ಮಂಗಳೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ

MANGALORE UNIVERSITY

(Accredited by NAAC Grade)

ಕ್ರಮಾಂಕ/No. : MU/ACC/CR.20/2025-26/A2

ಕುಲಸಚಿವರಕಛೇರಿ
ಮಂಗಳಗಂಗೋತ್ರಿ – 574 199
Office of the Registrar
Mangalagangothri – 574 199
ದಿನಾಂಕ/Date:31.07.2025

NOTIFICATION

Sub: Revised syllabus of M.Sc. in Computer Science Programme.

Ref: Academic Council approval vide agenda No.:ಎಸಿಸಿ:ಶೈ.ಮ.ಸಾ.ಸ.1:1 (2025-26) dtd 18.07.2025.

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The revised syllabus of M.Sc. in Computer Science programme which has been approved by the Academic Council at its meeting held on 18.07.2025 is hereby notified for implementation with effect from the academic year 2025-26 and onwards.

Copy of the Syllabus shall be downloaded from the University Website (www.mangaloreuniversity.ac.in)

REGISTRAR

To,

1. The Registrar (Evaluation), Mangalore University.
2. The Chairman, PG Board of Studies in Computer Science and Computer Applications, Dept. of Computer Science, Mangalore University.
3. The Chairman, Dept. of Computer Science, Mangalore University.
4. The Asst. Registrar (ACC), O/o the Registrar, Mangalore University.
5. The Director, DUIMS, Mangalore University – with a request to publish in the website.
6. Guard File.

MANGALORE UNIVERSITY

Credits Pattern, Scheme of Examination and Syllabus for Master of Science in Computer Science Degree Programme

Choice Based Credit System (CBCS) (2025-26)

POST-GRADUATE DEPARTMENT OF STUDIES AND RESEARCH IN COMPUTER SCIENCE
MANGALORE UNIVERSITY, MANGALAGANGOTHRI, KONAJE – 574 199
JUNE - 2025

Credits Pattern, Scheme of Examination and Syllabus for Master of Science in Computer Science Degree Programme (CBCS Semester Scheme)

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

M.Sc. in Computer Science Degree programme provides a demanding education that combines central topics in computing and specialization in a more focused area with added prominence on the physical and architectural substructures of modern computer system design. Our graduates have the extensiveness of understanding a practice both in traditional areas of computing and in applications to other disciplines. The Learning objectives of this programme are:

PEO1: Practice and grow as computing professionals, conducting research and/or leading, designing, developing or maintaining projects in various technical areas of computer science.

PEO2: Utilize knowledge and skills in Computer Science effectively for improving the society.

PEO3: Use new technical advancements of Computer Science to produce tangible contributions in the profession.

The Programme Learning Objectives:

The curriculum leading to M.Sc in Computer Science degree prepares the students for the positions as Computer Scientists, Data Scientists, and Software Engineers and Academicians in Business Intelligence, Information Technology, Software Industry and Government segments. The curriculum's main objectives are to convey students with an understanding of the Hardware, Software and problem solving skills through Algorithmic approaches and to develop proficiency in the practice of computing, and to prepare them for continued professional development. After completion of M.Sc. in Computer Science, students will be able to:

PLO1: Apply algorithmic, mathematical and scientific reasoning to a variety of computational problems.

PLO2: Design, Evaluate, implement and document solutions to significant computational problems.

PLO3: Analyze and compare alternative solutions to computing problems.

PLO4: Implement software systems that meet specified design and performance requirements.

PLO5: Work effectively in teams to design and implement solutions to computational problems.

PLO6: Communicate effectively, both orally and in writing.

PLO7: Recognize the social and ethical responsibilities of a professional working in the discipline.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

On completion of the M.Sc.-Computer Science Degree programme the graduates will be able to:

PSO1: Design and develop computer programs/computer-based systems in the areas related to algorithms, networking, web design, cloud computing, IoT and data analytics of varying complexity.

PSO2: Apply standard Software Engineering practices and strategies in real-time software project development using open-source programming environment or commercial environment to deliver quality product for the organization success.

PSO3: Acquaint with the contemporary trends in industrial/research settings and thereby innovate novel solutions to existing problems.

Credits Pattern and Scheme of Examination

I Semester M.Sc. Computer Science								
Course Code	Courses	Theory Hours/ Week	Practical Hours/ Week	Duration of exams (Hours)	Marks & Credits			
					IA	Exam	Total	Credits
HARD CORE								
25CSH101	Mathematical Foundations of Computer Science	4L	-	3	30	70	100	4
25CSH102	Advanced Data Structures and Algorithms	4L	-	3	30	70	100	4
25CSH103	Data Communications and Computer Networks	4L	-	3	30	70	100	4
25CSH104	Advanced Operating System	4L	-	3	30	70	100	4
SOFT CORE [Any ONE course shall be selected from the list of courses]								
25CSS101	.NET Technology	4L	-	3	30	70	100	4
25CSS102	Android Programming	4L	-	3	30	70	100	4
25CSS103	Python Programming	4L	-	3	30	70	100	4
PRACTICALS [Two practical courses shall be selected from the list]								
25CSP101	Advanced Data Structures and Algorithms Lab	-	6	3	30	70	100	3
25CSP102	.NET Technology Lab	-	6	3	30	70	100	3
25CSP103	Android Programming Lab	-	6	3	30	70	100	3
25CSP104	Python Programming Lab	-	6	3	30	70	100	3
	TOTAL	20	12	21	210	490	700	26

II Semester M.Sc. Computer Science								
Course Code	Courses	Theory Hours/ Week	Practical Hours/ Week	Duration of exams (Hours)	Marks & Credits			
					IA	Exam	Total	Credits
HARD CORE								
25CSH201	Internet of Things	4L	-	3	30	70	100	4
25CSH202	Principles of Data Science	4L	-	3	30	70	100	4
25CSH203	Advanced Database Management Systems	4L	-	3	30	70	100	4
SOFTCORE [Any ONE course shall be selected from the list of courses]								
25CSS201	Digital Image Processing	4L	-	3	30	70	100	4
25CSS202	Big Data Analytics	4L	-	3	30	70	100	4
25CSS203	Wireless Sensor Networks	4L	-	3	30	70	100	4
25CSS204	Mobile Computing	4L	-	3	30	70	100	4
PRACTICAL [Two practical courses shall be selected from the list]								
25CSP201	Principles of Data Science Lab	-	6	3	30	70	100	3
25CSP202	Internet of Things Lab	-	6	3	30	70	100	3
25CSP203	Digital Image Processing Lab	-	6	3	30	70	100	3
25CSP204	Big Data Analytics Lab	-	6	3	30	70	100	3
25CSP205	Wireless Sensor Networks Lab	-	6	3	30	70	100	3
25CSP206	Mobile Computing Lab	-	6	3	30	70	100	3
OPEN ELECTIVE								
25CSE201	Introduction to Information Technology	3L	-	3	30	70	100	3*
	Total	20	12	21	210	490	700	22 + 3*

*** Not included for CGPA.**

III Semester M.Sc. Computer Science								
Course Code	Courses	Theory Hours/ Week	Practical Hours/ Week	Duration of exams (Hours)	Marks & Credits			
					IA	Exam	Total	Credits
HARD CORE								
25CSH301	Machine Learning	4L	-	3	30	70	100	4
25CSH302	Principles of Cyber Security	4L	-	3	30	70	100	4
25CSH303	Software Engineering	4L	-	3	30	70	100	4
SOFT CORE [Only ONE course shall be selected from the list of courses]								
25CSS301	Information Retrieval Systems	4L	-	3	30	70	100	4
25CSS302	Cloud Computing	4L	-	3	30	70	100	4
25CSS303	Natural Language Processing	4L	-	3	30	70	100	4
25CSS304	Soft Computing Paradigm	4L	-	3	30	70	100	4
25CSS305	Block Chain Management	4L	-	3	30	70	100	4
PRACTICALS [One practical course shall be selected from the list]								
25CSP301	Machine Learning Lab	-	6	3	30	70	100	3
25CSP302	Principles of Cyber Security Lab	-	6	3	30	70	100	3
25CSP303	Software Engineering Lab	-	6	3	30	70	100	3
PROJECT/SEMINAR								
25CSM301	Mini Project and Domain Knowledge Seminar	-	6	3	30	70**	100	3
OPEN ELECTIVE								
25CSE301	Digital Fluency – Tools and Techniques	3L	-	3	30	70	100	3*
Total		**19**	**12**	**21**	**210**	**490**	**700**	**22 + 3***

** The conduction of examination is similar to the practical examination which is evaluated based on the Mini Project Work.

* Not included for CGPA.

IV SEMESTER M.Sc. Computer Science							
Course Code	Course	Practical Hours/ Week	Duration of Exam (Hrs.)	Marks & Credits			
				IA	Dissertation + Viva-voce Exam	Total	Credits
25CSP401	Dissertation and Viva-Voce	24	__	100	200 (Report :100 Viva-Voce: 100)	300	12
25MCAE402	Course offered through MOOCS-SWAYAM/NPTEL (Minimum of 8 weeks duration course)					100	02
25MCAE403	Course offered through MOOCS-SWAYAM/NPTEL (Minimum of 8 weeks duration course)					100	02
TOTAL MARKS OF FIRST SEMESTER						**700**	**26**
TOTAL MARKS OF SECOND SEMESTER						**700**	**22+3***
TOTAL MARKS OF THIRD SEMESTER						**700**	**22+3***
TOTAL MARKS OF FOURTH SEMESTER						**500**	**16**
GRAND TOTAL CREDITS OF ALL THE FOUR SEMESTERS						**2600**	**86+6***

Note: The dissertation work shall be carried out either in the University, Software Company, R&D Organization or any Institutes of National Importance.

* Not included for CGPA.

List of Hard Core, Soft Core and Elective Courses

Hard Core Courses			
Sl. No.	Course Code	Course Title	Total Credits
1.	25CSH101	Mathematical Foundation for Computer Science	4
2.	25CSH102	Advanced Data Structures and Algorithms	4
3.	25CSH103	Data Communications and Computer Networks	4
4.	25CSH104	Advanced Operating Systems	4
5.	25CSH201	Internet of Things	4
6.	25CSH202	Principles of Data Science	4
7.	25CSH203	Advanced Database Management Systems	4
8.	25CSH301	Machine Learning	4
9.	25CSH302	Principles of Cyber Security	4
10	25CSH303	Software Engineering	4
11	25CSP401	Dissertation and viva voce examination	12
12	25CSE402	MOOCS Course-2	2
13	25CSE403	MOOCS Course-2	2
TOTAL			56

Soft Core Courses			
Sl. No.	Course Code	Course Title	Total Credits
1.	25CSS101	. Net Technology	4
2.	25CSS102	Android Programming	
3.	25CSS103	Python Programming	
4.	25CSP101	Advanced Data Structures Lab	3+3
5.	25CSP102	. Net Technology Lab	
6.	25CSP103	Android Programming Lab	
7.	25CSP104	Python Programming Lab	
8.	25CSS201	Digital Image Processing	4
9.	25CSS202	Big Data Analytics	
10.	25CSS203	Wireless Sensor Networks	
11.	25CSS204	Mobile Computing	

12.	25CSS205	Embedded Systems	
13.	25CSP201	Principles of Data Science Lab	3+3
14.	25CSP202	Internet of Things Lab	
15.	25CSP203	Digital Image Processing Lab	
16.	25CSP204	Big Data Analytics Lab	
17.	25CSP205	Wireless Sensor Networks Lab	
18.	25CSP206	Mobile Computing Lab	
19.	25CSS301	Information Retrieval Systems	4
20.	25CSS302	Cloud Computing	
21.	25CSS303	Natural Language Processing	
22.	25CSS304	Soft Computing Paradigm	
23.	25CSS305	Block Chain Management	
24.	25CSP301	Machine Learning Lab	3
25.	25CSP302	Principles of Cyber Security Lab	
26.	25CSP303	Software Engineering Lab	
27.	25CSM301	Mini Project and Domain Knowledge Seminar	3
Total			**30**

Open Elective Courses			
Sl. No.	**Course Code**	**Course Title**	**Total Credits**
1	25CSE201	Introduction to Information Technology	3*
2	25CSE301	Digital Fluency – Tools and Techniques	3*
Total			**6***

Percentage coverage of Hard core/ Soft core/ Open Elective Courses:

Hard Core Credits:	16 + 12+12+16	= 56	(60.87%)
Soft Core Credits:	10 +10+10	= 30	(32.60%)
Open Elective Credits:	03* +03*	= 06*	(06.52%)

QUESTION PAPER PATTERN

Name of the Examination: ____

Duration: 3 Hrs. Max. Marks: 70

Section – A: Answer all the questions and each question carries TWO marks

1. i)

ii)

iii)

iv)

v)

Section – B: Answer all the questions. Each question carries FIFTEEN marks

UNIT-1:	2. **OR** 3.
UNIT-2:	4. **OR** 5.
UNIT-3:	6. **OR** 7.
UNIT-4:	8. **OR** 9.

Note: *Each question of an UNIT under Section-B may contain multiple sub-questions, summing to fifteen marks.*

MANGALORE UNIVERSITY

SYLLABUS FOR TWO YEARS MSc PROGRAMME

CBCS PATTERN: 2025-26

POST-GRADUATE DEPARTMENT OF STUDIES AND RESEARCH IN COMPUTER SCIENCE
MANGALORE UNIVERSITY, MANGALAGANGOTHRI, KONAJE – 574 199
JUNE - 2025

25CSH101: MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Hours/Week: 4 I.A. Marks: 30

Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- The primary objective of this course is to provide mathematical background and sufficient experience on various topics of discrete mathematics like logic and proofs, combinatory, graphs, algebraic structures, formal languages and finite state automata.
- Course will extend student's Logical and Mathematical maturity and ability to deal with abstraction and to introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
- On completion of this course, students should be able to demonstrate their understanding of and apply methods of discrete mathematics in CS to subsequent courses in algorithm design and analysis, automata theory and computability, information systems, computer networks.
- In particular, students should be able to - use logical notation to define fundamental mathematical concepts such as sets, relations, functions and various algebraic structures, reason mathematically using such structures, and evaluate arguments that use such structures.

Course Outcomes: After completing the course, the students will be able to,

- Understand basic probability axioms and rules and the moments of discrete and continuous random variables as well as be familiar with common named discrete and continuous random variables.
- Gain the knowledge of computing and mathematics appropriate to the discipline.
- Know the significance of mathematical foundations, algorithmic principles and computer science theory to the modeling and design of computer based systems in a way that demonstrates.
- Understand the design and development principles in the construction of software systems of varying complexity.
- Ability to write and evaluate a proof or outline the basic structure of and give examples of each proof technique described.
- Understand Model problems in Computer Science using graphs and trees.

UNIT-I **12 Hrs.**

Sets: Elements of a set, methods of describing a set, Tabular or Roster Method, Rule Method or Set Builder, Empty or Void or Null Set, Types of sets : Finite sets and Infinite sets, singleton, equal sets, subsets, Proper Subset, Power Set, Universal Set, Venn Diagrams, Operations on Sets, Union, Intersection of Sets, Disjoint Sets, Difference of two Sets, Symmetric Difference of Sets, Complement of a Set, De- Mogran's laws, Algebra of sets.

Relations: Introduction, Properties of a binary relation in a set, Relation matrix and graph of a relation, Equivalence relations, compatibility relations, composition of Binary relations.

Functions: Definition, graph of a function, types of functions: Surjective, bijective, Injective, Composition of functions, Inverse functions.

Introduction to Probability Theory: Definitions of Sample Space, Random Variables, Probability Distributions, Expected Values, Joint Distributions, Variance, Covariance related problems, Bayes' theorem statement and problems.

UNIT-II **12 Hrs.**

Propositional Logic: Introduction, Statements and Notation, Connectives-Negation, Conjunction, Disjunction, Statement, Formulas and Truth Tables, Conditional and Biconditional, Tautologies, contradiction, contingency, Equivalence of Formulas, Duality Law.

Predicate Logic: Limitations of Predicate Logic, Universal and Existential Quantification; Modus Ponens and Modus Tollens.

Proof Techniques: Notions of Implication, Converse, Inverse, Contrapositive, Negation, and Contradiction.

The Structure of Formal Proofs: Direct Proofs; Proof By Counter Example; Proof By Contraposition; Proof By Contradiction;

Mathematical Induction, Strong Induction; Recursive Mathematical Definitions.

UNIT-III **12Hrs.**

Theory of Computation: Introduction, Strings and their properties, Formal Languages, Types of Grammars and Languages, Chomsky classification of Languages, Recursive And Recursively Enumerable Sets, Operations, Theory of Automata: Finite State Models, Minimization, Regular sets and Regular Grammars, Pumping Lemma, Closure properties, Applications of Finite automata.

UNIT-IV **12Hrs.**

Context Free Languages: Context Free Grammar and Push Down Automata, Equivalence of PDA and CFG, Deterministic PDA, Normal forms, Applications of CFG. Turing Machines, Representation and Design of TM, Halting problem, Universal TM and modifications.

REFERENCE BOOKS:

1. JD Ullman et al., Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson Publication, 2006.
2. C L Liu, Elements of Discrete Mathematics: A Computer Oriented Approach, McGraw- Hill Ed., 2013.
3. K. S. Trivedi, Probability and Statistics with Reliability, Queuing and Computer Science Applications, First Edition, Prentice Hall of India. 2008.
4. Schöning, Uwe, Pruim, Randall J, Gems of Theoretical Computer Science, Springer Publications.
5. Hary R Lewis, Christor H Papadimetrion, Elements of the Theory of Computation, Prentice-Hall International, 1998.
6. KLP Mishra and N Chandrashekar, Theory of Computer Science, 3rd Edition, PHI publication, 2007.

25CSH102: ADVANCED DATA STRUCTURES AND ALGORITHMS

Hours/Week: 4 I.A. Marks: 30
Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- Understand and analyze algorithms
- Design and implement various data structures suitable for different applications
- To introduce various techniques for representation of the data in the real world
- Compute the complexity of various algorithms.

Course Outcomes: After completing the course, the students will be able to,

- Ensure that the student evolves as a competent programmer capable of design, analyze and implement algorithms and data structures for different kinds of problems.
- Expose the student to the algorithm analysis techniques, to the theory of reductions, and to the classification of problems into complexity classes like NP.
- Design and analyze programming problem statements, choose appropriate data structures and algorithms for a specific problem.
- Understand the necessary mathematical abstraction to solve problems, Come up with analysis of efficiency and proofs of correctness.
- Comprehend and select algorithm design approaches in a problem specific manner.
- Come across the importance of graphs and their features for the applications uses.
- Gathering the real strategies searching and sorting techniques.

UNIT-I **12Hrs.**

Review of basic data structures: Arrays, Stack, Queue, Circular Queue, Linked List-Singly Linked List, Doubly Linked List, Circular Linked List.
Introduction to Algorithms: Algorithms, Performance Analysis-time complexity and space complexity, O-notation, Omega notation and Theta notation.

UNIT-II **12Hrs.**

Search Trees: Introduction to Nonlinear data structure, Trees, Binary trees, Binary Tree Traversal, Applications of Binary Trees, Binary Search Trees- Searching, Insertion and Deletion on Binary Search Trees, Balanced Search Trees- AVL Trees- Insertion and deletion on AVL Trees, Red –Black Tress- Representation, Insertion and Deletion on Red–Black Trees, Heaps: Representation, Insertion and Deletion on Heaps.

UNIT-III **12Hrs.**

Graphs: Introduction to Graphs, digraphs, Sub-graphs, Paths, Walks, Graphs Representation, Graph Traversals - Depth-first and breadth-first traversal, Applications of graphs - Minimum Spanning Tree – Prim's and Kruskal's algorithms.
Hashing: Introduction to hashing, hash table representation, hash functions, collision resolution-separate chaining, open addressing-linear probing, quadratic probing, double hashing.

UNIT-IV **12Hrs.**

Design Strategies: Divide and Conquer- Binary Search, Merge Sort, Greedy method- Job sequencing with deadlines, Dynamic Programming – Optimal Binary Search Tree, Backtracking- 8 Queens problem, Introduction to NP-Hard and NP-Completeness.

REFERENCE BOOKS:

1. Mark A. Weiss, "Data structures and Algorithm analysis in C++(Java)", Fourth Edition, PHI , 2013.
2. Anany Levitin, "Introduction to the Design and Analysis of Algorithms" Pearson Education, 2015 .
3. E. Horowitz, S. Sahni and Dinesh Mehta, "Fundamentals of Data structures in C++", University Press, 2007.

25CSH103: DATA COMMUNICATIONS AND COMPUTER NETWORKS

Hours/Week: 4 I.A. Marks: 30
Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- Acquire the computer networking knowledge as well as the existing connectivity technologies and the required infrastructure which comprises the key steps involved in the communication process.
- Identify the key issues for the realization of the LAN/WAN/MAN network architectures and the hybridized existing form in the business environment and enterprise.
- Establish a solid knowledge of the layered approach that makes design, implementation and operation of extensive networks possible. To learn the 7-layer OSI network model (each layer and its responsibilities) and understand the TCP/IP suite of protocols and the networked applications supported by it.
- Establish a solid knowledge of the layered approach that makes design, implementation, and operation of extensive networks possible.

Course Outcomes: After completing the course, the students will be able to,

- Understanding the basic communication concepts in real time applications
- Identify the different networking and internetworking devices and their functions within a network
- Familiar with the protocols in DC and CN
- Know the Importance of ISO - OSI and TCP / IP reference model.
- Clearly understand the importance of services of all layers.
- Come across with the architecture of a number of different networks.
- Recognizable with modern telecommunications.

UNIT-I 12Hrs.

Introduction: Data communications fundamentals, computer communications architecture, Data Communication tasks, Data Communication Systems Applications, Data Communication System Characteristics features, Data Communication network criteria, Protocols and standards, Transmission mode, Analog and Digital Signals, Bit rate, Baud rate, Channel capacity using Nyquist and Shannon's relation. Modulation, encoding and decoding techniques. Transmission media characteristics, Transmission impairments, multiplexing.

UNIT-II 12Hrs.

Introduction to Computer Networks, Application and goals, Classification of Computer Networks, ISO-OSI Architecture, Services of Physical, Data link, Network, Transport, Session, Presentation and Application Layers., TCP /IP reference Model, Topology. Physical and Data Link Layer Services, Network Layer Services: Networking and Internetworking Technology Devices, Repeaters, Bridges, Routers, Gateways and Other Devices.

UNIT-III **12Hrs.**

TCP/IP Protocol Suit: Overview of TCP/IP, TCP/IP and the Internet, TCP/IP and OSI, Internetwork Protocol (IP), Classes of IP, Addressing, Protocols in the Network Layer, Address Resolution Protocol (ARP), Reverse Address Resolution Protocol (RARP), Internet Control MESSAGE Protocol (ICMP), Internet Group Message Protocol (IGMP), Transport Layer Services, Functionalities of the Transport Layer.

UNIT-IV **12Hrs.**

Upper OSI Layers: Session Layer Services, SPDU. Presentation Layer Services: Application layer Services, PPDU. Application Layer Services: Client / Server Model,, BOOTP, Dynamic Host Configuration Protocol(DHCP), Domain Name System (DNS), Telnet, Fle transfer Protocol (FTP), Trivial File Transfer Protocol (TFTP),Simple Mail Transfer Protocol (SMTP), Post Office Protocol (POP), Simple Network Management Protocol (SNMP), Hyper Text Transfer Protocol (HTTP) , World Wide Web (WWW).

REFERENCE BOOKS:

1. Prakash C. Gupta, Data Communications and Computer Networks, PHI (Latest Edition), 2016.
2. Behrouz A Forouzan, Data Communications and Networking, McGraw Hill, (Fourth Edition), 2017.
3. Behrouz A Forouzan and Firouz, Computer Networks A Top - Down Approach, McGraw Hill, (Special Indian Edition), 2017.
4. Tananbaum A.S., "Computer Networks", Latest Ed, PHI, 2015.
5. Black U., "Computer Networks-Protocols, Standards and Interfaces", PHI, 2007.
6. Stallings W., "Computer Communication Networks", PHI, 2015.
7. Stallings W., "SNMP, SNMPv2, SNMPv3, RMON 1&2", latest Ed., Addison Wesley, 2010

25CSH104: ADVANCED OPERATING SYSTEMS

Hours/Week: 4 I.A. Marks: 30
Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- Explore the structure of OS and basic architectural components involved in OS design.
- Analyze and design the applications to run in parallel either using process or thread models of different OS.
- Study the various device and resource management techniques for timesharing and distributed systems.
- Understand the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system. Interpret the mechanisms adopted for file sharing in distributed Applications.

Course Outcomes: After completing the course, the students will be able to,

- Understand the structure of OS and basic architectural components involved in OS design.
- Analyze and design the applications to run in parallel either using process or thread models of different OS.
- Study the various device and resource management techniques for time sharing and distributed systems.
- Recognize the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system.
- Interpret the mechanisms adopted for file sharing in distributed Applications.
- Evaluate the requirement for process synchronization and coordination handled by OS.
- Collecting and understanding the various security aspects of operating system.

UNIT-I **12Hrs.**

Operating System Overview : Operating System Objectives and Functions, The Evolution of Operating Systems, Major Achievements, Developments Leading to Modern Operating Systems, Microsoft Windows Overview, Traditional UNIX Systems, Modern UNIX Systems, Linux. Process description & control: Process States, Process Description, Process Control, Process Synchronization – The Critical Section Problem, Peterson's Problem, Semaphores, Classic Problems of Synchronization.

UNIT-II **12Hrs.**

CPU Scheduling: Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Multiprocessor Scheduling, Real-Time Scheduling, Linux and Windows Scheduling.
Virtual Memory: Hardware and Control Structures, Operating System Software, LINUX and Windows Memory Management.

UNIT-III **12Hrs.**

Threads, SMP, and Microkernel: Processes and Threads, Symmetric Multiprocessing (SMP), Microkernels, Windows Thread and SMP Management, Linux Process and Thread Management. Distributed Process Management: Process Migration, Distributed Global States, Distributed Mutual Exclusion, Distributed Deadlock. Distributed File Systems:

Naming and Transparency, Remote File Access, Stateful verses Stateless Service, File Replication.

UNIT-IV **12Hrs.**

Kernel Organization: Using Kernel Services, Daemons, Starting the Kernel, Control in the Machine, Modules and Device Management, Module Organization, Module Installation and Removal, Process and Resource Management, Running Process Manager, Creating a new Task, IPC and Synchronization, The Scheduler, Memory Manager, The Virtual Address Space, The Page Fault Handler, File Management, Security: Security Threats, Attacks, and Assets, Intruders, Malicious Software Overview, Viruses, Worms, and Bots, Rootkits.

REFERENCE BOOKS:

1. William Stallings, Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2013.
2. Gary Nutt, Operating Systems, 3rd Edition, Pearson, 2014.
3. Silberschatz, Galvin, Gagne, Operating System Concepts, 8th Edition, Wiley,2008
4. Andrew S. Tanenbaum, Albert S. Woodhull, Operating Systems, Design and Implementation, 3rd Edition, Prentice Hall,2006.
5. Pradeep K Sinha: Distributed Operating, PHI, 2015.

25CSS101: .NET TECHNOLOGY

Hours/Week: 4 I.A. Marks: 30
Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- The concept of .NET framework, building blocks of .NET framework and application development using IDE.
- C# programming language, use of windows forms and GUI based programs.
- OOP concepts, concept of assemblies and string manipulation.
- Designing of web applications and validating forms using validation controls, interacting with database using server side programming.

Course Outcomes: After completing the course, the students will be able to,

- Understand .NET framework, its runtime environment and application development using IDE of Visual Studio 2010 and higher versions.
- Develop well-defined programs using the C# programming language; learn to use Windows forms and to create GUI-based programs.
- Able to apply the principles of object-oriented programming and develop assemblies and deployment in .NET.
- Apply and build web applications and validation form data using validation controls.
- Create dynamic web applications that interact with a database using server-side programming.
- Understand Constructing classes, method sand instantiate objects.
- Understand and implement string manipulation, events and exception handling within .NET application environment.

UNIT-I 12Hrs.

Introduction: Principles of .NET, Overview of .NET Framework, Review of OOP Concepts – C# language fundamentals – Basic Elements of C# – Program Structure and simple Input and Output Operations – Data types –Value types –Reference types – Identifiers – Variables – Constraints –Literals – Operators and Expressions – Statements – Arrays and Structures. Object Oriented Programming Concepts: Encapsulation – Encapsulation Services – Pseudo- Encapsulation: Creating Read-Only Fields- Inheritance - Namespace – Polymorphism – Interface and Overloading – Multiple Inheritance – Property – Indexes – Delegates and Events – Publish/Subscribe Design Patterns- Operator Overloading– Method Overloading.

UNIT-II 12Hrs.

C# Concepts for creating Data Structures - File Operation – File Management systems – Stream Oriented Operations- Multitasking – Multithreading – Thread Operation – Synchronization– Exceptions and Object lifetime, Building C# Applications: The Role of the Command Line Complier – Building C # Applications, Working with csc.exe, Response Files– Generating Bug Reports – Remaining C# Compiler Options – The Command Line

Debugger (cordbg.exe) – Using the Visual Studio .NET IDE – Other Key Aspects of the VS.NET IDE – C# "Preprocessor:" Directives.

UNIT-III **12Hrs.**

.NET ASSEMBLERS and Windows Applications: An Overview of .NET Assembly – Building a Simple File Test Assembly– A C# Client Application– A Visual Basic .NET Client Application– Cross Language Inheritance– Exploring the Car Library's– Manifest– Exploring the Car Library's Types– Building the Multi-file Assembly– Using Assembly– Understanding Private Assemblies– Probing for Private Assemblies (The Basics) – Private Assemblies XML Configurations Files– Probing for Private Assemblies (The Details) – Understanding Shared Assembly – Understanding Shared Names– Building a Shared Assembly– Understanding Delay Signing– Installing/Removing Shared Assembly. Building Windows application –Working with C# controls– Event handling – Graphics Device Interface (GDI).

UNIT-IV **12Hrs.**

ADO.NET and Database Connectivity: Introduction to ADO.NET– Major Components of ADO.NET– Establishing Database Connections– Connection objects– Command objects– Datasets– Data readers– Querying databases– Data Grid Views– Data Validation.

REFERENCE BOOKS:

1. Stephen C. Perry — "Core C# and .NET", Pearson Education, 2006.
2. S. ThamaraiSelvi and R. Murugesan—"A Textbook on C#" —, Pearson Education, 2003.
3. Andrew Troelsen, Pro C# with .NET 3.0 Special Edition, Dream tech Press, India, 2007.
4. E. Balagurusamy, Programming in C#, 5th Reprint, Tata McGraw Hill, 2004. (ForProgramming Examples)
5. Tom Archer, Inside C# WP Publishers, 2001.
6. Herbert Scheldt, C#: The Complete Reference, Tata McGraw Hill, 2004.
7. Robinson et al, -"Professional C#", Fifth Edition, Wrox Press, 2002.

25CSS102: ANDROID PROGRAMMING

Hours/Week: 4 I.A. Marks: 30
Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- Fundamentals of Android Operating systems, android application components and android development framework.
- Designing of Android User Interfaces using various components like buttons, text views, toggle buttons, check boxes, spinners etc.
- How to develop software's with reasonable complexity and deploying software to mobile devices.
- The concept of intents and broadcasts, persistent storage and database connectivity concepts.

Course Outcomes: After completing the course, the students will be able to,

- Demonstrate their understanding of the fundamentals of Android operating systems
- Show their skills of using Android software development tools
- Develop software with reasonable complexity and their design aspects.
- Deploy software to mobile devices and debug the programs
- Understands the working of Android OS Practically and able to develop, deploy and maintain the Android Applications.
- Understands the concept of persistent storage and develop User Interface.
- Recognizes basics of SQLlite database and perform various possible operation on database.

UNIT-I **12Hrs.**

Introduction to Android Operating System: Introduction to Mobile applications, Android: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Eclipse platform, Creating AVDs, Types of Android applications, Android tools Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus, Resources for different devices and languages, Runtime Configuration Changes Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes.

UNIT-II **12Hrs.**

Android User Interface: Measurements – Device and pixel density independent measuring units Layouts – Linear, Relative, Grid and Table Layouts User Interface (UI) Components – Editable and non-editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers Event Handling – Handling clicks or changes of various UI components, Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities.

UNIT-III **12Hrs.**

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new, Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity Notifications – Creating and Displaying notifications, Displaying Toasts.

UNIT-IV **12Hrs.**

Android capabilities: flutter framework, Introduction-including libraries future, asynch and wait, including files in application shared preferences, Introduction to SQLLite database, creating and opening a database, creating tables, inserting, retrieving and deleting data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update). Connecting to internet resource, using download manager Location Based Services – Finding Current Location and showing location on the Map, updating location.

REFERENCE BOOKS:

1. RetoMeier,, Wiley India, (Wrox) , Professional Android 4 Application Development, 2012.
2. James C Sheusi, Android Application Development for Java Programmers, Cengage Learning, 2013.
3. Wei-Meng Lee, Beginning Android 4 Application Development, Wiley India (Wrox), 2013.
4. Rap Payne, Beginning App Development with Flutter: Create Cross-Platform Mobile Apps -

25CSS103: PYTHON PROGRAMMING

Hours/Week: 4 I.A. Marks: 30
Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- Fundamentals of python programming, python development framework.
- Developing application programs using python.
- Developing software with reasonable complexity and deploying software.
- Python program for data analysis and database programming.

Course Outcomes:

After completing the course, the students will be able to,

- Demonstrate their understanding of the fundamentals of python programming
- Show their skills of using python development framework
- Develop software with reasonable complexity and their design aspects.
- Deploy software to data analysis and debug the programs
- Understands the concept of data visualization for data analysis.
- Recognizes basics of SQLlite database and perform various possible operation on database.

UNIT-1 **12 Hrs.**

Introduction to Python, Python Syntax and Variables: Python syntax and structure, Variables and data types, Input and output functions.
Control Structures: Conditional statements (if, elif, else), Looping with for and while loops, Controlling loops (break, continue), Indentation and code block.
Strings, Lists, Tuples, and Dictionaries: Strings and operations, Lists and list operations, Tuples and tuple operations, Dictionaries and dictionary operations; Python libraries for numerical data.

UNIT-2 **12 Hrs.**

Functions: Function parameters and return values, Scope and lifetime of variables, Function based programming concepts, Functional Programming: Functional programming concepts, Lambda functions and higher-order functions
Object-Oriented Programming in Python: Introduction to Object-Oriented Programming (OOP), OOP concepts (classes and objects), Creating classes and objects in Python, Methods and attributes, Inheritance and polymorphism: Function overloading and operator overloading, Abstract classes

UNIT-3 **12 Hrs.**

File handling and Input/Output: Reading and writing files, working with CSV, JSON, and XML data, Serialization and deserialization, Exception handling and custom exceptions; Database Connectivity and SQL: Database concepts and relational databases, SQLite and Python, Executing SQL queries with Python.

UNIT-4 **12 Hrs.**

Introduction to Data Visualization: Types of data and visualization, Matplotlib Basics, Creating basic plots (line plots, scatter plots), Customizing plots (labels, titles, colors), Multiple subplots and figure customization, Interactive Visualization with Plot library, Creating interactive plots (scatter plots, line charts), Building interactive dashboards.

Reference Books:

1. Learning Python 5ed: Powerful Object-Oriented Programming Paperback – 12 July 2013, by Mark Lutz
2. Python 3: The Comprehensive Guide, October 2022, by Johannes Ernesti, Peter Kaiser.
3. Python Programming: An Introduction to Computer Science (3rd Edition), John Zelle
4. Programming Python: Powerful Object-Oriented Programming (4th Edition), Mark Lutz, O'Reilly.
5. Python: The Complete Reference, Martin C. Brown, McGraw Hill

25CSP101: Advanced Data Structures Lab

Hours/Week: 6 I.A. Marks: 30
Credits: 3 Exam. Marks: 70

The practical problems shall be based on the data structure theory concepts and Python language shall be considered for implementation

25CSP102: . NET Technology LAB

Hours/Week: 6 I.A. Marks: 30
Credits: 3 Exam. Marks: 70

The practical problems shall be based on the .NET technology theory concepts and C#/Java language shall be considered for implementation

25CSP103: ANDROID Programming LAB

Hours/Week: 6 I.A. Marks: 30
Credits: 3 Exam. Marks: 70

The practical problems shall be based on the Android programming theory concepts and C#/Java language shall be considered for implementation

25CSP104: PYTHON PROGRAMMING LAB

Hours/Week: 6 I.A. Marks: 30
Credits: 3 Exam. Marks: 70

The practical problems shall be based on the Python programming theory concepts and general problems shall be considered for implementation

25CSH201: INTERNET OF THINGS

Hours/Week: 4 I.A. Marks: 30
Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- Understand the concepts of Internet of Things
- Analyze basic protocols in wireless sensor network
- Design IoT applications in different domain and be able to analyze their performance
- Implement basic IoT applications on embedded platform

Course Outcomes: After completing the course, the students will be able to,

- Understand the impact of IoT applications and Architectures in real world
- Realize the various IoT Protocols (Datalink, Network, Transport, Session, Service)
- Differentiate between the levels of the IoT stack and be familiar with the key technologies
- Interface different sensors to arduinouno and raspberry pi to read the environment data.
- Appreciate the role of big data, cloud computing and data analytics in a typical IoT system
- Provide an overview on the ICT ecosystem and enabling environment to foster IoT
- To provide an understanding of the technologies and the standards relating to IoT

UNIT-I 12Hrs.

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, IoT challenges.

UNIT-II 12Hrs.

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

UNIT-III 12Hrs.

Sensors and Actuators : Types of Sensors-Temperature and Humidity (DHT11), Proximity (Ultrasonic, IR), Motion (PIR, Accelerometer) and Environmental (Gas). Actuators: Relays, Servo Motors, DC Motors. Role of actuators in IoT Automation.

Programming with Raspberry PI: Introduction to Raspberry Pi, Interfacing sensors and actuators with Python programs. **Introduction to Arduino microcontroller**: Components of Arduino uno, Interfacing Sensors and actuators with Arduino Uno. **Introduction to Nodemcu**: architecture of ESP8266, programming with Nodemcu.

Edge Computing in IoT: Definition and Need for Edge Computing, Edge vs. Fog vs. Cloud Computing, Benefits of Edge Computing in IoT.

UNIT-IV **12Hrs.**

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.

REFERENCE BOOKS:

1. Arshdeep Bahga and Vijay Madisetti, Internet of Things - A Hands-on Approach, Universities Press, 2015, ISBN: 9788173719547
2. Matt Richardson & Shawn Wallace, Getting Started with Raspberry Pi, O'Reilly (SPD), 2014, ISBN: 9789350249759.

25CSH202: Principles of Data Science

Hours/Week: 4 I.A. Marks: 30
Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- Introduce the theoretical foundation of data science.
- Understand data types, data preprocessing, and lifecycle management.
- Build a solid foundation in exploratory data analysis and statistical inference.
- Explore introductory machine learning algorithms and project workflows

Course Outcomes: After completing the course, the students will be able to,

- Understand the data science lifecycle and types of data.
- Describe data preprocessing techniques and challenges.
- Interpret and summarize data using statistical and visualization techniques.
- Apply statistical inference for data-driven decision making.
- Understand basic machine learning concepts and data science project frameworks.

UNIT-I **12 Hrs.**

Foundations of Data Science and Data Handling: Definition and Scope of Data Science; Data Science vs Data Analytics vs Data Engineering; Data Science Lifecycle: Collection, Cleaning, Exploration, Modeling, Interpretation; Types of Data: Structured, Semi-Structured, Unstructured; Overview of Data Sources: APIs, Open Datasets, Web Data; Data Preprocessing Concepts: Handling Missing Values, Duplicates, Outliers; Overview of Data Transformation Techniques: Normalization, Scaling, Encoding. Introduction to Feature Engineering and Feature Selection.

UNIT-II **12 Hrs.**

Data Exploration and Visualization Principles: Role of Exploratory Data Analysis (EDA) in Data Science; Descriptive Statistics: Measures of Central Tendency and Dispersion; Concepts of Univariate, Bivariate, and Multivariate Analysis; Data Visualization - Histograms, Boxplots, Scatterplots, Heatmaps; Concepts of Correlation and Covariance; Ethical Considerations in Data Analysis (Bias, Fairness, Privacy).

UNIT-III **12 Hrs.**

Statistical Inference and Predictive Modeling Concepts - Basic Concepts of Probability and Random Variables; Probability Distributions: Normal, Binomial, Poisson (Theoretical Properties); Sampling Techniques, Population vs Sample; Estimation and Confidence Intervals; Hypothesis Testing: Concepts, Types of Errors, p-Value Interpretation; Linear Regression: Assumptions, Interpretation, Model Fit Measures; Logistic Regression: Use Cases and Conceptual Explanation; Bias-Variance Trade-off: Overfitting and Underfitting.

UNIT-IV **12 Hrs.**

Machine Learning and Data Science Project Framework: Machine Learning Paradigms: Supervised vs Unsupervised; Supervised Learning - K-Nearest Neighbors, Decision Trees, SVM; Unsupervised- K-Means Clustering; Model Evaluation Metrics: Accuracy, Precision, Recall, F1-Score; Model Validation Techniques - Train/Test Split, Cross-Validation; Overview of Project Lifecycle - Problem Definition, Data Understanding, Modeling, Deployment Concepts; Introduction to Reproducibility, Version Control, Documentation in Data Science Projects.

REFERENCE BOOKS:

1. Jake VanderPlas, " Python Data Science Handbook"
2. Allen B. Downey, " Think Stats (2nd Edition)"
3. Gareth James et al. An Introduction to Statistical Learning
4. Allen B. Downey Elements of Data Science
5. Ethics and Data Science – https://dssg.uchicago.edu/wp-content/uploads/2019/05/Ethics-and-Data-Science.pdf
6. Kleinberg, Hopcroft, Kannan, Foundations of Data Science – https://www.cs.cornell.edu/jeh/book.pdf

25CSH203: ADVANCED DATABASE MANAGEMENT SYSTEMS

Hours/Week: 4 I.A. Marks: 30

Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- Basics of NoSQL databases, Relational Databases, Information Retrieval and XML databases.
- The concepts of column databases, distributed database and data warehousing schemes
- Various concepts of MongoDB and types of consistency.
- Advance Databases, Convergent databases and Disruptive Databases.

Course Outcomes: After completing the course, the students will be able to,

- Explore the concepts of NoSQL Databases.
- Understand and use columnar and distributed database patterns.
- Learn to use various Data models for a variety of databases.
- Explore the relationship between Big Data and NoSQL databases
- Work with NoSQL databases to analyze the big data for useful business applications.
- Understands the concept of MongoDB and types of consistency.
- Learn the concepts of Advance Databases, Convergent databases and Disruptive Databases.

UNIT-I 12Hrs.

Database Revolutions- System Architecture- Relational Database- Database Design, Data Storage- Transaction Management- Data warehouse and Data Mining- Information Retrieval. Big Data evolution- CAP Theorem- Birth of NoSQL , Document Database, XML and XML Databases- JSON Document Databases- Graph Databases.

UNIT-II 12Hrs.

Column Databases, Data Warehousing Schemes- Columnar Alternative- Sybase IQ- CStore and Vertica - Column Database Architectures, SSD and In-Memory Databases, In-Memory, Databases- Berkeley Analytics Data Stack and Spark.

UNIT-III 12Hrs.

Distributed Database Patterns, Distributed Relational Databases- Non-relational Distributed Databases- MongoDB - Sharing and Replication- HBase- Cassandra- Consistency Models, Types of Consistency- Consistency MongoDB- HBase Consistency- Cassandra Consistency.

UNIT-IV 12Hrs.

Data Models and Storage- SQL- NoSQL APIs- Return SQL - Advance Databases PostgreSQL- Riak- CouchDB- NEO4J- Redis- Future Databases— Revolution Revisited- Counter revolutionaries- Oracle HQ- Other Convergent Databases- Disruptive Database Technologies.

REFERENCE BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", Sixth Edition, McGrawHill.
2. Guy Harrison, "Next Generation Databases", Apress, 2015.
3. Eric Redmond, Jim R Wilson, "Seven Databases in Seven Weeks", LLC. 2018.
4. Dan Sullivan, "NoSQL for Mere Mortals", Addison-Wesley, 2015.
5. Adam Fowler, "NoSQL for Dummies", John Wiley & Sons, 2015.

25CSS201: DIGITAL IMAGE PROCESSING

Hours/Week: 4 I.A. Marks: 30
Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- Understand digital image representation and processing fundamentals.
- Apply techniques for image enhancement, restoration, segmentation, and compression.
- Implement state-of-the-art and deep learning-based algorithms.
- Solve real-world image processing problems using modern libraries.

Course Outcomes: After completing the course, the students will be able to,

- Understand image transforms and their properties.
- Develop any image processing application and understand the rapid advances in Machine vision.
- Learn different techniques employed for the enhancement of images.
- Identify different causes for image degradation and overview of image restoration techniques.
- Explain different Image enhancement techniques.
- Design & Synthesize Color image processing and its real world applications.
- Come across the image representation with their model approaches.

UNIT-I 12Hrs.

Digitized image and its properties: Basic concepts, Image digitization, Digital image properties. Image Preprocessing: Image pre-processing; Histogram processing, Enhancement using arithmetic / logic operations, Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters. Brightness and geometric transformations, local preprocessing, Mathematical tools: matrix operations, 2D signals, convolution.

UNIT-II 12Hrs.

Edge Detection Techniques: Roberts, Sobel, Canny, Laplacian of Gaussian, Line Detection algorithms; Segmentation methods: Thresholding, Edge-based segmentation, Region based segmentation, Matching.

UNIT-III 12Hrs.

Image Enhancement: Image enhancement in the frequency domain: Background, Introduction to the Fourier transform and the frequency domain, Smoothing Frequency-Domain filters, Sharpening Frequency Domain filters, Homomorphic filtering. Image Compression: Fundamentals of compression: redundancy, entropy, rate-distortion, Lossless compression: Run Length Encoding, Huffman coding, Arithmetic coding, LZW, Lossy compression: Transform coding, JPEG, JPEG2000.

UNIT-IV 12Hrs.

Image Representation and Description: Region identification, Contour-based shape representation and description, Region based shape representation and description, Shape classes. Feature descriptors: SIFT, SURF, ORB, Texture analysis: GLCM, LBP, Image moments, HOG descriptors. Mathematical Morphology: Basic morphological concepts,

Morphology principles, Binary dilation and erosion, Gray-scale dilation and erosion, Morphological segmentation and watersheds.

REFERENCE BOOKS:

1. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis and Machine Vision 2nd Edition, Thomson Learning, 2001.
2. Rafel C Gonzalez and Richard E Woods, Digital Image Processing, 2nd Edition, Pearson Education,2003.
3. Anil K Jain, Fundamentals of Digital Image Processing Pearson Education/Prentice- Hall of India Pvt. Ltd.,1997.
4. B. Chanda, D Dutta Majumder, Digital Image Processing and Analysis Prentice-Hall India, 2002.

25CSS202: BIG DATA ANALYTICS

Hours/Week: 4 I.A. Marks: 30
Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- To optimize business decisions and create competitive advantage with Big Data analytics
- To explore the fundamental concepts of big data analytics.
- To learn to analyze the big data using intelligent techniques.
- To understand the various search methods and visualization techniques

Course Outcomes: After completing the course, the students will be able to,

- Implement statistical analysis techniques for solving practical problems.
- Perform statistical analysis on variety of data.
- Practically realize the working experiments of Python using Hadoop.
- Perform appropriate statistical tests using R and visualize the outcome.
- Understands the applications using Map Reduce Concepts.
- Develop Big Data Solutions using Hadoop Eco System.
- Manage Job Execution in Hadoop Environment.

UNIT- I **12 Hrs.**

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

UNIT- II **12 Hrs.**

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

UNIT-III **12 Hrs.**

History of Hadoop- The Hadoop Distributed File System – Components of Hadoop- Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS Basics-Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features.

UNIT- IV **12 Hrs.**

Setting up a Hadoop Cluster - Cluster specification - Cluster Setup and Installation – Hadoop Configuration-Security in Hadoop - Administering Hadoop – HDFS - Monitoring-Maintenance Hadoop benchmarks- Hadoop in the cloud. Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and Zoo Keeper - IBM InfoSphereBigInsights and Streams.

Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications

REFERENCE BOOKS:

1. Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.
3. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
4. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
5. Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.
6. Anand Rajaraman and Jefrey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012.
7. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.
8. Glen J. Myat, "Making Sense of Data", John Wiley & Sons, 2007
9. Pete Warden, "Big Data Glossary", O'Reily, 2011.
10. Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
11. ArvindSathi, "Big Data Analytics: Disruptive Technologies for Changing the Game", MC Press, 2012
12. Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

25CSS203: WIRELESS SENSOR NETWORKS

Hours/Week: 4 I.A. Marks: 30
Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- To understand the basic WSN technology and supporting protocols, with emphasis placed on standardization basic sensor systems and provide a survey of sensor technology.
- Understand the medium access control protocols and address physical layer concerns.
- Learn key routing protocols for sensor networks and main design issues.
- Understand the Sensor management, sensor network middleware, operating systems.

Course Outcomes: After completing the course, the students will be able to,

- Learn Ad hoc network and Sensor Network fundamentals.
- Understand the different routing protocols and the uses.
- Have an in-depth knowledge on sensor network architecture and design issues.
- Understand the transport layer and security issues possible in Ad hoc and Sensor networks.
- Have an exposure to mote programming platforms and tools.
- To develop wireless sensor systems for different applications using.
- Demonstrate knowledge of routing protocols developed for WSN.

UNIT-I **12 Hrs.**

AD HOC NETWORKS – Introduction and routing protocols: Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Example commercial applications of Ad hoc networking, Ad hoc wireless Internet, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV), On–Demand Routing protocols –Ad hoc On–Demand Distance Vector Routing (AODV).

UNIT-II **12Hrs.**

SENSOR NETWORKS – Introduction & architectures: Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture – Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture – Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.

UNIT-III **12Hrs.**

WSN NETWORKING CONCEPTS AND PROTOCOLS: MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts – S-MAC, The Mediation Device Protocol, Contention based protocols – PAMAS, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, Routing ProtocolsEnergy Efficient Routing, Challenges and Issues in Transport layer protocol.

UNIT-IV **12Hrs.**

SENSOR NETWORK SECURITY: Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering, black hole attack, flooding attack.

Key Distribution and Management, Secure Routing – SPINS, reliability requirements in sensor networks.
SENSOR NETWORK PLATFORMS AND TOOLS: Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms – TinyOS, nesC, CONTIKIOS, Node-level Simulators – NS2 and its extension to sensor networks, COOJA, TOSSIM, Programming beyond individual nodes – State centric programming.

REFERENCE BOOKS:

1. C. Siva Ram Murthy and B. S. Manoj, Ad Hoc Wireless Networks Architectures and Protocolsǁ, Prentice Hall, PTR, 2004. (UNIT I).
2. HolgerKarl , Andreas willig, Protocol and Architecture for Wireless Sensor Networksǁ, John wiley publication, Jan 2006.(UNIT II-V).
3. Feng Zhao, Leonidas Guibas, Wireless Sensor Networks: an information processing approach,Elsevier publication, 2004.
4. Charles E. Perkins, Ad Hoc Networkingǁ, Addison Wesley, 2000.
5. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, ireless sensor networks: a surveyǁ, computer networks, Elsevier, 2002.

25CSS204: MOBILE COMPUTING

Hours/Week: 4 I.A. Marks: 30
Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- The computer systems perspective on the converging areas of wireless networking, embedded systems, and software
- To provide an overview of Wireless Communication networks area and its applications in communication engineering.
- The contribution of Wireless Communication networks to overall technological growth.
- Explain the various terminology, principles, devices, schemes, concepts, algorithms and different methodologies used in Wireless Communication Networks.

Course Outcomes: After completing the course, the students will be able to,

- Discuss cellular radio concepts and identify various propagation effects.
- Have knowledge of the mobile system specifications.
- Classify multiple access techniques in mobile communication.
- Outline cellular mobile communication standards and analyze various methodologies to improve the cellular capacity.
- Explain the principles and theories of mobile computing technologies and describe infrastructures and technologies of mobile computing technologies.
- List applications in different domains that mobile computing offers to the public, employees, and businesses.
- Describe the possible future of mobile computing technologies and applications.

UNIT-I **12 Hrs.**

Introduction to Mobile Computing: applications, a simplified reference model, Wireless Transmission: frequencies of radio transmission, signals, antennas, signal propagation, multiplexing, modulation, spread spectrum, cellular system. Media Access Control: motivation for a specialized MAC, SDMA, FDMA, TDMA, CDMA, and Comparisons.

UNIT-II **12Hrs.**

Telecommunications systems: GSM-Mobile services, System architecture, Radio interface, Protocol, Security, DECT- System architecture, Protocol architecture, Wireless LAN: Infrared vs. radio transmission, Infrastructure and ad-hoc networks, IEEE 802.11, HPERLAN, Bluetooth.

UNIT-III **12Hrs.**

Mobile Network Layer: Mobile IP, Dynamic host configuration protocol, Mobile ad-hoc networks- Routing, Destination sequence distance vector, Dynamic source routing. Mobile Transport Layer: Traditional TCP, classical TCP improvements, TCP over 2.5/3G wireless networks.

UNIT-IV **12Hrs.**

Support for Mobility: FileSystems, World Wide Web, Wireless Application Protocol (WAP)-Architecture, Wireless datagram protocol, transport layer security, Wireless transaction protocol, Wireless session protocol, Wireless application environment, Wireless markup language, WML Script and WAP 2.0.

REFERENCE BOOKS:

1. Jochen Schiller, Mobile Communications‖, PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, Fundamentals of Mobile Computing, PHI Learning Pvt.Ltd, New Delhi , 2012.
3. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems",Thomson Asia Pvt Ltd, 2005.
4. UweHansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, Principles of Mobile Computing, Springer, 2003.
5. William.C.Y.Lee, Mobile Cellular Telecommunications, Analog and Digital Systems, Second Edition,TataMcGraw Hill Edition ,2006.
6. C.K.Toh, AdHoc Mobile Wireless Networks‖, First edition, Pearson Education, 2002.

25CSP201: PRINCIPLES OF DATA SCIENCE LAB

Hours/Week: 6 **I.A. Marks: 30**
Credits: 3 **Exam. Marks: 70**

The practical problems shall be based on the Data Science theory concepts and C#/Java/Python language shall be considered for implementation

25CSP202: INTERNET OF THINGS LAB

Hours/Week: 6 **I.A. Marks: 30**
Credits: 3 **Exam. Marks: 70**

The practical problems shall be based on the IoT theory concepts and C#/Java/Python language shall be considered for implementation

25CSP203: DIGITAL IMAGE PROCESSING LAB

Hours/Week: 6 **I.A. Marks: 30**
Credits: 3 **Exam. Marks: 70**

The practical problems shall be based on Image processing theory concepts and C#/Java/Python language shall be considered for implementation

25CSP204: BIG DATA ANALYTICS LAB

Hours/Week: 6 **I.A. Marks: 30**
Credits: 3 **Exam. Marks: 70**

The practical problems shall be based on the Big Data analytics theory concepts and C#/Java/Python language shall be considered for implementation

25CSP205: Wireless Sensor Networks LAB

Hours/Week: 6 **I.A. Marks: 30**
Credits: 3 **Exam. Marks: 70**

The practical problems shall be based on the WSN theory concepts and C#/Java/Python language shall be considered for implementation

25CSP206: Mobile Computing LAB

Hours/Week: 6 **I.A. Marks: 30**
Credits: 3 **Exam. Marks: 70**

The practical problems shall be based on the mobile computing theory concepts and C#/Java/Python language shall be considered for implementation

25CSE201: INTRODUCTION TO INFORMATION TECHNOLOGY

Hours/Week: 3 I.A. Marks: 30
Credits: 3 Exam. Marks: 70

Course learning objectives:

- Understanding of Information Systems (IS) and their role in organizations;
- Develop knowledge of capabilities of generic software.
- Introduce the business areas to which computers may be applied.
- Provide a basic knowledge of computer hardware and software.

Course Outcomes: After completing the course, the students will be able to,

- Acquire the knowledge about the basic knowledge of computer systems
- Learn the essential requirements of the number systems.
- Understanding the fundamentals of Operating systems and database.
- Aware of computer networks and internetworking.
- Understand the usage of MS - office.
- Understand the basic knowledge of computer hardware and software.
- Understand the main issues related to information policy and strategy

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UNIT-I **9 Hrs.**

Introduction to Computers: History, Generations of Computers, Application of computers in various fields, Classification of computers Block diagram of a computer, Input and output devices – Keyboard, Mouse and other input devices, Output devices – Monitor, Printer and Audio output devices, Storage devices – Primary and secondary storage – RAM, ROM and its types, Magnetic storage devices, Optical Storage devices,

UNIT-II **9 Hrs.**

Operating system: Definition of Operating System - Functions of OS - Types of OS: Single user, Multi-User, multi-task, RTOS, Single-user, Multi-tasking.
Introduction to Computer Networks – Network elements, Objectives and applications of networks, Network types – LAN, WAN and MAN, intranet v/s Internet, Network topologies, Internet services – E-mail, browsing, File services.

UNIT-III **9 Hrs.**

Web designing using HTML: Introduction to HTML, HTML tags, Different types of list – ordered, unordered and definition, linking multiple web pages.
Word Processing: Typing, Editing, Proofing & Reviewing, Formatting Text & Paragraphs, Automatic Formatting and Styles, Working with Tables, Graphics and Frames, Mail Merge, Automating Work & printing Documents.

UNIT-IV **9 Hrs.**

Excel Spreadsheet: Working & Editing in Workbooks, Creating Formats & Links, Formatting a Worksheet & creating graphic objects: Creating Charts (Graphs), formatting and analyzing data, Organizing Data in a List (Data Management), Sharing & Importing Data, Printing. MS Power point: Introduction to presentation – Adding Graphics to the Presentation, Adding Effects to the Presentation- Setting Animation & transition effect.

REFERENCE BOOKS:

1. M.M. Mano, Digital Logic and Computer Design,III edition ,Pearson Education.
2. V.Rajaraman, Fundamentals of Computers, Third Edition, PHI, New Delhi,.
3. T.C.Bartee, Computer Architecture and logical Design, McGraw Hill.
4. C. J. Date, A. Kannan and S. Swamynathan, An Introduction to Database Systems, Pearson Education, Eighth Edition.
5. AtulKahate, Introduction to Database Management Systems, Pearson.
6. Jennifer Niederst Robbins, Learning Web Design, Oreilly Fourth Edition
7. Jon Duckett, Beginning HTML, XHTML, CSS, and JavaScript,Wrox Press Ltd
8. Bill Jelen,Power of EXCEL with MrExcell,Holy Macro! Books
9. Peter Weverka, Office 2019 A L L - I N - O N E for dummies,For Dummies.

25CSH301: MACHINE LEARNING

Hours/Week: 4 I.A. Marks: 30
Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- Understand theoretical foundations of machine learning.
- Master implementation of classical and modern ML algorithms.
- Design and evaluate ML models for real-world problems.
- Explore practical applications through lab sessions and mini-projects.

Course Outcomes: After completing the course, the students will be able to,

- Recognize concept of knowledge representation and predicate logic and transform the real life information in different representation.
- Realize the state space and its searching strategies.
- Understand machine learning concepts and range of problems that can be handled by machine learning.
- Apply the machine learning concepts in real life problems.
- Compare AI with human intelligence and traditional information processing and discuss its strengths and limitations as well as its application to complex and human-centred problems.
- Discuss the core concepts and algorithms of advanced AI, including informed searching Algorithm, Different Types of Machine Learning Approaches
- Apply the basic principles, models, and algorithms of AI to recognize, model, and solve problems in the analysis and design of information systems.

UNIT-I **12 Hrs.**

Introduction to Machine Learning and Deep Learning, Life Cycle, Learning paradigms: supervised, unsupervised, reinforcement, Basic concepts: hypothesis space, generalization, overfitting, Case study discussion: ML/DL applications in real-world.

UNIT-II **12 Hrs.**

Perceptron, Multi-Layer Perceptrons (MLPs), Activation functions: Sigmoid, ReLU, Tanh, GELU, Loss functions, Optimization Algorithms: Adam, Adagrad, RMSProp; Backpropagation, Gradient Descent: Stochastic and Minibatch Gradient; Preventing Overfitting in Neural Networks.

UNIT-III **12 Hrs.**

Deep Neural Networks – Filters and Feature Maps – Description of Convolutional Layer, Maxpooling – Convolution Network Architecture – Image Classification; Deep Architectures: LeNet, AlexNet, VGG, ResNet, DenseNet, Transfer learning and fine-tuning.

UNIT-IV **12 Hrs.**

Recurrent Neural Networks, Bidirectional RNNs; Modern RNNs: Gated Recurrent Units (GRU), Long Short-Term Memory (LSTM), Bidirectional Long Short-Term Memory (BLSTM), Deep Recurrent Neural Network, Generative Adversarial Networks; GAN variants; Autoencoder: Architecture, Denoising and Sparcity.

REFERENCE BOOKS:

1. George F Luger, Artificial Intelligence – Structures and Strategies for Complex problem solving, 5thEdn, pearson.
2. E. Rich, K. Knight, S B Nair, Artificial intelligence, 3rdEdn, McGraw Hill.
3. S. Russel and P. Norvig, Artificial intelligence – A Modern Approach, 3rdEdn, Pearson
4. D W Patterson, Introduction to Artificial Intelligence and Expert Systems, PHI, 1990.
5. EthemAlpaydin, Introduction to Machine Learning- 3rd Edition, PHI.
6. Tom M. Mitchell, Machine Learning, McGraw-Hill.
7. Ian Goodfellow and YoshuaBengio and Aaron Courville, Deep Learning (Adaptive Computation and Machine Learning), MIT Press, 2016.

25CSH302: PRINCIPLES OF CYBER SECURITY

Hours/Week: 4 I.A. Marks: 30
Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- Basics of cyber security and cyber security framework.
- The concept of System Access, Threat and incident management and cyber-attack protection.
- Various techniques to solve cyber security threats and concepts of phishing.
- Cybercrime concepts and security in real time applications.

Course Outcomes: After completing the course, the students will be able to,

- Define and illustrate cyber security concepts and principles
- Analyze the working of cyber security principles to system design
- Apply appropriate techniques to solve cyber security threats
- Evaluate cyber security through network defense controls
- Realize the importance of security in real time applications
- Understand the tools and methods used in cyber security.
- Knows the concept of cybercrime and firewall protection

UNIT-I **12 Hrs.**

Introduction to Cyber Security, Cyberspace and Cyber security, Standards of Good Practice for Information Security, ISO Suite of Information Security Standards, NIST Cyber security Framework and Security Documents, CIS Critical Security Controls for Effective Cyber Defense, COBIT 5 for Information Security, Payment Card Industry Data Security Standard.

UNIT-II **12 Hrs.**

System Access System Access Concepts, User Authentication, Password-Based Authentication, Possession-Based Authentication, Biometric Authentication, Risk Assessment for User Authentication, Access Control, Customer Access. Threat and Incident Management Technical Vulnerability Management, Security Event Logging, Security Event Management, Threat Intelligence, Cyber Attack Protection.

UNIT-III **12 Hrs.**

Phishing and Identity Theft Introduction - Methods of Phishing, Phishing Techniques, Phishing Toolkits and Spy Phishing. Identity Theft – PII, Types of Identity Theft, Techniques of ID Theft. Digital Forensics Science, Need for Computer Cyber forensics and Digital Evidence, Digital Forensics Life Cycle

UNIT-IV **12Hrs.**

Tools and Methods used in Cybercrime Introduction, Proxy Server and Anonymizers, Password Cracking, Key loggers and Spyware, Virus and Worms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow Network Defense tools Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls

REFERENCE BOOKS:

1. William Stallings, Effective Cyber Security: A Guide to Using Best Practices and Standards, Addison-Wesley Professional, ISBN-13: 978-0134772806.
2. Nina Godbole&SunitBelapure, Cyber Security, Wiley India, 2012, ISBN: 9788126521791.
3. Mike Shema, Anti-Hacker Tool Kit (Indian Edition), 4th Edition, Publication McGraw Hill, ISBN: 9789339212155.
4. Nina Godbole and SunitBelpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley Publication, ISBN 9788126521791.

25CSH303: SOFTWARE ENGINEERING

Hours/Week: 4 I.A. Marks: 30
Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- Be agile software developers with a comprehensive set of skills appropriate to the needs of the dynamic global computing-based society.
- Capable of team and organizational leadership in computing project settings, and have a broad understanding of ethical application of computing-based solutions to societal and organizational problems.
- Acquire skills and knowledge to advance their career, including continually upgrading professional, communication, analytic, and technical skills.
- To understand project scheduling concept and risk management associated to various type of projects.

Course Outcomes: After completing the course, the students will be able to,

- Recognize the software engineering and software process.
- Understand different activities of Software process.
- Realize the concepts of agile methods and software testing.
- Learn the techniques of functional and non-functional requirements.
- Familiar with concepts of detailed and object oriented design.
- Define various software application domains and remember different process model used in software development.
- An ability to apply engineering design to produce solutions that meet specified needs.
- Consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

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UNIT-I **12 Hrs.**

Introduction: Professional Software Development, Software Engineering Ethics. Case Studies. Software Processes: Models. Process activities. Coping with Change. The Rational Unified Process.

UNIT-II **12 Hrs.**

Agile Software Development: Agile methods. Plan-driven and agile development. Extreme programming. Agile project management. Scaling agile methods. Requirements Engineering: Functional and non-functional requirements. The software Requirements Document. Requirements Specification. Requirements Engineering Processes. Requirements Elicitation and Analysis. Requirements validation. Requirements Management, Need for SRS, Characteristics of SRS, organization of SRS document.

UNIT-III **12 Hrs.**

Function Oriented Design: Design Principles, Module-Level Concepts, Design Notation and Specification, Structured Design Methodology, Verification, Metrics. Object-Oriented Design: OO Analysis and OO Design, OO Concepts, Design Concepts, Unified Modeling Language (UML), A Dsign Methodology, Metrics.

UNIT-IV **12 Hrs.**

Software Testing: Development testing, Test-driven development, Release testing, User testing. Software Evolution: Evolution processes. Program evolution dynamics. Software maintenance. Legacy system management. Project Planning: Software pricing. Plan-driven development. Project scheduling. Agile planning. Estimation techniques. Quality management: Software quality. Software standards. Reviews and inspections. Software measurement and metrics.

REFERENCE BOOKS:

1. Ian Sommerville, Software Engineering, 9th Edition, Pearson Education, 2012. (Listed topics only from Chapters 1,2,3,4, 5, 7, 8, 9, 24, and24)
2. Roger S. Pressman, Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill. 2013.
3. PankajJalote, An Integrated Approach to Software Engineering, WileyIndia.2010.

25CSS301: INFORMATION RETRIEVAL SYSTEMS

Hours/Week: 4 I.A. Marks: 30
Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- Enable students to understand the various aspects of an Information retrieval system and its evaluation and to be able to design.
- This module aims to give students an understanding of the fundamental techniques for hypermedia architectures, design and usability, document management and retrieval, metadata management, and searching the web.
- Analyze the performance of information retrieval using advanced techniques such as classification, clustering, and filtering over multimedia.
- Analyze ranked retrieval of a very large number of documents with hyperlinks between them.

Course Outcomes: After completing the course, the students will be able to,

- Understanding the basics of Information Retrieval
- Realize the data structures like Inverted Indices used in Information retrieval systems.
- Realize the concepts of agile methods and software testing.
- Learn the different techniques for compression of an index including the dictionary and its posting list.
- Developing the ability of develop a complete IR system from Scratch.
- Understanding the data structures like Inverted Indices used in Information retrieval systems.
- Understanding the different techniques for compression of an index including the dictionary and its posting list.

UNIT-I **12 Hrs.**

Introduction to Information Retrieval: The nature of unstructured and semi-structured text. Basic Text Processing: Tokenization, Stopwords, Stemming, Lemmatization. Spelling correction and Edit distances: Hamming distance, Longest common Subsequence, Levenstein edit distance. Inverted index and Boolean queries. Retrieval using unsupervised techniques: Retrieval using word-embeddings and clustering. Retrieval using Supervised ML: Introduction to Learning to Rank for retrieval, Retrieval using classification.

UNIT-II **12 Hrs.**

Retrieval Models: Boolean, Vector space, TFIDF, Okapi, probabilistic, language modeling, latent semantic indexing. Basic Ranking and Evaluation Measures: Precision, Recall, F-measures, Mean Reciprocal Rank (MRR), Mean Average Precision (MAP), Normalized Discounted Cumulative Gain (NDCG). Designing test collection, relevance judgments. Evaluating search engines. User happiness, precision, recall, Fmeasure. Creating test collections: kappa measure, inter-judge agreement.

UNIT-III **12 Hrs.**

Indexing and Searching: Different Compression Methods: Ziv-Lempel, Variable-Byte, Gamma, Gap encoding. Query Processing: TAAT, DAAT, WAND, Fagin's algorithm. Near Duplicate Detection: Shingling, Min-wise independent permutations, locality sensitive hashing. Text Indexing, Storage and Compression: index optimization. Index compression: lexicon compression and

postings lists compression. Index construction. Postings size estimation, dynamic indexing, positional indexes, n-gram indexes.

UNIT-IV **12 Hrs.**

Summarization, Topic detection and tracking, Personalization, Question Answering, Cross language information retrieval, Multi-lingual information retrieval, Web Information Retrieval: Hypertext, web crawling, search engines, ranking, link analysis, PageRank, HITS.

References

1. Introduction to Information Retrieval, by C. Manning, P. Raghavan, and H. Schütze (Cambridge University Press, 2008).
2. Managing Gigabytes, by I. Witten, A. Moffat, and T. Bell.
3. Information Retrieval: Algorithms and Heuristics, by D. Grossman and O. Frieder.
4. Modern Information Retrieval, by R. Baeza-Yates and B. Ribeiro-Neto.
5. Foundations of Statistical Natural Language Processing, by C. Manning and H. Schütze.
6. Search Engines: Information Retrieval in Practice, by B. Croft, D. Metzler, and T. Strohman.
7. Information Retrieval: Implementing and Evaluating Search Engines, by S. Büttcher, C. Clarke, and G. Cormack.

25CSS302: CLOUD COMPUTING

Hours/Week: 3 I.A. Marks: 30
Credits: 3 Exam. Marks: 70

Course Learning Objectives:

- Characteristics and design principles of grid and cloud computing.
- Security mechanisms in grid and cloud computing applications.
- Designing methodologies of distributed computing and Importance of cloud computing environments.
- The concepts of virtualization and use of cloud service models.

Course Outcomes: After completing the course, the students will be able to,

- Demonstrate in-depth understanding characteristics of grid and cloud computing.
- Demonstrate an in-depth understand of the design principles of grid and cloud computing.
- Illustrate security mechanisms in grid and cloud computing applications.
- Design and demonstrate distributed computing applications.
- Understand the importance of cloud computing environments.
- Understand cloud based data storage, cloud based database solutions and research trends in cloud computing.
- Analyze cloud security issues and applications of Fog computing.

UNIT-I **9 Hrs.**

Cloud computing basics: - Cloud computing components- Infrastructure-services-storage applications database services – Deployment models of Cloud- Services offered by Cloud- Benefits and Limitations of Cloud Computing – Issues in Cloud security- Cloud security services and design principles.

UNIT-II **9 Hrs.**

Virtualization fundamentals: Virtualization – Enabling technology for cloud computing- Types of Virtualization- Server Virtualization- Desktop Virtualization – Memory Virtualization – Application and Storage Virtualization- Tools and Products available for Virtualization.

UNIT-III **9 Hrs.**

SAAS and PAAS: Getting started with SaaS - Understanding the multitenant nature of SaaS solutions- Understanding OpenSaaS Solutions- Understanding Service Oriented Architecture- PaaS- Benefits and Limitations of PaaS. Security as a Service

UNIT-IV **9 Hrs.**

IAAS and cloud data storage: - Understanding IaaS- Improving performance through Load balancing- Server Types within IaaS solutions- Utilizing cloud based NAS devices – Understanding Cloud based data storage- Cloud based database solutions- Cloud based block storage. Cloud Applications and security: Open Source and Commercial

Clouds, Cloud Simulators, Research trends in Cloud Computing, Fog Computing and applications, Cloud Security challenges.

REFERENCE BOOKS:

1. R. Buyya, C. Vecchiola, S T. Selvi, Mastering Cloud Computing, McGraw Hill (India) Pvt Ltd., 2013
2. Kris Jamsa, Cloud Computing: SaaS, PaaS, IaaS, "Virtualization, Business Models, Mobile, Security and more, Jones & Bartlett Learning Company, 2013
3. Ronald L.Krutz, Russell vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley Publishing Inc., 2010.
4. Gautam Shroff, Enterprise Cloud Computing - Technology, Architecture, Applications, Cambridge University Press, 2010
5. Anthony T .Velte, Toby J.Velte, Robert Elsenpeter, Cloud Computing: A Practical Approach, Tata McGraw Hill Edition, Fourth Reprint, 2010
6. Ronald L. Krutz, Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley- India, 2010.
7. Antonopoulos, Nick; Gillam, Lee, Cloud Computing Principles, Systems and Applications, Springer, 2010.
8. G. Reese, Cloud Application Architecture, O'Reilly, 2009.

25CSS303: NATURAL LANGUAGE PROCESSING

Hours/Week: 4 I.A. Marks: 30
Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- Understand the foundational concepts and linguistic challenges involved in NLP, especially for multilingual and Indian languages.
- Apply standard text preprocessing techniques and tokenization schemes to prepare text for NLP tasks.
- Explain and compare classical text representation techniques and embeddings, including contextual and non-contextual word representations.
- Implement key NLP tasks using classical models (e.g., POS tagging, NER, text classification, topic modeling).
- Analyze the structure and functionality of neural architectures such as RNNs, LSTMs, and Transformers.
- Use and fine-tune modern large language models (e.g., BERT, GPT) for downstream applications like summarization and question answering.
- Critically evaluate the performance and limitations of traditional and modern NLP techniques.

Course Outcomes: After completing the course, the students will be able to,

- Describe the fundamentals of NLP and the linguistic challenges specific to Indian and multilingual contexts.
- Perform text preprocessing and tokenization using classical and modern tokenization schemes.
- Construct and compare word, sentence, and document embeddings using BoW, TF-IDF, Word2Vec, GloVe, and BERT.
- Build classical NLP models for tasks such as language modeling, classification, POS tagging, and NER.
- Explain and analyze neural architectures like RNNs, LSTMs, and Transformers used in modern NLP.
- Utilize pretrained LLMs (BERT, GPT, etc.) for real-world applications and perform basic prompt engineering.
- Evaluate NLP models based on performance metrics and interpret their limitations in different domains.

UNIT-I **12 Hrs.**

Foundations of NLP: Introduction to NLP and its applications, Challenges of processing Indian languages; Challenges in NLP – Ambiguity, Data Sparsity, Domain Adaptation; Text Preprocessing - Normalization, Lemmatization, Stemming, Stopword Removal; Tokenization – Types of Tokenization - Character, Word, ngrams, Subword, and Sentence Tokenization; Tokenization schemes **-** Whitespace tokenization, punctuation-based tokenization, Byte Pair Encoding (BPE), WordPiece.

UNIT-II **12 Hrs.**

Text Representation Techniques: Basic Representations - Bag-of-Words (BoW), TF, TF-IDF; Limitations, One-hot Encoding vs. Dense Representations; Word Embeddings - Word2Vec, GloVe, FastText; Limitations; Contextual Embeddings - ELMo, BERT, GPT; Sentence and Document Embeddings - SBERT, USE.

UNIT-III **12 Hrs.**

NLP Tasks and Classical Models: Language Modeling - n-gram models, Laplace Smoothing; Text Similarity and Clustering; Topic Modeling – LDA; Text Classification - Sentiment Analysis, Spam Detection; Part-of-Speech (POS) Tagging, Named Entity Recognition (NER).

UNIT-IV **12 Hrs**.

Neural Architectures and Large Language Models: Sequence Models: RNN, LSTM, GRU – Concepts and Limitations, Transformer Architecture - Self-Attention, Positional Encoding, BERT and its variants (RoBERTa, ALBERT, DistilBERT); GPT Models (GPT-2, GPT-3, GPT-4) - Capabilities and Limitations; Prompt Engineering and Fine-tuning Pre-trained Models; Applications of LLMs - Summarization, Translation, Q&A.

REFERENCE BOOKS:

1. Daniel Jurafsky and James H. Martin. 2020. Speech and Language Processing. 3rd Edition (draft)
2. Christopher D. Manning and Hinrich Schütze. 1999. Foundations of Statistical Natural Language Processing. MIT Press.
3. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana. 2020. Practical Natural Language Processing. O'Reilly.
4. Hobson Lane, Cole Howard, Hannes Hapke. 2019. Natural Language Processing in Action. Live Book.
5. Denis Rothman - Transformers for NLP
6. Yoav Goldberg - Neural Network Methods for NLP
7. Natural Language Processing with Python – Bird, Klein, Loper
8. Hugging Face Docs: https://huggingface.co/learn

25CSS304: SOFT COMPUTING PARADIGM

Hours/Week: 4 I.A. Marks: 30
Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- Understand Soft Computing concepts, technologies, and applications.
- Understand the underlying principle of soft computing with its usage in various applications.
- Understand different soft computing tools to solve real life problems.
- Develop application on different soft computing techniques like Fuzzy, GA and Neural network.

Course Outcomes: After completing the course, the students will be able to,

- Understand the fundamentals of Soft computing approaches and demonstrate the basic functionalities
- Apply the soft computing techniques to solve problems
- Analyze the results of soft computing techniques to handle various problems
- Evaluate the solutions of soft computing algorithms for optimization
- Aware of concepts with the real time applications
- Implement Neuro-Fuzzy and Neuro - Fuzz-GA expert system.
- Understand the Neural Networks, architecture, functions and various algorithms involved.

UNIT-I 12Hrs.

Introduction to soft Computing Paradigm, Artificial Neural Networks – fundamental concepts, Evolution, Basic models, important terminologies, MP – Neuron, Linear separability, Hebb network. Supervised learning networks – Perceptron network: Theory, Learning rule, Architecture, Training process, Training algorithm for single output class. Back-propagation network: theory, Architecture, training process, learning factors, testing.

UNIT-II 12Hrs.

Associative Memory networks: introduction, Training algorithms for pattern association: Hebb rule, Outer Products rule. Auto associative Memory Networks: Theory, architecture, training process and algorithm, testing. Unsupervised Learning networks: Kohenen self-Organizing feature maps: Theory, Architecture, Training algorithm. Adaptive Resonance Network – Theory: fundamental architecture, operating principle and algorithm. ART-1: Architecture, training process and algorithm.

UNIT-III 12Hrs.

Introduction: Fuzzy systems – Historical perspective, Utility and limitations, uncertainty and information, fuzzy sets and membership, Chance vs Fuzziness. Classical sets and Fuzzy sets: Classical set (Operations, properties, mapping to functions). Fuzzy sets (operations, properties, Alternative fuzzy set operations). Classical Relations and Fuzzy relations: Cartesian product, crisp relations (cardinality, operations, properties, composition), Fuzzy relations (cardinality, operations, properties, Fuzzy Cartesian products and composition),

Tolerance and equivalence relation, Crisp equivalence and tolerance relations, Fuzzy tolerance and equivalence relations

UNIT-IV **12Hrs.**

Properties of membership functions, Fuzzification and Defuzzification: Features of the membership functions, various forms, Fuzzification, Defuzzification to crisp sets, λ-cuts for fuzzy relations, Defuzzification to scalars. Logic and Fuzzy systems: Classical logic, proof, Fuzzy logic, approximate reasoning, other forms of the implication operation. Genetic Algorithms: Fundamentals of genetic algorithm: history, basic concepts, creation of off-springs, working principle, Encoding, fitness function, reproduction. Genetic modeling: inheritance operators, cross over, inversion and deletion, Mutation operators, Bit- wise operators used in GA, Generational cycle, convergence, application (any one).

REFERENCE BOOKS:

1. B. Yegnanarayana, Artificial Neural Networks, PHI
2. Satish Kumar, Neural Networks a class room approach, 2ndEdn, McGraw Hill.
3. Ross, Fuzzy Logic with Engineering Applications, 3rdEdn, Wiley India.
4. Sivanandan, Deepa, Principles of Soft Computing, 2ndEdn, Wiley India.
5. Rajasekharan and Viajayalakshmipai, Neural Networks, Fuzzy Logic and Genetic Algorithm, PHI, 2003. (For Unit 4).
6. S. N. Sivanandam, S. N. Deepa,Soft Computing, 2 nd Edition, 2015, Wiley Publishers, ISBN – 978- 81-265-2741-0
7. B. K. Tripathi, J. Anuradha, Soft Computing Advances and Applications, 2015, Cengage Learning India Pvt Ltd, ISBN-13: 978-81-315-2619-4, ISBN-10: 81-315-2619-4.
8. Earl Gose, Richard JohnsonBaugh, Steve Jost, Pattern Recognition and Image Analysis, Pearson, ISBN: 978-93-325-4979-1
9. James A. Anderson, An Introduction to Neural Networks, Prentice Hall of India, ISBN-81-203-1351-8.

25CSS305: BLOCK CHAIN MANAGEMENT

Hours/Week: 4 I.A. Marks: 30
Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- Basics of block chain management and Fundamentals of the design principles of Bitcoin and Ethereum.
- Advantages of Block chain over distributed computing.
- Solutions of soft computing algorithms for optimization.
- Designing, building and deploying smart contracts and distributed applications.

Course Outcomes: After completing the course, the students will be able to,

- Understand the fundamentals of the design principles of Bitcoin and Ethereum.
- Explain the Simplified Payment Verification protocol.
- Interact with a block chain system by sending and reading transactions.
- Evaluate the solutions of soft computing algorithms for optimization.
- Design build and deploy smart contracts and distributed applications.
- Easily Analyze regulations of crypto currency.
- Evaluate roots of bitcoin and the applications of crypto currency.

UNIT-I 12Hrs.

Basics of Block Chain Management, Distributed Database, Two General Problem, Byzantine General Problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete, Cryptography: Hash function, Digital Signature - ECDSA, MemoryHard Algorithm, Zero Knowledge Proof.

UNIT-II 12Hrs.

Blockchain: Introduction, Advantage over Conventional Distributed Database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public Blockchain.

UNIT-III 12Hrs.

Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate. Crypto currency:History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin.

UNIT-IV 12Hrs.

Crypto Currency Regulations: Stakeholders, Roots of Bit Coin, Legal Aspects-Crypto Currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and Future of Blockchain.

REFERENCE BOOKS:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press, 2016.
2. Antonopoulos, Mastering .Bitcoin: Unlocking Digital Cryptocurrencies
3. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
4. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
5. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum smart contracts.

25CSP301: MACHINE LEARNING LAB

Hours/Week: 6 I.A. Marks: 30
Credits: 3 Exam. Marks: 70

The practical problems shall be based on AI and ML theory concepts and C#/Java/Python language shall be considered for implementation

25CSP302: PRINCIPLES OF CYBER SECURITY LAB

Hours/Week: 6 I.A. Marks: 30
Credits: 3 Exam. Marks: 70

The practical problems shall be based on cyber security theory concepts and C#/Java/Python language shall be considered for implementation

25CSP303: SOFTWARE ENGINEERING Lab

Hours/Week: 6 I.A. Marks: 30
Credits: 3 Exam. Marks: 70

The practical problems shall be based on software engineering theory concepts and C#/Java/Python language shall be considered for implementation

25CSM301: Mini Project and Domain Knowledge Seminar

Hours/Week: 6 I.A. Marks: 30
Credits: 3 Exam. Marks: 70

The mini project problems shall be based on theory concepts they have studied in the first three semesters or research works of interest shall be taken-up and C#/Java/Python language shall be considered for implementation.

Domain knowledge seminar shall be conducted two hours in a week on a roll number basis where each student shall chose the topic by having discussion with allotted guide and present the same on the scheduled slot.

25CSE301: Digital Fluency – Tools and Techniques

Hours/Week: 3 I.A. Marks: 30
Credits: 3 Exam. Marks: 70

Course Learning Objectives:

- To equip students from all disciplines with the practical digital skills, tools, and critical thinking required to thrive in an increasingly digital world personally, academically, and professionally.

Course Outcomes: After completing the course, the students will be able to,

- Demonstrate proficiency in using operating systems, cloud storage, and collaboration tools.
- Apply smart search techniques and assess the credibility of online content.
- Practice responsible digital citizenship, including cybersecurity and netiquette.
- Utilize social media and emerging technologies (e.g., AI, automation) for personal and professional branding.

UNIT – I **9 Hrs.**

Foundations of Digital Fluency - Introduction to Digital Fluency: Difference between digital literacy and digital fluency, Importance of digital skills in education, careers, and daily life, Overview of the digital landscape (cloud computing, IoT, AI, mobile tech).
Digital Tools for Productivity: Collaboration tools (Google Docs, Sheets, Slides), Peripheral devices (printers, scanners, external drives), Basic troubleshooting (Wi-Fi issues, software updates).

UNIT-II **9 Hrs.**

Digital Communication & Internet Literacy - Professional Communication: Email etiquette (subject lines, signatures, tone), Calendar management (Google Calendar, Outlook), Video conferencing (Zoom, Google Meet, Teams).
Smart Search & Online Research: How the internet works (ISPs, DNS, browsers), Advanced search operators (Google, Bing), Evaluating sources (bias, fact-checking, Wikipedia reliability).

UNIT-III **9 Hrs.**

Cybersecurity & Digital Citizenship - Online Safety: Cyber threats (malware, phishing, social engineering), Password managers and two-factor authentication (2FA), Secure browsing (VPNs, HTTPS, incognito mode).
Privacy & Ethics: Digital footprint (social media, cookies, tracking), Privacy laws (GDPR, data protection), Ethical dilemmas (cancel culture, trolling).

Social Media Responsibility: Professional vs. personal branding (LinkedIn, Instagram), Cyberbullying and reporting mechanisms, Content sharing permissions (Creative Commons, fair use).

UNIT-IV **9 Hrs.**

Emerging Tools & Digital Branding - Content Creation: Graphic design (Canva, Adobe Express), Blogging (WordPress, Medium), Podcasting/video editing basics (Anchor, iMovie).
AI & Automation: Introduction to ChatGPT, Grammarly, DALL·E, Workflow automation (Zapier, Notion AI), Pros/cons of AI in education and work, smart assistants (Alexa, Google Home).

REFERENCE BOOKS:

1. "Digital Literacy for Dummies" by Faithe Wempen, Publisher: Wiley (2015)
2. "The Digital Citizen: A Guided Tour" by Christian Payne, Publisher: Kogan Page (2021)
3. "Cybersecurity for Beginners" by Raef Meeuwisse, Publisher: Apress (2022)
4. "Social Media Communication: Concepts, Practices, Data, Law and Ethics" by Jeremy Harris Lipschultz, Publisher: Routledge (2023)
5. "AI for Everyone: How Artificial Intelligence is Changing Our Lives" by Jeff Johnson, Publisher: No Starch Press (2023)

25CSP401: DISSERTATION AND VIVA VOCE

Hours/Week: 32 I.A. Marks: 100
Credits: 16 Max. Marks: 400

Dissertation & Viva-voce Exam

Dissertation Report Valuation - 200 marks
Viva - Voce - 100 marks
Total marks: 300

Course Learning Objectives:

- To offer students a glimpse into real world problems and challenges that need IT based solutions.
- To enable students to create very precise specifications of the IT solution to be designed.
- To introduce students to the vast array of literature available of the various research challenges in the field of IT.
- To create awareness among the students of the characteristics of several domain areas where IT can be effectively used.

Course Outcomes: After completing the course, the students will be able to,

- Discover potential research/project areas in the field of IT.
- Conduct a survey of several available literature in the preferred field of study.
- Compare and contrast the several existing solutions for research/project challenges.
- Demonstrate an ability to work in teams and manage the conduct of the research study.
- Formulate and propose a plan for creating a solution for the research/project plan identified.
- Report and present the findings of the study conducted in the preferred domain.
- Improve communication and management skills of the students.
