ಮಂಗಳೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ

MANGALORE UNIVERSITY

(Accredited by NAAC with 'A' Grade)

ಕ್ರಮಾಂಕ/ No. : MU/ACC/CR 33/2022-23/A2

ಕುಲಸಚಿವರ ಕಛೇರಿ
ಮಂಗಳಗಂಗೋತ್ರಿ – 574 199
Office of the Registrar
Mangalagangothri – 574 199
ದಿನಾಂಕ/Date:10.10.2022

NOTIFICATION

Sub: Revised syllabus of M.Sc. Computer Science programme.
Ref: Academic Council approval vide agenda
No.: ಎಸಿಸಿ:ಶೈ.ಸಾ.ಸ.2:17(2022–23) dtd 27.09.2022.

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The revised syllabus of M.Sc. Computer Science programme which is approved by the Academic Council at its meeting held on 27.09.2022 is hereby notified for implementation with effect from the academic year 2022-23.

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

REGISTRAR

To,

1. The Chairman, Dept. of Post Graduate Studies and Research in Computer Science, Mangalore University, Mangalagangothri.
2. The Chairman, P.G. BOS in Computer Science, Dept. of Post Graduate Studies and Research in Computer Science Mangalore University, Mangalagangothri.
3. The Registrar (Evaluation), Mangalore University.
4. The Principals of the college concerned.
5. The Superintendent (ACC), O/o the Registrar, Mangalore University.
6. The Asst. Registrar (ACC), O/o the Registrar, Mangalore University.
7. The Director, DUIMS, Mangalore University – with a request to publish in the website
8. 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) (2022-23)

POST-GRADUATE DEPARTMENT OF STUDIES AND RESEARCH IN COMPUTER SCIENCE
MANGALORE UNIVERSITY, MANGALAGANGOTHRI, KONAJE – 574 199
SEPTEMBER - 2022

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 Patten 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								
22CSH101	Mathematical Foundations of Computer Science	4L	-	3	30	70	100	4
22CSH102	Advanced Data Structures and Algorithms	4L	-	3	30	70	100	4
22CSH103	Data Communications and Computer Networks	4L	-	3	30	70	100	4
22CSH104	Advanced Operating System	4L	-	3	30	70	100	4
SOFT CORE [Any ONE course shall be selected from the list of courses]								
22CSS105	.NET Technology	4L	-	3	30	70	100	4
22CSS106	Android Programming	4L	-	3	30	70	100	4
22CSS107	Computer Graphics and Multimedia	4L	-	3	30	70	100	4
PRACTICALS [Two practical courses shall be selected from the list]								
22CSP108	Advanced Data Structures and Algorithms Lab	-	6	3	30	70	100	3
22CSP109	.NET Technology Lab	-	6	3	30	70	100	3
22CSP110	Android Programming Lab	-	6	3	30	70	100	3
22CSP111	Computer Graphics and Multimedia 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								
22CSH201	Internet of Things	4L	-	3	30	70	100	4
22CSH202	Principles of Data Science	4L	-	3	30	70	100	4
22CSH203	Advanced Database Management Systems	4L	-	3	30	70	100	4
SOFTCORE [Any ONE course shall be selected from the list of courses]								
22CSS204	Image Processing	4L	-	3	30	70	100	4
22CSS205	Big Data Analytics	4L	-	3	30	70	100	4
22CSS206	Wireless Sensor Networks	4L	-	3	30	70	100	4
22CSS207	Mobile Computing	4L	-	3	30	70	100	4
22CSS208	Embedded Systems	4L	-	3	30	70	100	4
PRACTICAL [Two practical courses shall be selected from the list]								
22CSP209	Principles of Data Science Lab	-	6	3	30	70	100	3
22CSP210	Internet of Things Lab	-	6	3	30	70	100	3
22CSP211	Image Processing Lab	-	6	3	30	70	100	3
22CSP212	Big Data Analytics Lab	-	6	3	30	70	100	3
OPEN ELECTIVE								
22CSE213	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								
22CSH301	Artificial Intelligence and Machine Learning	4L	-	3	30	70	100	4
22CSH302	Principles of Cyber Security	4L	-	3	30	70	100	4
22CSH303	Software Engineering	4L	-	3	30	70	100	4
SOFT CORE [Only ONE course shall be selected from the list of courses]								
22CSS304	Information Retrieval Systems	4L	-	3	30	70	100	4
22CSS305	Cloud Computing	4L	-	3	30	70	100	4
22CSS306	Natural Language Processing	4L	-	3	30	70	100	4
22CSS307	Soft Computing Paradigm	4L	-	3	30	70	100	4
22CSS308	Block Chain Management	4L	-	3	30	70	100	4
PRACTICALS [One practical course shall be selected from the list]								
22CSP309	Artificial Intelligence and Machine Learning Lab	-	6	3	30	70	100	3
22CSP310	Principles of Cyber Security Lab	-	6	3	30	70	100	3
22CSP311	Software Engineering Lab	-	6	3	30	70	100	3
22CSM312	Mini Project and Domain Knowledge Seminar	-	6	3	30	70**	100	3
OPEN ELECTIVE								
22CSE313	Data Analytics Tools	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
22CSP401	Dissertation and Viva-Voce	32	__	100	300 (Report :200 Viva-Voce: 100)	400	16
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						400	16
GRAND TOTAL CREDITS OF ALL THE FOUR SEMESTERS						2500	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.

List of Hard Core, Soft Core and Elective Courses

Hard Core Courses			
Sl. No.	Course Code	Course Title	Total Credits
1.	22CSH101	Mathematical Foundation for Computer Science	4
2.	22CSH102	Advanced Data Structures and Algorithms	4
3.	22CSH103	Data Communications and Computer Networks	4
4.	22CSH104	Advanced Operating Systems	4
5.	22CSH201	Internet of Things	4
6.	22CSH202	Principles of Data Science	4
7.	22CSH203	Advanced Database Management Systems	4
8.	22CSH301	Artificial Intelligence and Machine Learning	4
9.	22CSH302	Principles of Cyber Security	4
10	22CSH303	Software Engineering	4
11	22CSP401	Dissertation and viva voce examination	16
TOTAL			56

Soft Core Courses			
Sl. No.	Course Code	Course Title	Total Credits
1.	22CSS105	. Net Technology	4
2.	22CSS106	Android Programming	
3.	22CSP107	Computer Graphics and Multimedia	
4.	22CSP108	Advanced Data Structures Lab	3+3
5.	22CSP109	. Net Technology Lab	
6.	22CSP110	Android Programming Lab	
7.	22CSP111	Computer Graphics and Multimedia Lab	
8.	22CSS204	Image Processing	4
9.	22CSS205	Big Data Analytics	
10.	22CSS206	Wireless Sensor Networks	
11.	22CSS207	Mobile Computing	
12.	22CSS208	Embedded Systems	
13.	22CSP209	Principles of Data Science	3+3
14.	22CSP210	Internet of Things Lab	

15.	22CSP211	Image Processing Lab	
16.	22CSP212	Big Data Analytics Lab	
17.	22CSS304	Information Retrieval Systems	4
18.	22CSS305	Cloud Computing	
19.	22CSS306	Natural Language Processing	
20.	22CSS307	Soft Computing Paradigm	
21.	22CSS308	Block Chain Management	
22.	22CSS309	Artificial Intelligence & Machine Learning Lab	3
23.	22CSP310	Principles of Cyber Security Lab	
24.	22CSP311	Software Engineering Lab	
25.	22CSM312	Mini Project and Domain Knowledge Seminar	3
Total			30

Open Elective Courses			
Sl. No.	Course Code	Course Title	Total Credits
1	22CSE213	Introduction to Information Technology	3*
2	22CSE313	Data Analytics Tools	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*	(6.52%)

MANGALORE UNIVERSITY

SYLLABUS FOR TWO YEARS MSc PROGRAMME

CBCS PATTERN: 2022-23

POST-GRADUATE DEPARTMENT OF STUDIES AND RESEARCH IN COMPUTER SCIENCE
MANGALORE UNIVERSITY, MANGALAGANGOTHRI, KONAJE – 574 199
SEPTEMBER - 2022

22CSH101: 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,

CO1: 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.

CO2: Gain the knowledge of computing and mathematics appropriate to the discipline.

CO3: 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.

CO5: Understand the design and development principles in the construction of software systems of varying complexity.

CO6: Ability to write and evaluate a proof or outline the basic structure of and give examples of each proof technique described.

CO7: Understand Model problems in Computer Science using graphs and trees.

UNIT-I 12Hrs.

Review of Sets, Propositions, Relations, Functions, Graphs, Introduction to Probability Theory: Sample Space, Random Variables, Probability Distributions, Expected Values, Joint Distributions, Variance, Covariance.

UNIT-II 12Hrs.

Basic Logic: Propositional Logic: Logical Connectives; Truth Tables; Normal Forms (Conjunctive And Disjunctive); Validity; 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; Well Orderings.

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 and Linear Bounded Automata: TM model, Representation and Design of TM, Halting problem, Universal TM and modifications, Linear bounded automata.

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 edition, 2013.
3. K. S. Trivedi, Probability and Statistics with Reliability, Queuing and Computer Science Applications, First Edition, Prentice Hall ofIndia. 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. *KLPMishraandNChandrashekar, Theory of Computer Science, 3rd Edition, PHI* publication, 2007.

22CSH102: 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,

CO1: Ensure that the student evolves as a competent programmer capable of design, analyze and implement algorithms and data structures for different kinds of problems.

CO2: Expose the student to the algorithm analysis techniques, to the theory of reductions, and to the classification of problems into complexity classes like NP.

CO3: Design and analyze programming problem statements, choose appropriate data structures and algorithms for a specific problem.

CO4: Understand the necessary mathematical abstraction to solve problems, Come up with analysis of efficiency and proofs of correctness.

CO5: Comprehend and select algorithm design approaches in a problem specific manner.

CO6: Come across the importance of graphs and their features for the applications uses.

CO7: 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, Introduction to B Trees, Comparison of Search Trees. Heaps: Representation, Insertion and Deletion on Heaps.

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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, Finding Maximum and Minimum, Merge Sort, Greedy method- Job sequencing with deadlines, Backtracking- 8 Queens problem, sum of

subsets, Branch and Bound- 0/1 Knapsack problem, Dynamic Programming – Optimal Binary Search Tree, 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. AnanyLevitin, "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.

22CSH103: 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,

CO1: Understanding the basic communication concepts in real time applications
CO2: Identify the different networking and internetworking devices and their functions within a network
CO3: Familiar with the protocols in DC and CN
CO4: know the Importance of ISO - OSI and TCP / IP reference model.
CO5: Clearly understand the importance of services of all layers.
CO6: Come across with the architecture of a number of different networks.
CO7: 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 TransportLayer.

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

22CSH104: 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,

CO1: Understand the structure of OS and basic architectural components involved in OS design.

CO2: Analyze and design the applications to run in parallel either using process or thread models of different OS.

CO3: Study the various device and resource management techniques for time sharing and distributed systems.

CO4: Recognize the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system.

CO5: Interpret the mechanisms adopted for file sharing in distributed Applications.

CO6: Evaluate the requirement for process synchronization and coordination handled by OS.

CO7: 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 Scheduling, Windows Vista Scheduling.

Virtual Memory : Hardware and Control Structures, Operating System Software, UNIX and Solaris Memory Management, Linux Memory Management, Windows Vista Memory Management, Summary.

UNIT-III 12Hrs.

Threads, SMP, and Microkernel: Processes and Threads, Symmetric Multiprocessing (SMP), Microkernels, Windows Vista Thread and SMP Management, Solaris 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.

The Windows NT/2000/XP kernel: Introduction, The NT kernel, Objects, Threads, Multiplication Synchronization, Traps, Interrupts and Exceptions, The NT executive , 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.

22CSS105: .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,

CO1: Understand .NET framework, its runtime environment and application development using IDE of Visual Studio 2010 and higher versions.

CO2: Develop well-defined programs using the C# programming language; learn to use Windows forms and to create GUI-based programs.

CO3: Able to apply the principles of object-oriented programming and develop assemblies and deployment in .NET.

CO4: Apply and build web applications and validation form data using validation controls.

CO5: Create dynamic web applications that interact with a database using server-side programming.

CO6: Understand Constructing classes, method sand instantiate objects.

CO7: 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.

22CSS106: 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,

CO1: Demonstrate their understanding of the fundamentals of Android operating systems
CO2: Show their skills of using Android software development tools
CO3: Develop software with reasonable complexity and their design aspects.
CO4: Deploy software to mobile devices and debug the programs
CO5: Understands the working of Android OS Practically and able to develop, deploy and maintain the Android Applications.
CO6: Understands the concept of persistent storage and develop User Interface.
CO7: 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 -

22CSS107: COMPUTER GRAPHICS AND MULTIMEDIA

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

Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- The use of the components of a graphics system and become familiar with building approach of graphics system components
- To implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.
- Describe the importance of viewing and projections and understand a typical graphics pipeline.
- The fundamentals of animation, virtual reality and its related technologies.

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

CO1: Understand and appreciate the nature of discreteness of displayed graphics on computer screens
CO2: Realize perspective projection with 3D rotations.
CO3: Concepts of graphics algorithms for computing the coordinates of pixels that comprise lines and circles.
CO4: Familiar with practical approaches of the clipping lines and polygons
CO5: Understand the concepts of drawing smooth curves and learn about 3D graphics.
C06: Identify the basic problems to be solved in graphic computing, and the specific algorithms.
C07: Identify the best methodologies that can be applied for the conceptualization, design.

UNIT-I 12Hrs.

Introduction: Survey of computer Graphics and its applications; Interactive and passive Graphics; A graphics system: Video display devices, raster scan and random scan system

Elementary Concepts: Pixels and Device Coordinates, Logical Coordinates, Anisotropic and Isotropic Mapping Modes, Defining a Polygon through Mouse Interaction.

UNIT-II 12Hrs.

Geometrical Transformations: Matrix Multiplication, Linear Transformations, Translations, Homogeneous Coordinates, Inverse Transformations and Matrix Inversion, Rotation about an Arbitrary Point, Changing the Coordinate System, Rotations about 3D Coordinate Axes. Classic 2D Algorithms: Bresenham Line drawing , Circle Drawing ,Cohen–Sutherland Line Clipping , Sutherland–Hodgman Polygon Clipping .

UNIT-III 12Hrs.

Perspective and 3D Data Structure: Introduction, Viewing Transformation, Perspective Transformation, A Cube in Perspective, Specification and Representation of 3D Objects, Some Useful Classes. Hidden-Line and Hidden-Face Removal: Hidden-Line Algorithm, Back face Culling, Painter's Algorithm, Z-Buffer Algorithm.

UNIT-IV 12Hrs.

An Introduction: Multimedia applications; Multimedia System Architecture; Evolving technologies for Multimedia; Defining objects for Multimedia systems; Multimedia Data Interface standards ; Multimedia Databases; Compression & Decompression ; Data & File Format standards; Digital voice and audio; video image and animation ; Full motion video ;Storage and retrieval Technologies; Multimedia Authoring & User Interface; Hypermedia Messaging; Mobile Messaging; Virtual Reality.

REFERENCE BOOKS:

1. Edward Angel, Interactive Computer Graphics A Top-Down Approach with OpenGL 5th Edition, Addison-Wesley, 2008.
2. Leen Ammeraal, Kang Zhang, Computer Graphics for Java Programmers,3rd Edition, Springer International Publishing AG 2017.
3. Prabat K Andleigh and KiranThakrar, "Multimedia Systems and Design", PHI, 2003.
4. Donald Hearn and Pauline Baker, Computer Graphics – OpenGL, Version 2nd Edition, Pearson Education, 2003.

22CSP108: Advanced Data Structures and Algorithms lab

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

Course Learning Objectives:

- Understand and remember algorithms and its analysis procedure.
- Introduce the concept of data structures through ADT including List, Stack, and Queues.
- 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,

CO1: Select appropriate data structures as applied to specified problem definition.
CO2: Implement operations like searching, insertion, and deletion, traversing mechanism etc
CO3: Students will be able to implement linear and Non-Linear data structures.
CO4: Design advance data structure using Non-Linear data structure.
CO5: Implement appropriate sorting/searching technique for given problem.
CO6: Determine and analyze the complexity of given Algorithms.
CO7: To develop application using data structure algorithms.

22CSP109: .NET PROGRAMMING LAB

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

Course Learning Objectives:

- Introduce to .Net IDE Component Framework.
- Programming concepts in .Net Framework.
- Object Oriented Concepts in programming
- Creating web pages using C#.Net Controls.

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

CO1: Create user interactive web pages using C#.Net.
CO2: Create programs which demonstrate the features of object oriented programming.
CO3: Handle events and exceptions using C#.NET.
CO4: Perform file operations using c#.NET.
CO5: Perform Database operations for Windows Form and web applications.
CO6: Creating shared preferences, saving and retrieving data using Shared Preference Database.
CO7: Practically understand the OOPs programming concepts.

22CSP110: ANDROID PROGRAMMING LAB

Hours/Week: 6 I.A. Marks: 30

Credits: 3 Exam. Marks: 70

Course Learning Objectives:

- To gain knowledge of installing Android Studio and Cross Platform Integrated Development Environment.
- The designing of User Interface and Layouts for Android App.
- How to use intents to broadcast data within and between Applications.
- The content providers and Handle Databases using SQLite.

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

CO1: Experiment on Integrated Development Environment for Android Application Development.
CO2: Design and Implement User Interfaces and Layouts of Android App.
CO3: Use Intents for activity and broadcasting data in Android App.
CO4: Design and Implement Database Application and Content Providers.
CO5: Experiment with Camera and Location Based service and develop Android App with Security features.
CO6: To introduce Android APIs for Camera and Location Based Service.
CO7: To discuss various security issues with Android Platform

22CSP111: Computer Graphics and Multimedia Lab

Hours/Week: 6 **I.A. Marks: 30**

Credits: 3 **Exam. Marks: 70**

Course Learning Objectives:

- To underlying modern Computer Graphics and Machine Vision.
- The need of developing graphics application.
- To acquire algorithmic development of graphics primitives like: line, circle, polygon etc.
- The representation and transformation of graphical images and pictures.

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

CO1: Draw Geometric primitives using OpenGL.
CO2: Execute scan line polygon filling using OpenGL.
CO3: Implement basic transformations on objects using OpenGL.
CO4: Implement clipping algorithm on lines using OpenGL.
CO5: Execute 2D and 3D geometric transformations.
CO6: Implement Illumination models and surface rendering methods.
CO7: Practically implement the various design aspects of the Graphics.

22CSH201: 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,

CO1: Understand the impact of IoT applications and Architectures in real world
CO2: Realize the various IoT Protocols (Datalink, Network, Transport, Session, Service)
CO3: Differentiate between the levels of the IoT stack and be familiar with the key technologies
CO4: Interface different sensors to arduinouno and raspberry pi to read the environment data.
CO5: Appreciate the role of big data, cloud computing and data analytics in a typical IoT system
CO6: Provide an overview on the ICT ecosystem and enabling environment to foster IoT
C07: 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 Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

UNIT-III 12Hrs.

Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTP Lib. IoT Physical Devices and Endpoints -- Introduction to Arduino, Arduino UNO, Fundamentals of Arduino Programming. Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

UNIT-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: 9789350239759.

22CSH202: Principles of Data Science

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

Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- The probability distributions and density estimations to perform analysis of various kinds of data
- The statistical analysis techniques using Python and R programming languages.
- Expand the knowledge in R and Python to use it for further research.
- The students will be able to carry out data analysis/statistical analysis and visualize the data.

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

CO1: Understand the fundamentals of data analytics
CO2: Clean and reshape messy datasets
CO3: Realize the importance of filtering functions, charts and tables.
CO4: Learn the usage of python programming for data analysis
C05: Understand the various search methods and visualization techniques.
C06: Use exploratory tools such as clustering and visualization tools to analyze data
CO7: Perform linear regression analysis
CO8: Use methods such as nearest neighbors, decision trees, and support vector machines to build a classifier

UNIT-I 12Hrs.

Basics of Data Analytics, Applications of Data Analytics, Phases in Data Analytics, Data Definitions and Analysis Techniques, Elements, Variables, and Data categorization, Levels of Measurement, Data Management and Indexing, Introduction to Statistical Learning and R-Programming.

UNIT-II 12Hrs.

Introduction to Python: Python Libraries, NumPy Basics: Arrays and Vectorized Computation – NumPy ndarray, Data Processing Using Arrays, File Input and Output with Arrays, Pandas: Summarizing and Computing Descriptive Statistics, Handling Missing Data, Hierarchical Indexing, Data Loading, Storage and File formats, Data Wrangling: Clean, Transform, Merge, Plotting and Visualization, Data Aggregation and Group Operation.

UNIT-III 12Hrs.

Basic analysis techniques, Central Tendency and Dispersion, Probability Distributions, Sampling and Sampling Distribution, Distribution of sample: Mean, population and Variance, Confidence interval estimation, Statistical hypothesis generation and testing, Chi-Square test, t-Test, Analysis of variance, Correlation analysis, Maximum likelihood test, Regression analysis.

UNIT-IV 12Hrs.

Classification techniques: CART, Attribute selection measures, Bayesian Classification, Rule based Classification, Classification by Backpropagation, SVM, Cluster Analysis: K-mean Clustering, Hierarchical Method of Clustering, Density based Methods, Grid Based Methods, Model based Clustering Methods, Association Rules Analysis, Practice and analysis with Python

REFERENCE BOOKS:

1. McKinney, Wes. Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. O'Reilly Media, Inc., 2012, 1st Edition.
2. Samir Madhavan, Mastering Python for Data Science, 2015.
3. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", 2 nd Edition, Elsevier, Reprinted 2008.
4. E. Alpaydin, "Machine Learning", MIT Press, 2010.

22CSH203: 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,

CO1: Explore the concepts of NoSQL Databases.
CO2: Understand and use columnar and distributed database patterns.
CO3: Learn to use various Data models for a variety of databases.
CO4: Explore the relationship between Big Data and NoSQL databases
CO5: Work with NoSQL databases to analyze the big data for useful business applications.
CO6: Understands the concept of MongoDB and types of consistency.
CO7: 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.

12Hrs.

UNIT-II

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.

12Hrs.

UNIT-IV

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.

22CSS204: IMAGE PROCESSING

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

Credits: 4 Exam. Marks: 70

Course Learning Objectives:

- Fundamental concepts of a digital image processing system.
- Analyze the basic algorithms used for image processing
- To study the image fundamentals and mathematical transforms necessary for image processing.
- Design algorithms to solve image processing problems and meet design specifications.

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

CO1: Understand image transforms and their properties.
CO2: Develop any image processing application and understand the rapid advances in Machine vision.
CO3: Learn different techniques employed for the enhancement of images.
CO4: Identify different causes for image degradation and overview of image restoration techniques.
CO5: Explain different Image enhancement techniques.
CO6: Design & Synthesize Color image processing and its real world applications.
CO7: 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.

UNIT-II 12Hrs.

SEGMENTATION: 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: Image compression: Fundamentals, Image compression models, Elements of information theory, Error-Free Compression, Lossy compression.

UNIT-IV 12Hrs.

SHAPE REPRESENTATION: Region identification, Contour-based shape representation and description, Region based shape representation and description, Shape classes. 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.

22CSS205: 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,

CO1: Implement statistical analysis techniques for solving practical problems.
CO2: Perform statistical analysis on variety of data.
CO3: Practically realize the working experiments of Python using Hadoop.
CO4: Perform appropriate statistical tests using R and visualize the outcome.
CO5: Understands the applications using Map Reduce Concepts.
CO6: Develop Big Data Solutions using Hadoop Eco System.
CO7: 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, AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
11. ArvindSathi, "BigDataAnalytics: 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.

22CSS206: 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,

CO1: Learn Ad hoc network and Sensor Network fundamentals.
CO2: Understand the different routing protocols and the uses.
CO3: Have an in-depth knowledge on sensor network architecture and design issues.
CO4: Understand the transport layer and security issues possible in Ad hoc and Sensor networks.
CO5: Have an exposure to mote programming platforms and tools.
CO6: To develop wireless sensor systems for different applications using.
CO7: 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.

22CSS207: 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,

CO1 Discuss cellular radio concepts and identify various propagation effects.
CO2: Have knowledge of the mobile system specifications.
CO3: Classify multiple access techniques in mobile communication.
CO4: Outline cellular mobile communication standards and analyze various methodologies to improve the cellular capacity.
C05: Explain the principles and theories of mobile computing technologies and describe infrastructures and technologies of mobile computing technologies.
C06: List applications in different domains that mobile computing offers to the public, employees, and businesses.
C07: 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.

22CSS208: EMBEDDED SYSTEMS

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

Course Learning Objectives:

- Basics of Embedded Systems and concepts of SoC and VLSI.
- Classifications of Microprocessor and Micro Controller.
- Software Programming in ALP and HLL, Embedded Programming in C++ and Java and inter process communication.
- Basics of Real Time Operating Systems and management of Interrupt Service Routines.

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

CO1: Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.
CO2: Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.
CO3: Have an in-depth knowledge on sensor network architecture and design issues
CO4: Understand the transport layer and security issues possible in Ad hoc and Sensor networks
CO5: Have an exposure to mote programming platforms and tools
CO6: Learn to program in ALP and HLL and Inter Process Communication.
CO7: Understands basics of Real Time Operating Systems.

UNIT- I 12Hrs.

History & need of Embedded System– Basic components of Embedded System – Processor embedded into a system– Embedded hardware units and devices in a system– Programming Language Classification of Embedded System – Advantage & Disadvantage– examples of embedded systems– embedded SOC and use of VLSI circuit design technology– Complex systems design and processors– Design process in embedded system– formalization of system design– design process and design examples– classification of embedded systems– skills required for an embedded system designer.

UNIT- II 12Hrs.

8051 Architecture– Interfacing– Advanced Architectures– Processor and Memory Organization– Instruction Level Parallelism– I/O Types– Serial and Parallel Communication Devices– Wireless Devices– Network Embedded systems– MICROPROCESSOR & MICROCONTROLLER CLASSIFICATION – Difference between Microprocessor & Microcontroller – Classification based on architecture – Memory Classification – REGISTERS & MEMORY OF AT89C51 – Description of RAM – Description of CPU Registers – Functions of SFR

UNIT-III **12Hrs.**

Software Programming in ALP and HLL– Header– Source files and Pre-processor Directives in C– Macros and Functions– Program elements:- Data Types– Data structures– Modifiers– Statements– Loops and Pointers– Embedded Programming in C++ and Java– Multiple Process and Threads– Tasks– Task states– Task and Data– Shared Data– Inter-process communication– Functions:- Signal– Semaphore– Message queue– Pipe– Socket and RPC.

UNIT- IV **12Hrs.**

Introduction to Real Time Operating Systems: A Brief History of Operating Systems– Meaning and Types of operating system– Definition of RTOS– The Scheduler– Objects and Services– Key Characteristics of an RTOS– Memory Management and Interrupt Routines in an RTOS Environment: Memory Management– Timer Functions– Device I/O Management– Interrupt routines in an RTOS Environment– Basic design using an RTOS– Encapsulating Semaphores and Queues– Important Real Time operating Systems (RTOSs) – Case study: digital camera hardware and software architecture– embedded systems in automobile– embedded system for a smart card– mobile phone software for key inputs.

REFERENCE BOOKS:

1. Embedded Systems Architecture Programming and Design by Raj Kamal, II edition, Tata MC Graw-Hill.
2. Designing Embedded Systems with PIC Microcontrollers: principles and applications by Tim Wilmshurst, Elsevier.
3. Rao B. Kanta, Embedded Systems, PHI.
4. Elecia White, Making Embedded Systems, O"Reilly Douglass, Design Patterns for Embedded Systems in C., Newns (Elsevier), 2011.
5. Wayne Wolf,,Computers as Components: Principles of Embedded Computer System Design–Elsevier, 2005.
6. Tammy Noergaard, Embedded Systems Architecture–Elsevier, 2005.

22CSP209: PRINCIPLES OF DATA SCIENCE LAB

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

Course Learning Objectives:

- The probability distributions and density estimations to perform analysis of various kinds of data
- The statistical analysis techniques using Python and R programming languages.
- Expand the knowledge in R and Python to use it for further research.
- The students will be able to carry out data analysis/statistical analysis effectively visualize the data.

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

CO1: Understand the fundamentals of data analytics and study the basic concepts of Excel spreadsheet Functions.
CO2: Realize the importance of filtering functions, charts and tables.
CO3: Identify the importance and usage of R package and its features
CO4: Learn the fundamentals of python programming
C05: Understand the various search methods and visualization techniques.
C06: Learn to use various techniques for mining data stream and applications using Map Reduce Concepts.
C07: Introduce programming tools PIG & HIVE in Hadoop echo system.

22CSP210: INTERNET OF THINGS LAB

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

CO1: Implement the impact of IoT applications and Architectures in real world
CO2: Realize the various IoT Protocols (Datalink, Network, Transport, Session, Service)
CO3: Practically implementIoT stack and be familiar with the key technologies
CO4: Interface different sensors to arduinouno and raspberry pi to read theenvironment data.
CO5: Implement the role of big data, cloud computing and data analytics in a typical IoT system
CO6: Practice the ICT ecosystem and enabling environment to foster IoT
C07: Practically the technologies and the standards relating to IoT.

22CSP211: IMAGE PROCESSING LAB

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

Course Learning Objectives:

- Ability to learn digital image processing techniques and apply in practical problems.
- Understand the Image Restoration, Compression, Segmentation, Recognition, Representation and Description.
- Analyze a wide range of problems and provide solutions related to the design of image processing systems through suitable algorithms, structures, diagrams, and methods.
- Prepare and deliver coherent and structured verbal and written technical reports

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

CO1: Implement the relevant aspects of digital image representation and their practical implications.
CO2: Practice the role of alternative color spaces, and the design requirements leading to choices of color space.
CO3: Implementation of the underlying mechanisms of image compression, and the ability to design systems using standard algorithms to meet design specifications.
CO4: Design point wise intensity transformations to meet stated specifications.
CO5: Execute hands on experience in the use of Matlab and OpenCV.
CO6: Learning methods involving binary, gray scale and color image representations.
CO7: Practice the ability to perform spatial and frequency domain analysis.

22CSP212: BIG DATA ANALYTICS LAB

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

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

CO1: Implement statistical analysis techniques for solving practical problems.
CO2: Perform statistical analysis on variety of data.
CO3: Practically realize the working experiments of Python using Hadoop.
CO4: Perform appropriate statistical tests using R and visualize the outcome.
CO5: Understands the applications using Map Reduce Concepts.
CO6: Develop Big Data Solutions using Hadoop Eco System.
CO7: Manage Job Execution in Hadoop Environment.

22CSE213: 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,

CO1: Acquire the knowledge about the basic knowledge of computer systems
CO2: Learn the essential requirements of the number systems.
CO3: Understanding the fundamentals of Operating systems and database.
CO4: Aware of computer networks and internetworking.
CO5: Understand the usage of MS - office.
CO6: Understand the basic knowledge of computer hardware and software.
CO7: 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, Digital computers and Digital system: Number systems, Number base conversion, Complements, Binary codes, Binary arithmetic's.

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. Database Management System Concepts: Introduction, Database System Applications; Data Modeling for a Database; Entities and their Attributes, Relationships and Relationships Types, Advantages and Disadvantages of Database Management System.

UNIT-III 9 Hrs.

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. Web designing using HTML: Introduction to HTML, HTML tags, Different types of list – ordered, unordered and definition, linking multiple web pages.

UNIT-IV 9 Hrs.

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. 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.

22CSH301: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

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

Course Learning Objectives:

- The basic exposition to the goals and methods of Artificial Intelligence.
- The student to apply these techniques in applications which involve perception, reasoning and learning.
- To have an understanding of the basic issues of knowledge representation and blind and heuristic search.
- The basic understanding of some of the more advanced topics of AI such as learning, natural language processing, agents and robotics, expert systems, and planning.

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

CO1: Recognize concept of knowledge representation and predicate logic and transform the real life information in different representation.

CO2: Realizethe state space and its searching strategies.

CO3: Understand machine learning concepts and range of problems that can be handled by machine learning.

CO4: Apply the machine learning concepts in real life problems.

C05: 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.

C06: Discuss the core concepts and algorithms of advanced AI, including informed searching Algorithm, Different Types of Machine Learning Approaches C07: 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 - Overview of AI applications. Introduction to representation and search. The Propositional calculus, Predicate Calculus, Using Inference Rules to produce Predicate Calculus expressions, Application – A Logic based financial advisor.

UNIT-II 12 Hrs.

Introduction to structure and Strategies for State Space search, Graph theory, Strategies for state space search, Using the State Space to Represent Reasoning with the Predicate calculus (Sate space description of a logical system, AND/OR Graph). Heuristic Search: Introduction, Hill-Climbing and Dynamic Programming, The Best-first Search Algorithm, Admissibility, Monotonicity and informed ness, Using Heuristics in Games.

UNIT-III 12 Hrs.

Introduction to Machine Learning: Concept of Learning Task, Inductive Learning and The Concepts Of Hypothesis Space, Introduction To Different Types Of Machine Learning Approaches, Examples of Machine Learning Applications, Different Types of Learning; Supervised Learning, Unsupervised Learning, Reinforcement Learning. Training, Validation and Testing, Over-Fitting and Under-Fitting, Different Types of Error Calculation.

UNIT-IV **12 Hrs.**

Supervised Learning: Introduction, Learning A Class From Example, Learning Multiple Classes, Model Selection and Generalization, Linear Regression and Feature Selection, Bayesian and Decision Tree Learning; Classification Tree and Regression Tree, Multivariate Methods for Learning; Multivariate Classification and Regression. Unsupervised Learning: Introduction, Clustering; Mixture Densities, K-Means Clustering, Expectation Maximization Algorithm, Mixture Latent Variable Models, Latent Dirichlet Allocation, Spectral and Hierarchical Clustering, Dimensionality Reduction; Principal Component Allocation, Linear Discriminant Analysis, Canonical Correlation Analysis.

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.

22CSH302: 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,

CO1: Define and illustrate cyber security concepts and principles
CO2: Analyze the working of cyber security principles to system design
CO3: Apply appropriate techniques to solve cyber security threats
CO4: Evaluate cyber security through network defense controls
CO5: Realize the importance of security in real time applications
CO6: Understand the tools and methods used in cyber security.
CO7: Knows the concept of cybercrime and firewall protection

UNIT-I 12 Hrs

Introduction to Cyber Security, Defining 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 12Hrs.

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 12Hrs.

Phishing and Identity Theft Introduction, Phishing - 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, SQLinjection, 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 VsStateful 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.

22CSH303: 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,

CO1: Recognize the software engineering and software process.
CO2: Understand different activities of Software process.
CO3: Realize the concepts of agile methods and software testing.
CO4: Learn the techniques of functional and non-functional requirements.
CO5: Familiar with concepts of detailed and object oriented design.
CO5: Define various software application domains and remember different process model used in software development.
CO6: An ability to apply engineering design to produce solutions that meet specified needs.
CO7: Consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

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 Design 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, 23, 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.

22CSS304: 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,

CO1: Understanding the basics of Information Retrieval
CO2: Realize the data structures like Inverted Indices used in Information retrieval systems.
CO3: Realize the concepts of agile methods and software testing.
CO4: Learn the different techniques for compression of an index including the dictionary and its posting list.
CO5: Developing the ability of develop a complete IR system from Scratch.
C06: Understanding the data structures like Inverted Indices used in Information retrieval systems.
CO7: Understanding the different techniques for compression of an index including the dictionary and its posting list.

UNIT-I 12 Hrs.

Introduction: Definition, Objectives, Functional Overview, Relationship to DBMS, Digital libraries and Data Warehouses. Information Retrieval System Capabilities: Search, Browse, Miscellaneous

UNIT-II 12 Hrs.

Cataloging and Indexing: Objectives, Indexing Process, Automatic Indexing, Information Extraction. Data Structures: Introduction, Stemming Algorithms, Inverted file structures, N-gram data structure, PAT data structure, Signature file structure, Hypertext data structure.

UNIT-III 12 Hrs.

Automatic Indexing: Classes of automatic indexing, Statistical indexing, Natural language, Concept indexing, Hypertext linkages Document and Term Clustering: Introduction, Thesaurus generation, Item clustering, Hierarchy of clusters.

UNIT-IV 12 Hrs.

User Search Techniques: Search statements and binding, Similarity measures and ranking, Relevance feedback, Selective dissemination of information search, weighted searches of Boolean

systems, Searching the Internet and hypertext. Information Visualization: Introduction, Cognition and perception, Information visualization technologies. Text Search Algorithms: Introduction, Software text search algorithms, Hardware text search systems. Information System Evaluation: Introduction, Measures used in system evaluation, Measurement example –TREC results.

REFERENCE BOOKS:

1. Kowalski, Gerald, Mark T Maybury: Information Retrieval Systems: Theory and Implementation, Kluwer Academic Press, 1997.
2. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
3. Yates, Modern Information Retrieval, Pearson Education, 1999.
4. Robert Korfhage, Information Storage &Retrieval, John Wiley & Sons, 1997.

22CSS305: CLOUD COMPUTING

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

Course Learning Objectives: **9 Hrs.**

- 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,

CO1: Demonstrate in-depth understanding characteristics of grid and cloud computing.
CO2: Demonstrate an in-depth understand of the design principles of grid and cloud computing.
CO3: Illustrate security mechanisms in grid and cloud computing applications.
CO4: Design and demonstrate distributed computing applications.
CO5: Understand the importance of cloud computing environments.
CO6: Understand cloud based data storage, cloud based database solutions and research tr computing.
CO7: 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.

22CSS306: NATURAL LANGUAGE PROCESSING

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

Course Learning Objectives:

- To introduce students the challenges of empirical methods for natural language processing (NLP) applications.
- To introduce basic mathematical models and methods used in NLP applications to formulate computational solutions.
- To introduce students research and development work in information retrieval, information extraction, and knowledge discovery using different natural language resources.
- Understand the principles of language resource annotation and its use in machine learning applications and apply the above principles in analysis of data and acquire intended information through the use of available tools.

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

CO1: Understand basic approaches to syntax and semantics in NLP.
CO2: Realize approaches to discourse, generation and dialogue in NLP
CO3: Familiarize the current methods for statistical approaches to machine translation.
CO4: Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammar.
CO5: Familiar with clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP
CO6: Understand the design and implementation issues in various NLP applications such as information retrieval and information extraction.
CO7: Understand the principles of language resource annotation and its use in machine learning applications and apply the above principles in analysis of data and acquire intended information through the use of available tools.

UNIT-I 12 Hrs.

OVERVIEW AND LANGUAGE MODELING: Overview: Origins and challenges of NLP- Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.

UNIT-II 12Hrs.

WORD LEVEL AND SYNTACTIC ANALYSIS: Word Level Analysis: Regular Expressions- Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.

UNIT-III 12Hrs.

SEMANTIC ANALYSIS AND DISCOURSE PROCESSING: Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure.

UNIT-IV **12Hrs.**

NATURAL LANGUAGE GENERATION AND MACHINE TRANSLATION: Natural Language Generation: Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation- Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.

REFERENCE BOOKS:

1. Edward Loper, Ewan Klein, and Steven Bird, Natural Language Processing withPython, 'Reilly Publication2009.;
2. Christopher D. Manning, HinrichSchütze, Foundations of Statistical Natural Language Processing, MITpress,1999.
3. Dan Jurafsky,James H. Martin, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Prentice Hall, 2009.

22CSS307: 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,

CO1: Understand the fundamentals of Soft computing approaches and demonstrate the basic functionalities
CO2: Apply the soft computing techniques to solve problems
CO3: Analyze the results of soft computing techniques to handle various problems
CO4: Evaluate the solutions of soft computing algorithms for optimization
CO5: Aware of concepts with the real time applications
CO6: Implement Neuro-Fuzzy and Neuro - Fuzz-GA expert system.
CO7: 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.

22CSS308: 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,

CO1: Understand the fundamentals of the design principles of Bitcoin and Ethereum.
CO2: Explain the Simplified Payment Verification protocol.
CO3: Interact with a block chain system by sending and reading transactions.
CO4: Evaluate the solutions of soft computing algorithms for optimization.
CO5: Design build and deploy smart contracts and distributed applications.
CO6: Easily Analyze regulations of crypto currency.
CO7: 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.

22CSP209: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING LAB

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

Course Learning Objectives:

- To introduce basic machine learning techniques.
- To develop the skills in using recent machine learning software for solving practical problems in high-performance computing environment.
- To develop the skills in applying appropriate supervised, semi-supervised or unsupervised learning algorithms for solving practical problems.
- Identify innovative research directions in Artificial Intelligence, Machine Learning and Big Data analytics.

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

CO1: Students will demonstrate the ability to solve problems collaboratively
CO2: Students will demonstrate knowledge of artificial intelligence concepts
CO3: An understanding of fundamental concepts and methods of machine learning, statistical pattern recognition and its applications.
CO4: An ability to analyze and evaluate simple algorithms for pattern classification.
CO5: An ability to design simple algorithms for pattern classification, code them with Python programming language and test them with benchmark data sets.
CO6: Practically establish, refine and implement strategies to take the idea in to students and faculty fraternity.
CO7: Practice sustainable funding models for GRIET and related efforts

22CSP310: PRINCIPLES OF CYBER SECURITY LAB

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

CO1: Define and illustrate cyber security concepts and principles
CO2: Analyze the working of cyber security principles to system design
CO3: Apply appropriate techniques to solve cyber security threats
CO4: Evaluate cyber security through network defense controls
CO5: Realize the importance of security in real time applications
CO6: Understand the tools and methods used in cyber security.
CO7: Knows the concept of cybercrime and firewall protection

22CSP311: SOFTWARE ENGINEERING Lab

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

CO1: Recognize the software engineering and software process.
CO2: Understand different activities of Software process.
CO3: Realize the concepts of agile methods and software testing.
CO4: Learn the techniques of functional and non-functional requirements.
CO5: Familiar with concepts of detailed and object oriented design.
CO5: Define various software application domains and remember different process model used in software development.
CO6: An ability to apply engineering design to produce solutions that meet specified needs.
CO7: Consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

CSM312: Mini Project and Domain Knowledge Seminar

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

ourse 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,

CO1: Discover potential research areas in the field of IT.
CO2: Conduct a survey of several available literature in the preferred field of study.
CO3: Compare and contrast the several existing solutions for research challenge.
CO4: Demonstrate an ability to work in teams and manage the conduct of the research study.
CO5: Formulate and propose a plan for creating a solution for the research plan identified.
CO6: Report and present the findings of the study conducted in the preferred domain.
CO7: Improve the team building, communication and management skills of the students.

22CSE313: DATA ANALYTICS TOOLS

Hours/Week: 3 I.A. Marks: 30

Credits: 3 Exam. Marks: 70

Course Learning Objectives:

- To learn the probability distributions and density estimations to perform analysis of various kinds of data
- To explore the statistical analysis techniques using Python and R programming languages.
- To expand the knowledge in R and Python to use it for further research.
- The students will be able to carry out data analysis/statistical analysis and visualize the data.

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

CO1: Course Outcomes: After completing the course, the students will be able to
CO1: Understand the fundamentals of data analytics.
CO2: Study the basic concepts of Excel spreadsheet Functions
CO3: Realize the importance of filtering functions, charts and tables.
CO4: Identify the importance and usage of R package and its features
CO5: Learn the fundamentals of python programming
C06: understand the various search methods and visualization techniques.
C07: learn to use various techniques for mining data stream.
C08: understand the applications using Map Reduce Concepts.
C09: introduce programming tools PIG & HIVE in Hadoop echo system.

UNIT-I 9 Hrs.

Introduction to data analytics (DA), data preparation, and data cleaning, Data types and measures of similarity, Data Pre-processing and numerosity reduction, Introduction to data analysis techniques: Basic analysis techniques, Statistical hypothesis generation and testing, Correlation analysis, Maximum likelihood test, Regression analysis, Classification techniques, clustering.

UNIT-II 9 Hrs.

Introduction to Spreadsheets: Reading data into Excel using various formats, Basic functions in Excel, arithmetic as well as various logical functions, Formatting rows and columns, Using formulas in Excel and their copy and paste using absolute and relative referencing. Spreadsheet Functions to Organize Data: IF and the nested IF functions, VLOOKUP and HLOOKUP, The RANDBETWEEN function. Introduction to Filtering, Pivot Tables, and Charts: VLOOKUP across worksheets, Data filtering in Excel, Use of Pivot tables with categorical as well as numerical data, Introduction to the charting capability of Excel. Advanced Graphing and Charting: Line, Bar and Pie charts, Pivot charts, Scatter plots, Histograms

UNIT-III 9 Hrs.

Getting Started and Basics: An introductory R session, R as a calculator, Vectors and matrices, Getting help and loading packages, Data entry and exporting data. Exploratory Data Analysis with R: Summary statistics, Probability and Distribution- Generate numbers- the built-in distribution for cumulative distribution functions, quantiles and random numbers, Graphics in R - histograms, empirical cumulative distribution, QQ-plots, box plots, bar plots, dot charts and pie charts.

UNIT-IV **9 Hrs.**

Introduction to data analytics with Python: Importance of Python Programming, features of Python, Introduction to Jupyter and numpy, pandas, visualization. Significance of data analytics of Python programming.

REFERENCE BOOKS:

1. Joe Zhu ,Quantitative Models for Performance Evaluation and Benchmarking: Data Envelopment Analysis with Spreadsheets and DEA Excel Solver,Springer US
2. Peter Weverka, Office 2019 A L L - I N - O N E for dummies
3. Robert Gentleman Kurt Hornik Giovanni Parmigiani, Applied Spatial Data Analysis with R, Springer
4. Paul Cornell, Beginning Excel what-if data analysis tools : getting started with Goal Seek, data tables, scenarios and Solver , Apress
5. Eric Mayor, Learning Predictive Analytics with R: Get to grips with key data visualization and predictive analytic skills using R,Packt Publishing
6. Gerhard Svolba, Data Preparation for Analytics Using SAS, SAS Press
7. Anil Maheshwari,Data analytics ,McGraw-Hill Education 2017
8. Bharti Motwani,Data Analytics using Python,Wiley,2020
9. John Paul Mueller, Python for Data Science for Dummies, Wiley 2015

22CSP401: DISSERTATION AND VIVA VOCE

Hours/Week: 32 Max. Marks: 400

Credits: 16 I.A. Marks: 100

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,

CO1: Discover potential research/project areas in the field of IT.
CO2: Conduct a survey of several available literature in the preferred field of study.
CO3: Compare and contrast the several existing solutions for research/project challenges.
CO4: Demonstrate an ability to work in teams and manage the conduct of the research study.
CO5: Formulate and propose a plan for creating a solution for the research/project plan identified.
CO6: Report and present the findings of the study conducted in the preferred domain.
CO7: Improve communication and management skills of the students.