excel globally. Sustained initiatives are required to reform the present higher education system for improving and upgrading the academic resources and learning environments by raising the quality of teaching and standards of achievements in learning outcomes in undergraduate program in professional streams of higher education like computer science. One of the significant reforms in the postgraduate education is to introduce the Learning Outcomes-based Curriculum Framework (LOCF) which makes it student- centric, interactive and outcome-oriented with well-defined aims, objectives and goals to achieve. LOCF also aims at ensuring uniform education standard and content delivery across the country which will help the students to ensure similar quality of education irrespective of the institute and location. With initiatives of University Grants Commission (UGC) for nation-wide adoption and implementation of the LOCF for PG programmes in colleges, universities and HEIs in general.So MSc Computer Science at Sri Sri University is designed as per LOCF & as per UGC guidelines.

The main objective of MSc Computer Science program at Sri Sri University is to prepare a comprehensive course structure with detailed syllabus along with quality reading material in order to have a uniform standard of education in PG Computer Science programme among students. This document shall serve as a model document across the higher education institutes (HEIs) in the country for teachers, students and academic administrators. It is a student centric framework where they are expected to learn fundamentals of computer science along with the latest trends and techniques like Artificial Intelligence, Internet of Things, Machine Intelligence,Cloud Computing alongwith advanced skillsets that include Mobile Application Development, Object Oriented Programming among many other courses. It will help the students to be equipped with fundamental as well as advanced and latest technologies in computer science after completion of the programme

Introduction

MSc Computer Science has been evolving as an important branch of science and engineering throughout the world in last couple of decades and it has carved out a space for itself like any other disciplines of basic science and engineering. Computer science is a discipline that spans theory and practice and it requires thinking both in abstract terms and in concrete terms. Nowadays, practically everyone is a computer user, and many people are even computer programmers. Computer Science can be seen on a higher level, as a science of problem solving and problem solving requires precision, creativity, and careful reasoning. The ever-evolving discipline of computer science also has strong connections to other disciplines. Many problems in science, engineering, health care, business, and other areas can be solved effectively with computers, but finding a solution requires both computer science expertise and knowledge of the particular application domain.

MSc Computer Science has a wide range of specialties. These include Computer Architecture, Software Systems, Graphics, Artificial Intelligence, Computational Science, and Software Engineering. Drawing from a common core of computer science knowledge, each specialty area focuses on specific challenges. Computer Science is practised by mathematicians, scientists and engineers. Mathematics, the origins of MSc Computer Science, provides reason and logic. MSc Computer Science provides the methodology for learning and refinement.

MSc Computer Science will commence at Sri Sri University in this year 2020, as this discipline evolved itself to a multidisciplinary discipline. Information Technology is growing rapidly. Increasing applications of computers in almost all areas of human endeavour has led to vibrant industries with concurrent rapid change in technology. Unlike other basic disciplines, developing core competency in this discipline that can be reasonably stable becomes a challenge.

Career Objective

MSc Computer Science is aimed at postgraduate level training facilitating multiple career paths. Students so graduated, can take up postgraduate programmes in CS leading to research as well as R&D, can be employable at IT industries, or can pursue a teachers' training programme such BEd in Computer Education, or can adopt a business management career. . There are several employment opportunities and after successful completion of an MSc

Computer Science graduating students can fetch employment directly in companies as Web Developer, Software Engineer, Network Administrator, Data Scientist, or AI/ML personnel.

The Learning Outcome-based Curriculum Framework in MSc Computer Science is aimed at allowing flexibility and innovation in design and development of course content, in method of imparting training, in teaching learning process and in assessment procedures of the learning outcomes. The emphasis in computer science courses, in outcome-based curriculum framework, help students learn solving problems, accomplishing IT tasks, and expressing creativity, both individually and collaboratively. The proposed framework will help Students learn programming techniques and the syntax of one or more programming languages.

Many of the learning outcomes of MSc Computer Science can be achieved only by programming a computer for several different meaningful purposes. All students must, therefore, have access to a computer with a modern programming language installed. The computer science framework does not prescribe a specific language. The teacher and students will decide which modern programming languages students will learn. More importantly, students will learn to adapt to changes in programming languages and learn new languages as they are developed.

The present Learning Outcome-based Curriculum Framework for MSc Computer Science is intended to facilitate the students to achieve the following.

1.To develop an understanding and knowledge of the basic theory of Computer Science and Information Technology with good foundation on theory, systems and applications such as algorithms, data structures, data handling, data communication and computation.

2.To develop the ability to use this knowledge to analyse new situations

3.To acquire necessary and state-of-the-art skills to take up industry challenges. The objectives and outcomes are carefully designed to suit to the above-mentioned purpose.

4.The ability to synthesize the acquired knowledge, understanding and experience for a better and improved comprehension of the real-life problems

5.To learn skills and tools like mathematics, statistics, physics and electronics to find the solution, interpret the results and make predictions for the future developments.

Curriculum Planning- Learning Outcomes-based Approach for MSc Computer Science

MSc Computer Science in India is generally a two-year degree program which develops advanced theoretical and research skills in subject . It is an appropriate course for students who wish to pursue Mphil(CS) or Doctor of Philosophy (PhD) in CS and a research or academic career. This program facilitates students who wish to pursue an independent research project in an area of interest under the supervision of an academic.

Aims of MSc Computer Science Programmes

The MSc Computer Science emphasizes problem solving in the context of algorithm development and software implementation and prepares students for effectively using modern computer systems in various applications. The curriculum provides required computer science courses such as programming languages, data structures, computer architecture and organization, algorithms, database systems, operating systems, and software engineering; as well as elective courses in artificial intelligence, computer-based communication networks, distributed computing, information security, graphics, human-computer interaction, multimedia, scientific computing, web technology, and other current topics in computer science. The main aim of this Bachelor's degree is to deliver a modern curriculum that will equip graduates with strong theoretical and practical backgrounds to enable them to excel in the workplace and to be lifelong learners. The purpose of the MSc Computer Science programs are twofold: (1) to prepare the student for a position involving the design, development and implementation of computer software/hardware, and (2) to prepare the student for entry into Research field.

MSc Computer Science focus on the concepts and techniques used in the design and development of software systems. Students in this program explore the conceptual underpinnings of Computer Science -- its fundamental algorithms, programming languages, operating systems, and software engineering techniques. In addition, students choose from a rich set of electives that includes data science, computer graphics, artificial intelligence, database systems, computer architecture, and computer networks, among other topics. A generous allotment of free electives allows students to combine study in computer science with study in auxiliary fields to formulate a program that combines experiences across disciplines.

Programme Learning Outcomes for MSc Computer Science

The MSc Computer Science program enables students to attain, by the time of completion :

PLO-A. Demonstrate the aptitude of Computer Programming and Computer based problem solving skills.

PLO-B. Display the knowledge of appropriate theory, practices and tools for the specification, design, implementation

PLO-C. Ability to learn and acquire knowledge through online courses available at different MOOC Providers.

PLO-D. Ability to link knowledge of Computer Science with other two chosen auxiliary disciplines of study.

PLO-E. Display ethical code of conduct in usage of Internet and Cyber systems.

PLO-F. Ability to pursue higher studies of specialization and to take up technical employment.

PLO-G. Ability to formulate, to model, to design solutions, procedure and to use software tools to solve real world problems and evaluate .

PLO-H. Ability to operate, manage, deploy, configure computer network, hardware, software operation of an organization.

PLO-I.Ability to present result using different presentation tools.

PLO-J. Ability to appreciate emerging technologies and tools.

PLO-K. Apply standard Software Engineering practices and strategies in real-time software project development

PLO-L. Design and develop computer programs/computer -based systems in the areas related to algorithms, networking, web design, cloud computing, IoT and data analytics.

PLO-M.Acquaint with the contemporary trends in industrial/research settings and thereby innovate novel solutions to existing problems

PLO-N. The ability to apply the knowledge and understanding noted above to the analysis of a given information handling problem.

PLO-O. The ability to work independently on a substantial software project and as an effective team member.

The Course of Study and the Scheme of Examinations

Year / Semester	Subject	Paper	Title of the Paper	Credit	Max. Marks		
					IA	Uni. Exam	Total
I Year I Semester	Core	MDS101	Design and Analysis of Algorithms	4	40	60	100
	Core	MDS102	Introduction to Data Science	4	40	60	100
	Core	MDS102	Database Systems & Implementation	4	40	60	100
	Core	MDS104	Probability & Statistics for Data Science	4	40	60	100
	Elective I	MDS105	A) Optimization Techniques (B) Object Oriented Programming using UML	4	40	60	100
	Core Practic	MDS106	Python for Data Science Lab	2		100	100
	Core Practic	MDS107	Database Lab	2		100	100
I Year II Semester	Core	MDS201	Computer Networks	4	40	60	100
	Core	MDS202	Computational Intelligence	4	40	60	100
	Core	MDS203	Operating System Design	4	40	60	100
	Core	MDS204	Theory of Computation	4	40	60	100
	Elective II	MDS205	(A)Introduction to Data Analytics (B) IoT (C) Data Mining	4	40	60	100
	Core Practic	MDS206	Computational Intelligence Lab	2		100	100
	Core Practic	MDS207	Operating Systems Lab	2		100	100
II Year III Semester	Core	MDS301	Artificial Intelligence	4	40	60	100
	Core	MDS302	Software Engineering	4	40	60	100
	Core	MDS303	Machine Learning(Specialization)	4	40	60	100
	Elective III	MDS304	(A) Cryptography & Cyber Security (B) Cloud Computing	4	40	60	100
	Elective IV	MDS305	(A)Distributed Systems (B) Natural Language Processing (C) Digital Marketing	4	40	60	100
	Core Practic	MDS306	R Programming Lab	2		100	100
	Core Practic	MDS307	Software Engineering Lab	2		100	100
II Year IV Semester		MDS401	Comprehensive Viva	4		100	100
		MDS402	Project Work and Viva Voce	12		300	300
			Total	**100**			**2500**

List of Electives *

1	Optimization Techniques
2	Object Oriented Programming using UML
	Introduction to Data Analytics
3	Data Mining
6	Cryptography & Cyber Security
7	Cloud Computing
8	Distributed System
9	Natural Language Processing
10	Digital Marketing

*Subject to availability of Faculty

MDS101-DESIGN AND ANALYSIS OF ALGORITMS

UNIT-I

Introduction:

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithm Efficiency – Analysis Framework – Asymptotic Notations and its properties – Mathematical analysis for Recursive and Non-recursive algorithms. Amortized Analysis

UNIT-II

Brute Force and Divide-and-Conquer:

Brute Force – Closest-Pair and Convex-Hull Problems-Exhaustive Search – Traveling Salesman Problem – Knapsack Problem – Assignment problem. Divide and conquer methodology – Merge sort – Heap Sort- Quick sort – Binary search – Multiplication of Large Integers – Strassen's Matrix Multiplication-Closest-Pair and Convex-Hull Problems.

UNIT-III

Dynamic Programming and Greedy Techniques:

Computing a Binomial Coefficient – Warshall's and Floyd's algorithm – Optimal Binary Search Trees – Knapsack Problem and Memory functions. Greedy Technique– Prim's algorithm- Kruskal's Algorithm- Dijkstra's Algorithm-Huffman Trees.

UNIT- IV

Iterative Improvements:

The Simplex Method-The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs- the Stable Marriage Problem.

UNIT- V

Coping with the Limitations of Algorithm Power:

Limitations of Algorithm Power-Lower-Bound Arguments-Decision Trees-P, NP and NPComplete Problems–Coping with the Limitations – Backtracking – n-Queens problem – Hamiltonian Circuit Problem – Subset Sum Problem-Branch and Bound – Assignment problem – Knapsack Problem – Traveling Salesman Problem- Approximation Algorithms for NP – Hard Problems – Traveling Salesman problem – Knapsack problem.

Text Books:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.
2. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.

Reference books:

1. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
2. Donald E. Knuth, "The Art of Computer Programming", Volumes 1& 3 Pearson Education, 2009. Steven S. Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2008

3. http://nptel.ac.in/

MDS102- INTRODUCTION TO DATA SCIENCE

Unit-I

Introduction to Data Science

Foundation of Data science, Area and Scope of Data Science, Steps of Data Science Process: Data collection, Pre-processing, training, and testing. Use cases in various domain such Image, Natural Language, Audio and Video.

Unit-II

Introduction to Artificial Intelligence

Introduction Artificial Intelligence, The Foundations of AI, AI Technique, Production system characteristics, Production systems: 8-puzzle problem. Searching: Uniformed search strategies – Breadth first search, depth first search.

Unit-III

Searching Algorithms and Learning

Local Search Algorithms: Generate and Test, Hill climbing, simulated annealing search, Constraint satisfaction problems, Greedy best first search, A* search, AO* search.
Self-Learning: Propositional logic - syntax & semantics Game Playing: Overview, Minimax algorithm, Alpha-Beta pruning, Additional Refinements.

Unit-IV

Introduction to Data Mining and Machine Learning (15 L)

Introduction to Data Mining and Machine Learning, Supervised, Unsupervised and Reinforcement learning. Prediction vs Classification v/s Clustering. Association Rule Mining, classification and regression techniques, clustering, Scalability and data management issues in data mining algorithms, measures of interestingness

Recommended Books:

1. Rachel Schutt, Cathy O'Neil, "Doing Data Science: Straight Talk from the Frontiline" by Schroff/O'Reilly.
2. S. Russell and P. Norvig, Artificial Intelligence A Modern Approach, 2nd Edition. Pearson Ed., 2007.
3. John W. Foreman, "Data Smart: Using data Science to Transform Information into Insight" by John Wiley & Sons.
4. Ian Ayres, "Super Crunchers: Why Thinking-by-Numbers Is the New Way to Be Smart" , 2007.
5. Eric Seigel, "Predictive Analytics: The Power to Predict who Will Click, Buy, Lie, or Die", Wiley, 2013.
6. Matthew A. Russel, "Mining the Social Web: Data mining Facebook, Twitter, Linkedln,Goole

MDS103- DATABASE SYSTEMS & IMPLEMENTATION

UNIT-I

Database System : Database System Applications, Database Systems versus File Systems, View of Data & Data Models, Database Languages, Database Users and Administrators, Transaction Management, Database System Structure, Application Architecture. Entity-Relationship Model : Basic Concepts & Constraints, Keys, Design Issues, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R Features, Design of E-R Database Schema, Reduction of an E-R Schema to Tables, Overview of Relational Model and Relational Database Design.

UNIT-II

SQL : Basic Structure, Set Operations, Aggregate Functions, Null Values, Nested Sub-queries, Views, Complex Queries, Modification of the Database, Joined Relations, Data-Definition Language, Embedded SQL. Dynamic SQL. Integrity and Security: Domain Constraints, Referential Integrity, Assertions, Triggers, Security and Authorization, Authorization in SQL, Encryption and Authentication.

UNIT-III

Query Processing: Measures of Query Cost, Selection Operation, Sorting, Join and other Operations, Evaluation of Expressions. Query Optimization: Estimating Statistics of Expression Results, Transformation of Relational Expressions, Choice of Evaluation Plans, Materialized Views.

UNIT-IV

Object-Oriented Databases: Complex Data Types, Object-Oriented Data Model, Object-Oriented Languages, Persistent Programming Languages, Persistent C++ Systems, Persistent Java Systems. Object-Relational Databases: Nested Relations, Complex Types, Inheritance, Reference Types, Querying with Complex Types, Functions and Procedures, Object-Oriented Vs Object-Relational.

UNIT-V

Transactions: Transaction, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Transaction Definition in SQL, Testing for Serializability. Concurrency Control: Lock-Based, Timestamp-Based, Validation-Based Protocols Multiple Granularity, Multiversion Schemes, Deadlock Handling, Insert and Delete Operations, Weak Levels of Consistency, Concurrency in Index Structures. Recovery System : Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Shadow Paging, Recovery with Concurrent Transactions, Buffer Management, Failure with Loss of Nonvolatile Storage, Advanced Recovery Techniques, Remote Backup Systems.

Text Book:

Silbcrschatz. A,. Korth, H.F., and Sudarshan.S. : Database System Concepts 4/ed.

(McGraw-Hill Int.)

MDS104- PROBABILITY & STATISTICS FOR DATA SCIENCE

Unit-I

Introduction: Probability and Probability Distribution: Events and the Sample Space,Calculating Probabilities using Simple events, Useful counting rules, Probability rules: Addition rule, Conditional probability and multiplication rule, Bayes' rule.

Unit-II

Probability Distributions: Random Variable, Discrete random variable, Mean and Standard deviation of discrete random variable, Discrete Probability Distributions:Binomial, Poisson and Hypergeometric probability distribution, Continuous Probability distribution: Normal distribution.

Unit-III

Sampling Distribution: sampling plans and experimental designs, Sampling distribution of a statistic, Central Limit theorem, Sampling distribution of the Sample mean and Proportion.Large Sample Estimation: Point estimation, Interval estimation, Confidence interval of population mean, Population proportion, difference between two population means, difference between two population proportions.

Unit-IV

Large Sample Tests of Hypothesis: Test of a Population mean, Test of difference of two population means, Test of hypothesis for a binomial proportion, Test of hypothesis for the difference between two binomial proportions.

Unit-V

Inference from Small Samples: Student's t Distribution, Small Sample inferencesconcerning a population mean and difference between two population means,Inferences concerning a population variance and difference between two population variances.

Recommended Books:

Recommended Books:
1. William Mendenhall, Robert J. Beaver, Barbara M. Beaver, "Probability and Statistics" 14/e, CENGAGE Learning.
2. W. W. Hines, D.C. Montgomery, D.M. Goldsman, & C.M. Borror, "Probability & Statistics in Engineering"
3. Probability & statistics,A.K.P.C Swain

MDS105A- OPTIMIZATION TECHNIQUES

UNIT-I

Basics of idea of optimization of a function: Extremizer of function of single variable, and several variables, local minimizer and global minimizer of functions. Concept of critical points. feasible regions, convex region. Constrained optimization, unconstrained optimization. Introduction to linear programming problem(lpp). Formulation of lpp. Basic feasible solution of set of linear constraints. Determination feasible solutions of lpp with two variables by graphical method, use of iso-profit line. Different forms of lpp, standard form and canonical form.

UNIT-II

Solution of linear programming problem : Solution of lpp by simplex method, use of artificial variable in solving lpp. Identifying initial basic feasible solution, solution of lpp by Big-M method, and by two phase method. Duality in lpp , general rule for converting primal lpp to its dual. Dual simplex method is solving special types of lpp. Duality theorems (discussions on statements only), duality techniques in solving lpp.

UNIT-III

Special types of lpp : Introduction to transportation problem(TP) as an lpp. Solution of transportation problem: searching initial basic feasible solution of transportation problem by Vogel's method, test for optimality in TP, improving feasible solution for optimality, optimal solution of TP by MODI method. Degeneracy in TP. Introduction to assignment problem as special type of TP, solution of assignment problem by Konig's algorithm. Special type of assignment problem prohibited assignment and traveling sales man problem.

UNIT-IV

Network Scheduling Problem: Introduction to network scheduling problem, Network and basic components, rules of network construction. Network scheduling by Critical Path Method (CPM) and Program Evaluation and Review method, distinction between CPM and PERT method.

UNIT-V

Non Linear Programming : One dimensional optimization, unimodal functions and its minimizer, optimization of unimodular functions by function comparison methods-two point equal search method, bisection method, golden section method; polynomial interpolation methods- quadratic interpretation, cubic interpretation; iterative methods- Newton's method, secant method. Unconstrained gradient based optimizations; method of steepest descent method, conjugate gradient method, Newton type method. Constrained optimization of non linear functions in function of several variables- Lagrange multipliers method, optimization by using Khun-Tucker conditions.

Recommended Books:

1.Operations Research, K. Swarup, P. K. Gupta, M. Mohan, Sultan Chand & sons, New Delhi, 1990.
2. Optimization : Theory and Practice, M. C. Joshi, K. M. Moudgalya, Narosa Publishing House.
3.Optimization Techniques: An Introduction,L. R. Foulds,Springer-Verlag.
4. Optimization Techniques,Chander Mohan and Kusum Deep,New Age Science.
5. Operation Research : An Introduction, H. A Taha, Mc Millan Publishing Co, New York, 1986.

MDS105B- OBJECT ORIENTED DESIGN USING UML

UNIT-I

Complexity: The inherent complexity of software – The Structure of complex systems – Bringing order to chaos – On designing complex systems. – Categories of analysis and design methods. The Object Model : The evolution of object model – Elements of object model – Applying the object model – Foundations of the object model. Classes and Objects : The nature of an object – Relationship among objects – The nature of a class – Relationship among classes

UNIT-II

Structural Modeling: Introduction to UML – Software development life cycle -RUP–Inception , Elaboration, Construction and Implementation-Classes – Relationships – Interfaces, Types and roles – Packages – Instances – Class diagram – Object diagram.

UNIT-III

Behavioral Modeling: Use cases – Use case diagram – Interaction diagram – Activity diagrams – Events and signals – State machines - Processes and Threads – State chart Diagrams.

UNIT-IV

Architectural Modeling: Components – Component Diagram - Deployment – Deployment Diagrams – Patterns and Frameworks - Systems and Models.

UNIT-V

Distributed objects communication between distributed objects-Distributed object model-Case Study: ATM, Library Information System, Payroll system, Student Information System, Railway Reservation System.

Text Book(s)

1. Grady Booch, “Object –Oriented analysis and Design with Applications”, Pearson Education.
2. Grady Booch, James Rumbaugh and Ivar Jacobson, “The Unified Modeling Languages User Guide”, Pearson Education.
3. H Srinath, H Eriram, A Krishnamurthy by Scitech “OOAD using UML”

References

1. Ali Bahrami, “Object Oriented Systems Development” Irwin-McGraw Hill, New Delhi, International editions, 1999.
2. Martin Fowler, Kendall Scott, “UML Distilled-Applying the standard Object Modeling Language”, Addition Wesley 1977.
4. UML in a Nut Shell by Alhir SPD Orilley

MDS105C- BUSINESS DATA ANALYSIS

MDS201- COMPUTER NETWORKS

UNIT-I

Encoding & Modulation: Digital-To-Digital, Analog-to-Digital, Digital-to-Analog and Analog-t-Analog Conversions. Transmission of Digital Data, Interfaces and Modems: Digital Data Transmission, DTE-DCE Interface Standards, Modems, 56K Modem, Cable Modem. Multiplexing: Frequency Division, Wave Division and Time Division Multiplexing, Multiplexing in the Telephone System, Digital Subscriber Line (DSL), FTTC.

UNIT-II

Data Link Control: Line Discipline, Flow Control, Error Control. Data Link Protocols: Asynchronous Protocols, Character-Oriented Protocols, Bit-Oriented Protocols, Link Access Procedures. Local Area Networks: Project 802, Ethernet, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, Token Bus, Token Ring, Fiber Distributed Data Interface (FDDI).

UNIT-III

Metropolitan Area Networks: IEEE 802.6 (DQDB), Switched, Multimegabit Data Services (SMDS). Switching: Circuit Switching, Packet switching, Message Switching. Point-To-Point Protocol: Transition States, PPP Layers, Link Control Protocol (LCP), Authentication, Network Control Protocol (NCP).

UNIT-IV

Integrated Services Digital Network: Services, Scribers Access to the ISDN, ISDN layers, Broad Band ISDN. X.25 : X.25 Layers. Frame Relay: Frame Relay Operation, Frame Relay Layers, Congestion Control, Leaky Bucket Algorithm, Traffic Control.

UNIT-V

ATM: ATM Architecture, Switching, Switch Fabrics, ATM Layers, Service Classes, ATM Applications. SONET: Synchronous Transport Signals, Physical Configuration, SONET Layers, SONET Frame, Multiplexing STS Frames, Applications. Networking & Internetworking Devices: Repeaters, Bridges, Routers, Gateways, Routing Algorithms (Distance Vector & Link State Routing).

Text Book :

1. Forouzan, B. A.: Data Communications and Networking, 2/Ed (TMH)

Reference Books :

1. Tanenbaum, A. S.: Computer Networks, 4/Ed (PHI)

MDS202- COMPUTATIONAL INTELLIGENCE

Learning Objectives:

- To provide a strong foundation on fundamental concepts in Computational Intelligence.
- To enable Problem-solving through various searching techniques.
- To apply these techniques in applications which involve perception, reasoning and learning.
- To apply Computational Intelligence techniques for information retrieval
- To apply Computational Intelligence techniques primarily for machine learning.

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

- Provide a basic exposition to the goals and methods of Computational Intelligence.
- Study of the design of intelligent computational techniques.
- Apply the Intelligent techniques for problem solving
- Improve problem solving skills using the acquired knowledge in the areas of, reasoning, natural language understanding, automatic programming and machine learning.

Unit-I

Artificial Neural Network(ANN) : Difference between Artificial and Biological Neuron, Models of an artificial Neuron, Neural Network Architecture, Terminologies of ANN, Hebb Network, Learning methods

Unit-II

Supervised Learning Networks: Single Layer Perceptron model, Multi Layer Perceptron Model, Architecture and study of Back Propagation Networks(BPN) , Effect of Tunning the parameters of the Back propagation, Adaline, Multiple Adaline

Associative memory: Auto, hetero and linear associative memory networks, Applications of ANN

Unit-III

Fuzzy set theory: crisp sets, fuzzy sets, crisp relations, fuzzy relations,

Fuzzy Systems: Crisp logic predicate logic, fuzzy logic, fuzzy Rule based system, Defuzzification Methods, Fuzzy rule based reasoning, Applications of Fuzzy Logic in Real life Problems.

Unit-IV

Fundamentals of genetic algorithms: Encoding, Fitness functions, Reproduction.

Genetic Modeling : Cross cover, Inversion and deletion, Mutation operator, Bit-wise operators, Applications of Genetic Algorithms in Real life Problems.

Unit-V

Tools and Frameworks : Scikit-learn, Weka, Octave, Python or R-stuido

Recommended Books:

1. Principles of Soft Computing- S.N.Sivanandan and S.N.Deepa, Wiley India, 2 nd
2. Edition,2011S.Rajasekaran, G.A. Vijayalakshmi Pai, PHI
3. Neuro Fuzzy and Soft Computing, J. S. R. JANG,C.T. Sun, E. Mitzutani, PHI
4. Neural Networks, Fuzzy Logic, and Genetic Algorithm (synthesis and Application)

MDS203- OPERATING SYSTEM DESIGN

UNIT- I

Operating System, Computer-System Organization, Computer-System Architecture, Operating-System Structure, Operating-System Operations, Process Management, Memory Management, Storage Management, Protection and Security, Distributed Systems, Special Purpose Systems, Computing Environments, Open-Source Operating Systems. Operating System Services, User Operating System Interface, System Calls, Types of System Calls, System Programs, Operating-System Design and Implementation, Operating System Structure, Virtual Machines, Operating System Debugging, Operating System Generations. System Boot.

UNIT- II

Process: Process Concept, Process Scheduling, Operations on Processes, Inter-Process Communication, Examples of IPC Systems, Communication in Client-Server Systems. Multithreaded Programming: Multithreading Models, Thread Libraries, Threading Issues, Operating-System Examples.

UNIT- III

Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling. Multiple-Process Scheduling. Synchronization: The Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Monitors, Synchronization Examples, Atomic Transactions.

UNIT- IV

Deadlocks: System Model, Deadlock Characterization, Methods of Handling Deadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock Detection, Recovery from Deadlock. Memory Management Strategies: Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation, Example: The Intel Pentium.

UNIT- V

Virtual-Memory Management: Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory. File System: File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing, Protection.

TEXT BOOK:

Operating System Concepts**:** Silberschatz, Galvin, Gagne, 8/e (Wiley-India)

MDS204- THEORY OF COMPUTATION

UNIT I: - Regular Languages & Finite Automata:

Deterministic Finite Automata, Non-deterministic Finite Automata, Equivalence of NFA, and DFA. Regular Expressions & Languages, Conversion of DFAs to Regular Expressions, and vice versa. Properties of Regular Languages: Pumping Lemma, Closure properties: Union, Intersection, Complement, Difference, Reversal, Homomorphism, and Inverse Homomorphism. Decision Problems for Regular Languages, DFA Minimization.

UNIT II: - Context Free languages & Pushdown Automata

Context Free Languages, Context Free Grammars, Derivation, Ambiguity, Parsing. Pushdown Automata: Definition of PDAs, Acceptance of PDAs by final state and by empty stack. Conversion of CFG to PDA and vice versa. DPDAs & DCFLs, Determinism & Parsing. Simplification of CFG's, Chomsky Normal Form. The Pumping Lemma for CFL's. Closure properties: union, concatenation, *, +, Homomorphisms, and Reversal. Nonclosure under reversal and complementation. Decision Problems for CFLs, CYK Algorithm, Undecidable Problems for CFLs.

UNIT III: - Turing Machines

TM Definition and Notation; Instantaneous Descriptions, NTM & DTM, Programming tricks for TMs, Examples involving TM Computations, Extensions & Restrictions to Basic TM Model, (Multi Tape, Multi Dimensional, Counter machine, Two Stack PDAs).

UNIT IV: - Decidability Theory

The Church-Turing Thesis, Universal Turing Machines and TM Encoding. Decidable and semi-decidable languages, Recursive Enumeration and Decidability, Many-one Reductions, Hardness, Undecidability, Closure Properties. The Diagonalization Language, The Halting Problem, Post's Correspondence Problem, Undecidable Problems from Language Theory, Rice's Theorem. Linear Bounded Automata (LBA).

UNIT V: - Complexity Theory

Measuring Complexity, The Big **Oh**, **Theta, Big Omega** Notations, Time Complexity classes: P, NP, NP-Completeness, Coping with NP-Completeness. Cook-Levin's Theorem, Some NP-Complete Problems: SAT, 3-SAT, Hamiltonian Path, Vertex Cover, Independent Set. Space Complexity classes: PSPACE, L, NL.

Text Book: Introduction to Automata Theory, Language & Computation- Hopcroft, Motwani & Ullman

MDS205A- INTRODUCTION TO DATA ANALYTICS

UNIT-I

Introduction: Definition of data mining - data mining vs query tools - machine learning -taxonomy of data mining tasks - steps in data mining process - overview of data mining techniques.

UNIT-II

Data Pre-Processing And Characterization: Data Cleaning - Data Integration and Transformation - Data Reduction - Discretization and Concept Hierarchy Generation - Primitives - Data Mining-Query Language - Generalization - Summarization - Analytical Characterization and Comparison

UNIT-III

Association Rule - Mining: Market basket analysis, frequent Itemset generations, The Apriori principle, Candidate Itemset generation and Pruning, Support counting using Hash tree, Multi Dimensional data from Transactional Database and Relational Database. FP-Growth Algorithm, objective measures of Interestingness

UNIT-IV

Classification: Classification - Decision Tree Induction - Bayesian Classification - Back Propagation, Lazy learners, K-Nearest Neighbour, Rule based classification, Accuracy, Prediction-Linear regression, Non-linear regression models

UNIT-V

Cluster analysis: Types of data, Distance measures, Evaluation criteria measures, Clustering Methods - Partitioning methods, K-Means, Density based method- DBSCAN, Model based clustering methods – Expectation-maximization, outlier analysis.

Text Books

1. Jiawei Han, Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufman Publishers, 2006.

Reference Books

1. Usama M.Fayyad, Gregory Piatetsky Shapiro, Padhrai Smyth, Ramasamy Uthurusamy, Advances in Knowledge Discover and Data Mining, The M.I.T.Press, 2007.
2. Ralph Kimball, Margy Ross, The Data Warehouse Toolkit, John Wiley and Sons Inc., 2002.
3. Alex Berson, Stephen Smith, Kurt Thearling, Building Data Mining Applications for CRM, Tata McGraw Hill, 2000.
4. Margaret Dunham, Data Mining: Introductory and Advanced Topics, Prentice Hall, 2002.
5. Daniel T. Larose John Wiley & Sons, Hoboken, Discovering Knowledge in Data: An Introduction to Data Mining, New Jersey, 2004.
6. M.Panda, S.Dehuri and M.R.Patra, Modern Approaches of Data Mining: Concepts and techniques, Narosa Publications, 2016

MDS205B- INTERNET OF THINGS

Unit-I

Introduction- M2M :

M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics.

M2M to IoT :

A Market Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Unit-II

M2M and IoT Technology Fundamentals :

Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management.

Unit-III

IoT Architecture:

State of the Art – Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model

Unit-IV

IoT Reference Architecture :

Introduction, Functional View, Information View, Deployment
and Operational View, Other Relevant architectural views. Real-World Design Constraints Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control. Industrial Automation- Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, Commercial Building,

Unit-V

Automation- Introduction. :

Case study: phase one-commercial building automation today,
Case study: phase two- commercial building automation in the future.

Recommended Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014.
2. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-onApproach)”, 1stEdition, VPT, 2014.
3. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013

MDS205C- DATA MINING

Unit-I

1. Data Mining : Introduction, Techniques, Issues and challenges, applications, Data preprocessing, Knowledge representation

2.Association Rule Mining : Introduction, Methods to discover association rules, Association rules with item constraints

Unit-II

3. Decision Trees : Introduction, Tree construction principle, Decision tree construction algorithm, pruning techniques, Integration of pruning and construction;

4. Cluster analysis : Introduction, clustering paradigms, Similarity and distance, Density, Characteristics of clustering algorithms, Center based clustering techniques, Hierarchical clustering, Density based clustering, Other clustering techniques, Scalable clustering algorithms, Cluster evaluation.

Unit-III

5. Rough set theory :, use of rough set theory for classification & feature selection.

6. ROC Curves: Introduction, ROC Space, Curves, Efficient generation of Curves, Area under ROC Curve, Averaging ROC curves, Applications.

Unit-IV

7. Advanced techniques : Web mining - Introduction, Web content mining, Web structure mining, Web usage mining; Text mining- Unstructured text, Episode rule discovery from text, Text clustering; Temporal data mining – Temporal association rules, Sequence mining, Episode discovery, time series analysis; Spatial data mining – Spatial mining tasks, Spatial clustering, Spatial trends

Recommended Books:

1. Data Mining Techniques: A.K. Pujari, Universities Press, 2001

2. Mastering Data Mining: M. Berry and G. Linoff, John Wiley & Sons., 2000

MDS301- ARTIFICIAL INTELLIGENCE

UNIT-I

Introduction to AI: History of AI, State of the Art Intelligent Agents,
Problem Solving by Searching: BFS, Uniform Cost Search, DFS, IDS, Bi-directional Search, Constraint Satisfactory Search, Informed Search Best First Search, Heuristic Function, Memory bounded search, A* and IDA*,
Game Playing: Min-Max search and Alpha-Beta pruning.

UNIT-II

Knowledge & Reasoning: Agents that reason logically, First Order Logic, Syntax and Semantics. Inference in First Order Logic: Inference Rules, Modus Ponems, Unification, Forward and Backward Reasoning,
Resolutions Planning: A simple Planning Agent, from Problem Solving to Planning, Planning in Situation Calculus.

UNIT-III

Learning: Learning from Observations. A General Model of Learning Agents, Inductive Learning; Expert Systems, Robotics.
Introduction to Machine Learning: Statistical Technique, Artificial Neural Network, Hidden Markov Model.

UNIT-IV

Introduction to Pattern Recognition: Recognition & Classification Process, learning, Classification Patterns, Visual Image Understanding, Image Transformation; Perception: Image Formation, Image Processing Operations for easy Vision, Speech, Recognition.
Introduction to Robotics: Parts of a Robot.

UNIT-V

Dealing with Uncertainty and Inconsistencies in Big Data: Truth Maintenance System, Default Reasoning, Probabilistic Reasoning, Bayesian Probabilistic Inference, Possible World Representations.
Understanding Natural Languages: Syntactic Processing, Semantic Analysis, Parsing Techniques, Efficient Parsing, Context-Free and Transformational Grammars, Recursive and Augmented Transition Nets.

Text Book:

Stuart Russel &, Peter Norvig: Artificial Intelligence A Modern Approach (Person Education Asia.) 3rd edition.

MDS302- SOFTWARE ENGINEERING

UNIT-I

Computer-Based System Engineering: Emergent System Properties, Systems and their Environment, System Modeling, System Engineering Process, System Procurement. Software Processes: Software Process Models, Process Iteration, Software Specification, Design and Implementation, Software Validation and Evaluation, Automated Process Support. Project Management: Management Activities, Project Planning, Project Scheduling, Risk Management.

UNIT-II

Software Requirements: Functional and Non-Functional Requirements, User Requirements, System Requirements, Software Requirements Document. Requirements Engineering Processes: Feasibility Studies, Requirements Elicitation and Analysis, Requirements Validation, Requirements Management. System Models: Context Models, Behavioral Models, Data Models, Object Models, CASE Workbenches.

UNIT-III

Architectural Design: System Structuring, Control Models, Modular Decomposition, Cohesion and Coupling, Data Flow-oriented design. Distributed System Architectures: Multiprocessor Architectures, Client-Server Architectures, Distributed Object Architectures, CORBA. Object-Oriented design. Real-Time Software Design: System Design, Real-Time Executives, Monitoring and Control Systems, Data Acquisition Systems. Design with Reuse: Component-Based Development, Application Families, Design Patterns.

UNIT-IV

Verification and Validation: Verification and Validation Planning, Software Inspections, Automated Static Analysis, Clean-room Software Development. Software Testing: Defect Testing, Integration Testing, Object-Oriented Testing, Testing Workbenches. Software Cost Estimation: Productivity, Estimation Techniques, Algorithmic Cost Modeling, Project Duration and Staffing.

UNIT-V

Dependability: Critical Systems, Availability and Reliability, Safety, Security. Critical Systems Specifications: Software Reliability Specification, Safety Specification, Security Specification. Critical Systems Development: Fault Minimization, Fault Tolerance, Fault Tolerance Architectures, Safe System Design.

Text Book:

Sommerville, I: Software Engineering, 6/e

Reference Book

1. Pressman, R. S: Software Engineering, 4/e (McGRAW-HILL)
2. Aggarwal, K. K. & Singh, Y: Software Engineering (New Age International)

MDS303- MACHINE LEARNING

Unit-I

Linear Regression : Prediction using Linear Regression, Gradient Descent, Linear Regression with one variable, Linear Regression with multiple variables, Polynomial Regression, Feature Scaling/Selection.
Logistic Regression : Classification using Logistic Regression, Logistic Regression vs. Linear Regression, Logistic Regression with one variable and with multiple variables.

Unit-II

Regularization : Regularization and its utility: The problem of Overfitting, Application of Regularization in Linear and Logistic Regression, Regularization and Bias/Variance.

Unit-III

Neural Networks : Introduction, Model Representation, Gradient Descent vs. Perceptron Training, Stochastic Gradient Descent, Multilayer Perceptrons, Multiclass Representation,Backpropagation Algorithm.

Unit-IV

Deep Learning :

History, Scope and specification, why deep learning now, building block of neural network, neural networks, Deep learning hardware. Feedforward neural networks, xor model, cost function estimation (maximum likelihood), units, activation functions, layers, , normalization, hyper-parameter tuning, Convolution neural networks, architecture, recurrent neural networks, architecture, types and overview, GAN (Generative Adversarial Networks).

Unit-V

Deep learning applications :

Computer vision, sentiment analysis, music generation, text generation, neural style transfer, image captioning

Recommended Books:

1. EthemAlpaydin, "Introduction to Machine Learning" 2nd Edition, The MIT Press, 2009.
2. Tom M. Mitchell, "Machine Learning", First Edition by Tata McGraw-Hill Education, 2013.
3. Christopher M. Bishop, "Pattern Recognition and Machine Learning" by Springer, 2007.
4. Mevin P. Murphy, "Machine Learning: A Probabilistic Perspective" by The MIT Press, 2012.

MDS304A- CRYPTOGRAPHY AND CYBER SECURITY

UNIT–I

Overview of cryptography, substitution and affine cipher and their cryptanalysis, Perfect Security, Block cipher, Data Encryption Standard(DES), Differential and linear Cryptanalysis, Block Cipher Design Principles, Block Cipher modes of operation, Advanced Encryption Standard.

UNIT–II

Principles of Public- key Cryptosystems, The RSA Algorithm, Key Management, Diffie-Hellman Key Exchange, Authentication Functions, Message Authentication codes(MAC), Hash Functions, Security of Hash Functions and MAC, Secure Hash Algorithm, HMAC.

UNIT–III

Discrete Logarithms, ElGamal Cryptosystem, Algorithm for Discrete Logaritlun Problem, security of EIGamal System, Schnorr signature scheme, Baby step-Gaint step, Chinese reminder, The ElGamal signature scheme, The digital signature algorithm, Provable secure signature schemes.

UNIT–IV

Elliptic curve over the reals, Elliptic curves modulo a prime, Properties of Elliptic curves Point compression, Computing point multiples on Elliptic curves, Elliptic curve digital signature algorithm, Elliptic curve factorization, Elliptic curve primality test.

UNIT–V

Network Security Practice: Kerberos, X.509 Authentication Service, Public Key Infrastructure. E-Mail Security (Pretty Good Privacy), IP Security (Architecture, Authentication Header, Encapsulating Security Payload, Combining Security, Associations, Key Management), Web Security (Secure Sockets Layer and Transport Layer Security).

Text Books:

1. W.Sta1lings- Cryptography and Network Security Principles and Practice, Person Education Asia, 2000. (3rd Edition) Chapters: [1,3, 5 , 9, 10(10.1,10.2), II, 12(12.2,12.4), 13(13.3), 14,15,16,17].

2. D.Stinsori, Cryptography: Theory and Practice, CRC press, 2006. Chapters: [1,2(2.3),6,7,12].

References:

1. A. Menezes, P. Van Oorsch, S. Vanstans- Handbook of Applied Cryptography, CRC press,1997. '

2. B. Schmeier- Applied Cryptography, New York, Wiley, 1996.

3. N.Koblitz: a course in number theory and cryptography, Springer verlag.

MDS304B- CLOUD COMPUTING

Unit-I

Overview of Computing Paradigm: Recent trends in Computing : Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing. Introduction to Cloud Computing: Introduction to Cloud Computing,History of Cloud Computing, Cloud service providers, Benefits and limitations of Cloud Computing.

Unit-II

Cloud Computing Architecture: Comparison with traditional computing architecture (client/server), Services provided at various levels, Service Models-Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), How Cloud Computing Works, Deployment , Models-Public cloud, Private cloud, Hybrid cloud, Community cloud, Case study of NIST architecture.

Unit-III

Case Studies: Case Study of Service, Model using Google App Engine Microsoft Azure, Amazon EC2.

Service Management in Cloud Computing: Service Level Agreements (SLAs),Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud,Economics of Scaling.

Unit-IV

Cloud Security: Infrastructure Security- Network level security, Host level security, Application level security, Data security and Storage- Data privacy and security Issues, Jurisdictional issues raised by Data location, Authentication in Cloud Computing.

Recommended Books:

1. Barrie Sosinsky, “Cloud Computing Bible”, Wiley-India, 2010
2. Rajkumar Buyya, James Broberg, Andrzej, M. Goscinski, “Cloud Computing Principles & Paradigms”, Wiley-2011.
3. Cloud computing for dummies,wiley publication

MDS305A- MOBILE COMPUTING

UNIT-I

Personal Communications Services (PCS) Architecture, Cellular Telephony, Cordless Telephony and Low-Tier PCS, Third-Generation Wireless Systems. Wireless Transmission: Transmission concepts, Signal Propagation. Multiplexing Techniques: Space Division Multiplexing (SDM), Time Division Multiplexing (TDM), Frequency Division Multiplexing (FDM), Code Division Multiplexing (CDM), Modulation, Spread spectrum techniques, Cellular System. Medium Access Control (MAC): Issues relating to MAC, SDMA, FDMA, TDMA, CDMA.

UNIT-II

Mobility Management: Handoff, Roaming Management for SS7 and CT2. Handoff Management: Mobility detection, Channel Assignment, Hard Handoff and Soft Handoff for Radio Link Transfer. Switching: Circuit Switched Data Services on Cellular Networks, Packet Switched Data Services on Cellular Networks. Addressing Mobile quality of service, Access point control protocol.

UNIT-III

Global System for Mobile Communication (GSM): GSM Architecture, Location Tracking and Call Setup, Data Services, Protocol Model, Mobility Management, Short Message Service (SMS), Roaming Facility and Security. Analog Mobile Phone Service (AMPS): IS-136 North American TDMA Standard, IS-95: The North American CDMA Digital Cellular Standard. General Packet Radio Service (GPRS): GPRS Architecture, GPRS Network, Interfaces and Procedures.

UNIT-IV

Third Generation Mobile Services (3G): IMT-2000, W-CDMA, CDMA-2000, Quality of Service (QoS) in 3G, Wireless Operating System for 3G Handset. Wireless LAN: Infrastructure and Ad hoc networks, IEEE 802.11, Hiperlan, Blue tooth. Mobile Multimedia (MM): Wireless ATM (WATM), WATM services, Reference model

UNIT-V

Mobile Network Layer: Mobile IP, Dynamic Host Configuration Protocol (DHCP), Ad hoc Networks. Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Security features. Wireless Application Protocol (WAP): WAP Model and Architecture, WAP Gateway, WAP Protocols, Wireless Markup Language (WML). Wireless Local Loop (WLL): WLL Architecture, WLL Technologies, and WLL Products.

TEXT BOOKS:

1. Yi-Bing Lin and Imrich Chlamtac, “Wireless and Mobile Network Architectures”, 2001, John Wiley and Sons.
2. Jochen Schiller, “Mobile Communication”, 2000, Pearson Education Asia.

REFERENCE:

1. Raj Pandya, “Mobile and Personal Communication Systems and Services”, 2001, Prentice Hall of India.
3. C.Y. William Lee, “Mobile Cellular Telecommunications: Analog and Digital System”, 2nd Edition, 1997, MC Graw Hill.

MDS305B- NATURAL LANGUAGE PROCESSING

UNIT-I
Stages of NLP and ambiguity problem, Words and Transducers (FSA and FST for Morphological Parsing), Applications such as NLP tasks in syntax, semantics and pragmatics; Applications such as information extraction, question answering, and machine translation. The problem of ambiguity. The role of Machine Learning

UNIT-II
POS-tagging, POS-tagging perspective, POS tagging and HMM, Hidden Markov models (Forward and Viterbi algorithm and EM training), POS-tag set, Machine translation, Parsing algorithms, Probabilistic parsing, Parser Comparison

UNIT-III
Grammar, constituency and dependency, CYK algorithm, Parse tree construction, Semantics, Word sense disambiguation

UNIT-IV
Knowledge based and supervised WSD, Unsupervised EM based WSD, Multilingual Resource constrained WSD

UNIT-V
Linear and logistic Regression, Dimensionality Reduction, PCA
Machine translation, Statistical Machine translation, Binding Theory and Merger, X-bar theory

TEXT BOOKS:

1. Stuart Russel &, Peter Norvig: Artificial Intelligence A Modern Approach (Person Education Asia.)
2. Dan Jurafsky and James H. Martin, Speech and Language Processing, (Pearson Education Asia) 3rd Edition.

MDS305C- DIGITAL MARKETING

Eligibility for admission to M. Sc. Data Science :

1. B. Sc. Data Science/B.Sc(Hons) Data Science
2. B. Sc. Computer Science/B.Sc(Hons) Computer Science
3. B. Sc. ITM with Mathematics at +2 level,
4. BCA with Mathematics at +2 level
5. Btech(CSE)/Btech(IT)
6. Bsc(Hons) Data Science

With 50% marks

Examinations: As per University norms for M. Sc. Courses.