SYLLABUS (STRUCTURE ONLY)

Master of Computer Application (MCA)

(To be effective from 2023-24)

Rajiv Gandhi University

(A Central University)

RONO HILLS, DOIMUKH,

ARUNACHAL PRADESH

S.No.	Course Code	Course Title	Hours/Week			Course Hours	Scheme of Examination				No of Credits
			L	T	P		Exam Type	End Semester Marks	Internal Exam. Marks	Total Marks	
Semester I											
1	CSE-102-CC-5110	Mathematical Foundation for Computer Science	3	1	0	60	Theory	80	20	100	4
2	CSE-102-CC-5120	Programming and Problem Solving	2	0	2	90	Theory	80	20	100	4
							Practical	80	20	100	
3	CSE-102-CC-5130	Operating Systems	3	1	0	60	Theory	80	20	100	4
4	CSE-102-CC-5140	Computer Networks	3	0	1	75	Theory	80	20	100	4
							Practical	80	20	100	
5	CSE-102-MC-5110	Web Programming	2	0	2	90	Theory	80	20	100	4
							Practical	80	20	100	
											20
Semester II											
1	CSE-102-CC-5210	Data Structures	3	0	1	75	Theory	80	20	100	4
							Practical	80	20	100	
2	CSE-102-CC-5220	Theory of Computation	3	1	0	60	Theory	80	20	100	4
3	CSE-102-CC-5230	Database Management System	3	0	1	75	Theory	80	20	100	4
							Practical	80	20	100	
4	CSE-102-RC-5210	Research and Publication Ethics	3	1	0	60	Theory	80	20	100	4
5	CSE-102-RP-5210	System Project	0	0	4	120	Practical	80	20	100	4
											20

S. No.	Course Code	Course Title	Hours/Week			Course Hours	Scheme of Examination				No of Credits
			L	T	P		Exam Type	End Semester Marks	Internal Exam. Marks	Total Marks	
Semester III											
1	CSE-102-CC-6110	Design and Analysis of Algorithms	3	1	0	60	Theory	80	20	100	4
2	CSE-102-CC-6120	Compiler Design	3	0	1	75	Theory	80	20	100	4
							Practical	80	20	100	
3	CSE-102-CW-61310	Departmental Elective 1(Introduction to Machine Learning)	3	1	0	60	Theory	80	20	100	4
4	CSE-102-CW-61410	Departmental Elective 2(Data Pre-processing and Feature Engineering)	3	1	0	60	Theory	80	20	100	4
5	CSE-102-RC-6110	Research Methodology	3	1	0	60	Theory	80	20	100	4
											20
Semester IV											
1	CSE-102-RP-6210	Project	0	0	20	600	Practical	320	80	400	20
											20

COURSE CODE	COURSE TITLE	Credits
CSE -102-CW-61310	Introduction to Machine Learning	(3-0-1)
CSE -102-CW-61410	Data Pre-processing and Feature Engineering	(3-0-1)
To do:		
CSE -102-CW-61410	Programming with MATLAB	(3-0-1)
CSE -102-CW-61410	Data Analytics	(3-0-1)
CSE -102-CW-61410	Computer Ethics	(3-1-0)
CSE -102-CW-61410	R for Data Science	(3-0-1)
CSE -102-CW-61410	Soft Computing	(3-0-1)
CSE -102-CW-61410	Data Mining	(3-0-1)
CSE -102-CW-61410	Cloud Computing	(3-0-1)

CSE -102-CW-61410	Internet of Things	(3-0-1)
CSE -102-CW-61410	Cryptography Theory and Practice	(3-1-0)
CSE -102-CW-61410	Image and video processing	(3-1-0)
CSE -102-CW-61410	Computational neuroscience	(3-1-0)
CSE -102-CW-61410	Deep learning by mathematics	(3-1-0)
CSE -102-CW-61410	Speech and Natural Language Processing	(3-1-0)
CSE -102-CW-61410	Introduction to Mobile Application Development	(3-1-0)
CSE -102-CW-61410	Embedded System	(3-1-0)
CSE -102-CW-61410	Database Security	(3-0-1)

MCA I SEMESTER

CSE-102-CC-1110: Mathematical Foundations for Computer Applications [3 – 1 – 0]

Course Objectives:

1. Develop a strong foundation in mathematical concepts essential for computer science applications.
2. Understand logic, proof techniques, and set theory used in algorithmic reasoning and computation.
3. Apply principles of combinatorics, relations, and functions in analyzing algorithms and data structures.
4. Introduce graph theory and its applications in modelling networks and solving computational problems.
5. Build problem-solving and analytical thinking skills necessary for advanced computer science research and applications.

Course Outcomes:

After successful completion of this course, students will be able to:

CO Code	Course Outcome Description	Bloom's Level
CO1	Demonstrate understanding of basic mathematical logic, propositional and predicate calculus used in computer science.	Understanding
CO2	Apply set theory, relations, and functions to design and analyze data structures and algorithms.	Applying
CO3	Use graph theory concepts such as trees, connectivity, and traversal in designing computational models.	Applying
CO4	Analyze algebraic structures such as groups and lattices for applications in coding theory and cryptography.	Analyzing
CO5	Employ mathematical reasoning and proof techniques to evaluate correctness and complexity of algorithms.	Evaluating

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	2	3	1	2	1	1	2	2	3
CO2	3	3	3	3	2	2	1	3	3	2	2	2
CO3	2	2	2	3	2	3	3	2	2	3	2	3
CO4	3	3	2	2	3	3	3	1	1	2	1	2
CO5	3	2	1	1	2	3	3	2	2	2	3	2
Average	2.8	2.2	1.8	2.2	2.4	2.4	2.4	1.8	1.8	2.2	2	2.4

1: Low 2: Medium 3: High -: No Correlation

UNIT-I

Discrete Mathematics: Propositional and first order logic, Sets and Subsets, Set Operations and the Laws of Set Theory, Counting and Venn Diagrams, Principles of Inclusion and Exclusion, Permutations and Combinations with repetition. Fundamentals of Logic : Basic Connectives and Truth Tables, Logic Equivalence- the laws of Logic, Logical Implications, Rules of Inference, The use of Quantifiers, Quantifier Definitions, Proofs of Theorems.

UNIT–II

Functions: Cartesian products and Relations, Functions-Plain and One-to-One, Onto Functions, Stirling Numbers of the Second Kind, Special functions, The Pigeon-hole principle, Function composition and inverse functions. Relations : Properties of Relations, Computer recognition-Zero One Matrices and Directed graphs, Posets and Hasse Diagrams

UNIT–III

Linear Algebra: Introduction, types of matrices, elementary row operations, row echelon matrix, rank, consistency of a system of linear equations. Eigen values and eigen vectors. Largest eigen value using power method. Cayley-Hamilton theorem (without proof) – inverse of a matrix using Cayley-Hamiltonian theorem. Algorithms to solve system of linear algebraic equations: Gauss elimination, Gauss seidel and Jacobi iterative procedures.

UNIT–IV

Statistics: Introduction, Measures of central tendency (Arithmetic mean, Geometric mean, Harmonic mean, Median, Quartiles, Mode). Measures of dispersion (Range, Quartile deviation, mean deviation and standard deviation).

UNIT-V

Random variable and probability distribution: Concept of random variable, discrete probability distributions, continuous probability distributions, Mean, variance and co-variance and co-variance of random variables. Binomial and normal distribution, Exponential and normal distribution with mean and variables and problems.

Reference Books

1. Ralph P. Grimaldi, Discrete and Combinatorial Mathematics And Applied Introduction, 4th Edition, Pearson Education, 2003.
2. Richard A Johnson and C.B Gupta “Probability and statistics for engineers” Pearson Education.
3. Dr. K. S. Chandrashekhar, Engineering Mathematics- IV, Sudha Publications

CSE-002-CC-1120 PROGRAMMING AND PROBLEM SOLVING [2-0-2]

Course Objectives (COBs)

The objectives of this course are to:

1. **COB1:** Introduce the fundamental concepts of programming and computational problem-solving.
2. **COB2:** Develop logical thinking and algorithmic skills required to translate real-world problems into computational solutions.
3. **COB3:** Familiarize students with programming constructs such as data types, control statements, functions, and arrays.
4. **COB4:** Enable learners to design, implement, test, and debug programs using a high-level programming language (e.g., C / Python).
5. **COB5:** Develop good programming practices, including modular design, code documentation, and input-output handling.

Course Outcomes (COs)

After successful completion of this course, students will be able to:

CO Code	Course Outcome Description	Bloom's Level
CO1	Explain the fundamentals of computers, algorithms, and flowcharts for problem-solving.	Understanding
CO2	Develop algorithms and flowcharts to represent logical solutions to computational problems.	Applying
CO3	Write syntactically correct programs using appropriate data types, operators, and control structures.	Applying
CO4	Implement modular programs using functions and structured programming techniques.	Applying
CO5	Analyze and debug programs to ensure correctness, efficiency, and readability.	Analyzing

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	3	1	2	1	1	2	2	3
CO2	3	3	3	3	2	2	1	3	3	2	3	2
CO3	2	2	2	3	2	3	3	2	3	3	2	3
CO4	3	3	2	2	3	2	3	1	1	2	1	2
CO5	3	2	1	1	2	3	3	2	2	2	3	2
Average	2.8	2.5	1.8	2.2	2.4	2.2	2.4	1.8	1.6	2.2	2.4	2.4

1: Low 2: Medium 3: High -: No Correlation

Unit -I

Fundamentals of C: Elementary data types, variables, constants and identifiers. Integer, character floating point and string constants. Variable declarations. Syntax and semantics. Reserved words. Initialization of variable during declaration. Constant data types. Expressions in C-Operator precedence and associativity. Unary, binary and ternary operators. C arithmetic operators, assignment operators, relational operators, logical operators and bit-wise operators.

L-value and R-value. Side effects of operators. Expression statement. Conditional statements –if, if –else, switch Iterative statements –while, do –while, for Other statements-break, continue, go-to, return, null statement , block statement. Simple programs like programs to compute –an arithmetic expression, unit conversion, the sum of a series (like trigonometrical series), gcd, factorial, fibonacci number, generation of prime numbers, reversing digits of an integer, finding the square root of a number, generation of pseudo random numbers, prime factors of an integer, base conversion of numbers. Test if three points form a triangle and classify the triangle to right angled, isosceles, equilateral etc. Roots of a quadratic equation. Generating simple patterns of characters on screen.

Unit-II

Functions: Declaration and definition of functions. Calling a function. Parameters-call by value, call by reference and its absence in C. Cast and size of operator. Automatic type conversion.

Unit –III

Arrays and pointers Different types of variables-local, global, register, static extern. Scope and lifetime of variable. Arrays and pointers and corresponding operators. Pointer arithmetic. Programs using arrays and pointers like sum, average, minimum, maximum of an array of numbers. Add and delete an element of an array. Searching - Linear and binary search methods, sorting - Bubble sort, selection sort, Insertion sort, Quick sort, merge sort. Merge two sorted arrays. String manipulation programs-like reverse, test for palindrom, copy, concatenate, find length etc. Matrix manipulation programs like addition, subtraction, multiplication and their combinations. Sum rows, columns, and diagonal elements of a matrix. Transpose a matrix. Selection and bubble sort.Linear search and binary search.

Unit-VI

Structures: Structure –Declaration and use. Structure dereference and structure pointer dereference operators. Programs to show the use of structures. Array of structure. Standard C library. Suggested

Unit-V

File Handling: Defining and Opening a file, Closing Files, Input/output Operations on Files, Predefined Streams, Error Handling during I/O Operations, Random Access to Files, Files functions – fopen(), fclose(), fprintf(), fscanf(), fseek(), ftell(), rewind(), putc(), getc(), putw(), getw(), Command Line Arguments.

Reference Books

1. Programming with C, B.S. Gottfried, Tata Mc-Graw Hill.
2. The C Programming Language, B.W. Kernighan and D.M.Ritchie, PHI

CSE-102-CC-1230 INTRODUCTION TO DATABASE MANAGEMENT SYSTEM [3-0-1]

Course Objectives (COBs)

The main objectives of this course are to:

1. **COB1:** Introduce the fundamental concepts and architecture of database systems.
2. **COB2:** Understand data models, schemas, and the process of database design using Entity–Relationship (ER) modelling.
3. **COB3:** Familiarize students with the use of Structured Query Language (SQL) for database creation, manipulation, and querying.
4. **COB4:** Explain relational algebra, normalization, and integrity constraints for designing efficient databases.
5. **COB5:** Understand transaction processing, concurrency control, and recovery mechanisms to ensure database consistency.

Course Outcomes (COs)

After successful completion of this course, students will be able to:

CO Code	Course Outcome Description	Bloom's Level
CO1	Describe the basic concepts, characteristics, and architecture of database systems.	Understanding
CO2	Design conceptual models using the ER diagram and transform them into relational schemas.	Applying
CO3	Apply relational algebra operations to query and manipulate data.	Applying
CO4	Write SQL commands to define, manipulate, and control databases.	Applying
CO5	Normalize database tables to eliminate redundancy and maintain data integrity.	Analyzing

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	3	1	2	1	1	2	2	3
CO2	3	3	3	3	2	2	1	3	3	2	2	2
CO3	2	2	2	3	2	3	3	2	3	3	2	3
CO4	3	3	2	2	3	2	2	1	1	1	1	2
CO5	3	2	1	1	2	3	3	2	2	2	3	2
Average	2.8	2.5	1.8	2.2	2.4	2.2	2.1	1.8	1.6	2.1	2	2.4

1: Low 2: Medium 3: High -: No Correlation

UNIT-1

Basic concepts: Database & Database Users. Characteristics of the Database Approach advantages of using DBMS. Data Models, Schemas &Instances. DBMS Architecture & Data independence. System Architecture for DBMS and Data Dictionary, Database Users Data Base languages &Interfaces. Data Modeling using the Entity-Relationship Model -Entity

types, Entity Sets, Attributes and Keys, Relationship, Relationship Types, Week Entity Types, Structural Constraints, Enhanced ER Model- Specialization Generalization, Constraints on Specialization Generalization.

UNIT-2

Relational Model, Languages & Systems: Relational Data Model Concepts and Constraints. Relational Algebra - select, project, set theoretic, join operations. Overview of Relational Calculus. SQL - A Relational Database Language. Data Definition commands, View and Queries , transaction commands, Specifying Constraints & Indexes in SQL.

UNIT-3

Relational Data Base Design: Function Dependencies & Normalization for Relational Databases. Informal design guidelines for relation schemas, Functional Dependencies. Normal forms based on primary keys (INF, 2NF,3NF& BCNF). Lossless join & Dependency preserving decomposition. Multivalued dependencies, join dependencies (4NF & 5NF), De-normalization.

UNIT-4

Transactions, Concurrency Control, Recovery Techniques: Basic concept; ACID properties; transaction state; implementation of atomicity and durability; concurrent executions; basic idea of serializability; view and conflict serializabllity Recovery Techniques Failure Classification , Storage Structure, Recovery and Atomicity Log Based Recovery, Shadow Paging ,stable storage implementation, data access; recovery and atomicity - log based recovery,deferred database modification, immediate database modification, checkpoints.

UNIT-5

Emerging fields in DBMS: Distributed databases; Basic idea; distributed data storage; data replication; data fragmentation horizontal,vertical and mixed fragmentation. Concepts of Multimedia databases, Object oriented data basemanagement systems. Data Warehousing & mining.

Text Books

1. Elmsari and Navathe, "Fundamentals of Database System", Addison Wesley. New York.
2. H.Korth & A. Silberschatz, “DATABASE SYSTEM CONCEPTS”, TMH.

Reference Books

1. Date. CJ, "An Introduction to Database System", Narosa Publishing House. New Delhi.
2. Desai, B, "An Introduction to Database Concepts", Galgotia Publications. New Delhi.
3. Ullman. J.D, "Principles of Database Systems", Galgotia Publications, New Delhi.

CSE-102-CC-1130 OPERATING SYSTEMS [3-1-0]

Course Objectives (COBs)

The objectives of this course are to:

1. **COB1:** Introduce the fundamental concepts, functions, and structure of operating systems.
2. **COB2:** Explain the process management mechanisms including process scheduling, synchronization, and inter-process communication.
3. **COB3:** Understand memory management techniques such as paging, segmentation, and virtual memory.
4. **COB4:** Discuss file system organization, disk management, and input-output handling.
5. **COB5:** Explain deadlock detection, prevention, and recovery techniques.

Course Outcomes (COs)

After successful completion of this course, students will be able to:

CO Code	Course Outcome Description	Bloom's Level
CO1	Explain the basic concepts, services, and architecture of operating systems.	Understanding
CO2	Illustrate process management concepts such as scheduling, synchronization, and inter-process communication.	Understanding
CO3	Apply memory management techniques like paging, segmentation, and virtual memory in resource allocation.	Applying
CO4	Analyze and solve problems related to deadlock handling and resource management.	Analyzing
CO5	Compare the features and functionalities of various modern operating systems.	Evaluating

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	3	1	2	1	1	2	2	3
CO2	3	2	3	3	2	2	1	3	3	2	2	2
CO3	2	2	2	2	2	3	3	2	3	3	2	3
CO4	2	3	2	2	3	2	3	1	1	2	1	2
CO5	3	2	1	1	2	3	3	2	2	2	3	2
Average	2.4	2.2	1.8	2.1	2.4	2.2	2.4	1.8	1.6	2.2	2	2.4

1: Low 2: Medium 3: High -: No Correlation

UNIT-I

Concepts, Processes and Threads: Operating system as an Extended Machine and as a Resource Manager, Operating system concepts (Files, Deadlocks, Memory Management, Input/Output, Processes, The Shell, Security), The evolution of Operating Systems (Serial Processing, Simple Batch Systems, Multiprogrammed Batch Systems, Mainframe Operating Systems, Server Operating Systems, Time Sharing Systems, Multiprocessor Operating Systems, Real-Time Systems, Embedded Operating Systems, Smart Card Operating), System Calls (Process Management, File Management, Directory management), Introduction to Processes (The Process Model, Process Creation, Process Termination, Process Hierarchies, Process States, Implementation of Processes, Process Control Block), Threads (The Thread Model, Thread Usage, Implementing Threads(In User Space and Kernel), Scheduler Activation, Pop Up Threads, Interprocess Communication (Race conditions, Critical Sections, Mutual Exclusion with Busy Waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message Passing), Classical IPC problems (The Dining Philosophers Problem, The Sleeping Barber Problem), Process Scheduling (Scheduling in Batch Systems, Scheduling in Batch Systems, Scheduling in Interactive Systems, Scheduling in Real-Time Systems, Thread Scheduling)

UNIT-II

Deadlocks and Memory Management: Resources, Deadlock (Conditions for Deadlock, Deadlock modeling), Deadlock detection and recovery, Deadlock avoidance, Deadlock prevention. Memory management without swapping or paging (Monoprogramming without swapping or paging, Multiprogramming with fixed partitions, Relocation and Protection), Swapping, Virtual Memory (Paging, Page Tables), Page Replacement Algorithms (Not-recently-used, First in first out, Second Chance page replacement algorithm, The Clock Page Replacement Algorithm, Least Recently used page replacement algorithm, The Working Set Page Replacement Algorithm, Modeling Paging Algorithms (Belady‟s Anomaly, Stack Algorithms, Predicting page fault rates), Design issues for Paging Systems, Implementation issues, Segmentation (Implementation of pure segmentation, Segmentation with Paging: MULTICS)

UNIT -III

Input/Output and File Systems:

Principles of I/O hardware (I/O devices, Device Controllers, Direct memory access), Principles of I/O software, I/O Software Layers, Disks (Disk hardware, disk formatting, disk arm scheduling algorithms, Error handling, Track-at-a-time caching, RAM disks) Clocks (Clock hardware, Clock software), Terminals (Terminal hardware, Input software, Output software)

Files (File Naming, File structure, File types, File access, File attributes, File operations, Memory mapped files), Directories, File System layout (Implementing files, Implementing directories, Shared files), Security (The security environment, Generic Security Attacks, Design Principles For Security, User Authentication), Protection mechanisms (Protection Domains, Access Control Lists, Capabilities,

Multilevel Security, Covert Channels), Type of File Systems (FAT, VFAT, FAT32, NTFS)

UNIT -IV

Introduction to Linux OS design –Case study

Overview of Unix, Processes in Unix (Fundamental Concepts, Process Management System Calls in Unix, Implementation of Processes in Unix), Memory Management in Unix, Input/Output in Unix, The Unix File System, Security in Unix

Books/References:

1. Tanenbaum, Modern Operating Systems, PHI (EEE)
2. Milenkovic, Operating Systems: Concepts and Design, McGraw Hill.
3. Sillberschatzet. al, Operating Systems, Wiley India.
4. W.R. Steveans, Advanced Progamming in the UNIX Environment, Addison Wesley.
5. M.J. Bach, The Design of the UNIX Operation System, PHI(EEE). Singhal and Shivaratri, Advanced Concepts in Operating Systems

CSE-102-CC-1140 Computer Networks [3-0-1]

Course Objectives (COBs)

The main objectives of this course are to:

1. **COB1:** Introduce the fundamental concepts, components, and architecture of computer networks.
2. **COB2:** Understand data communication principles, transmission media, and error detection/correction techniques.
3. **COB3:** Explain layered network architectures and protocols with emphasis on the OSI and TCP/IP models.
4. **COB4:** Analyze various routing, congestion control, and flow control mechanisms.
5. **COB5:** Understand transport and application layer protocols and their real-world applications.

Course Outcomes (COs)

After successful completion of this course, students will be able to:

CO Code	Course Outcome Description	Bloom's Level
CO1	Describe the basic concepts of data communication, network components, and topology.	Understanding
CO2	Explain the layered network architecture and compare OSI and TCP/IP models.	Understanding
CO3	Apply error detection and correction techniques for reliable data transmission.	Applying
CO4	Analyze various routing algorithms and evaluate network performance.	Analyzing
CO5	Illustrate the working of transport and application layer protocols such as TCP, UDP, HTTP, and DNS.	Applying

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	3	1	2	1	1	2	2	3
CO2	3	3	3	3	2	2	1	3	3	2	2	2
CO3	2	2	2	3	2	3	3	2	3	3	2	3
CO4	3	3	2	2	3	2	3	1	1	2	1	2
CO5	3	2	1	1	2	3	3	2	2	2	3	2
Average	2.8	2.5	1.8	2.2	2.4	2.2	2.4	1.8	1.6	2.2	2	2.4

1: Low 2: Medium 3: High -: No Correlation

UNIT I

Define computer network, identifying basic networking elements and describing roles of Clients, Server, Peers, and Transmission Media & Protocols Network Services: File, print, Message, Database Application Identifying Differences bet. Centralized & distributed network architecture Identifying appropriate transmission media to meet a business need. Cable Media & Wireless Media, Network Connectivity devices, Modern repeaters, Hubs Bridges, Multiplexes and routers

UNIT II

Identifying 7 Layers of OSI
Physical Layer: Connection types used in Computer Network, Common Physical technologies used in computer
Network: BUS, Ring, Star, Cellular, Analog & Digital Signals, bandwidth
Data link Layer: Purpose of data link Layer, Switching Methods, Routing, Network layer connection services, Bridging
Transport Layer: Purpose of transport layer, Address name resolution, Flow control, Error control Session Layer: Purpose of Session Layer, Session Administration, Dialog control methods
Presentation Layer: Purpose of Presentation Layer, Application Layer: Purpose of Application Layer

UNIT III

Identifying Network Classes, obtain register IP address, Domains, how Host name, host table and DNS work. Windows Internet naming services (WINS), Subnets, Subnets mask Assigning and managing IP subnets.

UNIT IV:

Introduction to Windows XP /Vista and Windows 7 as desktop operating systems and Sharing files and folders in Windows Network, Printing in Windows Network. Introduction to Windows 2003 and windows 2008 as Network operating system ,

UNIT V

Basics of Internet and Intranet: Types of Internet connections: Dialup, Broadband, Leased Line, Wi-Fi, Wi-Max, 2G, 3G, 4G, WWW, E- mails, Search Engines, Social Networking, Cloud application, Audio-video Conferencing, Voice over Internet Protocol (VOIP).

Books/References:

1. Kurose, James F., Ross, Keith W., *Computer networking : a top-down approach featuring the Internet***.** Pearson.
2. Computer Networking Andrew S. Tanenbam , PHI
3. Nader Mir F., Computer and Communication Networks, Pearson Education.

CSE-102-MC-1110 Web Programming [2-0-2]

Course Objectives (COBs)

The main objectives of this course are to:

1. **COB1:** Introduce the basic concepts, architecture, and technologies of the World Wide Web.
2. **COB2:** Enable students to design and develop static and dynamic web pages using HTML, CSS, and JavaScript.
3. **COB3:** Familiarize students with client-side and server-side scripting languages for interactive web applications.
4. **COB4:** Introduce database connectivity for dynamic content generation using technologies such as PHP or Ruby.
5. **COB5:** Develop an understanding of web frameworks, responsive design, and modern development tools.

Course Outcomes (COs)

After successful completion of this course, students will be able to:

CO Code	Course Outcome Description	Bloom's Level
CO1	Describe the architecture of the Internet and fundamental web technologies.	Understanding
CO2	Design and develop static web pages using HTML5 and CSS3.	Applying
CO3	Implement client-side interactivity and validation using JavaScript and DOM manipulation.	Applying
CO4	Integrate web applications with backend databases using SQL/NoSQL queries.	Applying
CO5	Evaluate web applications for performance, usability, and security best practices.	Evaluating

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	3	2	1	2	3	1	2	1	1	2	2	3
CO2	3	3	3	3	2	2	1	3	3	2	2	2
CO3	2	2	2	3	2	3	3	2	3	3	2	3
CO4	3	3	2	2	3	2	3	1	1	2	1	2
CO5	3	2	1	1	2	3	3	2	2	2	3	2
Average	2.8	2.5	1.8	2.2	2.4	2.2	2.4	1.8	1.6	2.2	2	2.4

1: Low 2: Medium 3: High -: No Correlation

UNIT-I

Fundamentals of Web and XHTML: Internet, WWW, Web Browsers, and Web Servers; URLs; MIME; HTTP; Security; The Web Programmers Toolbox. XHTML: Origins and evolution of HTML and XHTML; Basic syntax; Standard XHTML document structure; Basic text markup; Images; Hypertext Links; Lists; Tables; Forms; Frames; Syntactic differences between HTML4,HTML 5 and XHTML, Introduction to HTML5.0 form elements and validations.

UNIT–II

CSS Introduction: Levels of style sheets; Style specification formats; Selector forms; Property value forms; Font properties; List properties; Color; Alignment of text; The Box model; Background images; The and tags; Conflict resolution. JavaScript: Overview of JavaScript; Object orientation and JavaScript; General syntactic characteristics; Primitives, operations, and expressions; Screen output and keyboard input; Control statements; Object creation and modification; Arrays; Functions; Constructor; Pattern matching using regular expressions; Errors in scripts; Examples.

UNIT–III

Dynamic Documents with JavaScript: The JavaScript execution environment; The Document Object Model; Element access in JavaScript. Events and Event Handling: Handling events from the Body elements, Button elements, Text box and Password elements. The DOM 2 event model.

Introduction to AJAX: Overview of AJAX, The basics of AJAX, Rails with AJAX.

Introduction to PHP: Overview of PHP, General syntactic characteristics, Primitives, operations and expressions, Output, Control statements, Arrays, Functions, Pattern matching, Form handling, Files.

UNIT–IV

Session Handling with PHP: Tracking users, Cookies, Sessions. CRUD Operations using Database and Handling XML.

Introduction to Ruby on Rails: Origins and uses of Ruby, Scalar types and their operations, Simple input and output, Control statements, Arrays, Hashes, Methods, Classes, Code blocks

and iterators, Pattern matching. Introduction to Rails: Overview of Rails, Document requests, Processing forms, Rails applications.

Reference Books

1. Robert W. Sebesta, Programming the World Wide Web, 4th Edition, Pearson Education, 2008.
1. Chris Bates, Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2006.
2. Eric Ladd, Jim O' Donnel using HTML 4,XML and Java, Prentice Hall of India-QUE,1999.

CSE-102-CC-1210 DATA STRUCTURE [3-0-1]

Course Objectives (COBs)

The main objectives of this course are to:

1. **COB1:** Introduce fundamental concepts of data structures and the need for efficient data organization.
2. **COB2:** Enable students to implement and manipulate linear data structures such as arrays, stacks, queues, and linked lists.
3. **COB3:** Develop an understanding of non-linear data structures such as trees and graphs and their real-world applications.
4. **COB4:** Teach algorithmic techniques for searching, sorting, and traversing data efficiently.
5. **COB6:** Apply data structures for problem-solving and design of efficient algorithms in software development.

Course Outcomes (COs)

After successful completion of this course, students will be able to:

CO Code	Course Outcome Description	Bloom's Level
CO1	Explain the concept, representation, and applications of different data structures.	Understanding
CO2	Implement and apply linear data structures such as arrays, stacks, queues, and linked lists in problem solving.	Applying
CO3	Apply non-linear data structures like trees and graphs to represent hierarchical and networked data.	Applying
CO4	Analyze the performance of searching, sorting, and traversal algorithms.	Analyzing
CO5	Evaluate and compare different data structures based on their efficiency and suitability for applications.	Evaluating

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	3	1	2	1	1	2	2	3

CO2	3	3	3	3	2	2	1	3	3	2	2	2
CO3	2	2	2	3	2	3	3	2	3	3	2	3
CO4	3	3	2	2	3	2	3	1	1	2	1	2
CO5	3	2	1	1	2	3	3	2	2	2	3	2
Average	2.8	2.5	1.8	2.2	2.4	2.2	2.4	1.8	1.6	2.2	2	2.4

1: Low 2: Medium 3: High -: No Correlation

Unit-I

Introduction
Basic Terminology, Elementary Data Organization, Structure Operations, Algorithm, Complexity and Time-Space trade-off.
Arrays: Array Definition, Representation and Analysis, Single and Multidimensional Arrays, Address Calculation, Application of Arrays.

Unit-II
Stacks: Array Representation and Implementation of the stack, Operations on Stacks: Push & Pop, Array Representation of Stack, Linked Representation of Stack, Operations Associated with Stacks, Application of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack.

Unit-III
Queues: Array and linked representation and implementation of queues, Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, D-queues and Priority Queues.

Linked list: Representation and Implementation of Singly Linked Lists, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to/from Linked Lists, Insertion and deletion Algorithms, Doubly Linked List, Linked List in Array.

Unit-IV
Trees: Basic terminology, Binary Trees, Binary tree representation, Array and Linked Representation of Binary trees, Types of Binary Tree, Traversing Binary trees, Binary Search Tree (BST), Insertion and Deletion in BST, AVL Trees, Huffman algorithm.
Graphs: Terminology & Representations, Graphs & Multi-graphs, Directed Graphs, Sequential Representations of Graphs, Adjacency Matrices, Traversal, Connected Component and Spanning Trees, Minimum Cost Spanning Trees.

Unit-V

Searching and Hashing:
Sequential search, binary search, comparison and analysis, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation.
Sorting: Insertion Sort, Bubble Sorting, Selection Sort, Quick Sort, Merge Sort, Heap Sort, Linear time sorting, Practical consideration for Internal Sorting and External Sorting.

REFERENCE BOOKS

1. Cormen, T.H., Leiserson, C.E., Rivest, R.L. and Stein, C., *Introduction to Algorithms*, MIT Press, 2010.
2. Goodrich, M.T., Tamassia, R. and Mount, D.M., *Data Structures and Algorithms in C++*, John Wiley & Sons, 2016.
3. Langsam, Y., Augenstein, M. and Tenenbaum, A.M., *Data Structures using C and C++*, Prentice Hall, 2015.
3. Lipschutz, S., *Schaum's Outline of Theory and Problems of Data Structures*, McGraw-Hill, 2014

CSE-102-CC-1220 Theory of Computation [3-1-0]

Course Objectives (COBs)

The main objectives of this course are to:

1. **COB1:** Introduce the fundamental concepts of formal languages, automata, and grammars.
2. **COB2:** Develop an understanding of abstract computation models such as finite automata, pushdown automata, and Turing machines.
3. **COB3:** Explain the relationship between regular expressions, grammars, and automata.
4. **COB4:** Familiarize students with the concepts of decidability, computability, and complexity.
5. **COB5:** Enable students to classify problems based on their computational properties and understand limits of computation.

Course Outcomes (COs)

After successful completion of this course, students will be able to:

CO Code	Course Outcome Description	Bloom's Level
CO1	Describe fundamental concepts of formal languages, symbols, alphabets, and automata theory.	Understanding
CO2	Construct and analyze finite automata (DFA, NFA, ε-NFA) and regular expressions for regular languages.	Applying
CO3	Design context-free grammars and construct pushdown automata for context-free languages.	Applying
CO4	Analyze language classification (regular, context-free, recursive, recursively enumerable) and their relationships.	Analyzing
CO5	Apply theoretical models to understand compiler design, parsing, and complexity theory.	Applying

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	3	1	2	1	1	2	2	3

CO2	3	3	3	3	2	2	1	3	3	2	2	2
CO3	2	2	2	3	2	3	3	2	3	3	2	3
CO4	3	3	2	2	3	2	3	1	1	2	1	2
CO5	3	2	1	1	2	3	3	2	2	2	3	2
Average	2.8	2.5	1.8	2.2	2.4	2.2	2.4	1.8	1.6	2.2	2	2.4

1: Low 2: Medium 3: High -: No Correlation

UNIT–I

FINITE AUTOMATA: Introduction, Deterministic Finite Automata (DFA) -Formal definition, simpler notations (state transition diagram, transition table), language of a DFA. Nondeterministic Finite Automata (NFA)- Definition of NFA, language of an NFA, Equivalence of Deterministic and Nondeterministic Finite Automata, Applications of Finite Automata, Finite Automata with Epsilon Transitions, Eliminating Epsilon transitions, Minimization of Deterministic Finite Automata, Finite automata with output (Moore and Mealy machines) and Inter conversion.

UNIT – II

REGULAR EXPRESSIONS: Introduction, Identities of Regular Expressions, Finite Automata and Regular Expressions- Converting from DFA‟s to Regular Expressions, Converting Regular Expressions to Automata, applications of Regular Expressions. REGULAR GRAMMARS: Definition, regular grammars and FA, FA for regular grammar, Regular grammar for FA. Proving languages to be non-regular -Pumping lemma, applications, Closure properties of regular languages.

UNIT – III

CONTEXT FREE GRAMMAR: Derivation Trees, Sentential Forms, Rightmost and Leftmost derivations of Strings. Ambiguity in CFG‟s, Minimization of CFG‟s, CNF, GNF, Pumping Lemma for CFL‟s, Enumeration of Properties of CFL (Proof‟s omitted).

UNIT–IV

PUSHDOWN AUTOMATA: Definition, Model, Acceptance of CFL, Acceptance by Final State and Acceptance by Empty stack and its Equivalence, Equivalence of CFG and PDA.TURING MACHINES (TM): Formal definition and behaviour, Languages of a TM, TM as accepters, and TM as a computer of integer functions, Types of TMs.

UNIT- V

RECURSIVE AND RECURSIVELY ENUMERABLE LANGUAGES: Properties of recursive and recursively enumerable languages, Universal Turing machine, The Halting problem, Undecidable problems about TMs. Context sensitive language and linear bounded automata (LBA), Chomsky hierarchy, Decidability, Post's correspondence problem (PCP), undecidability of PCP

TEXT BOOKS:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory Languages and Computation, Pearson Education, India.
2. Michael Sipser, Introduction to Theory of Computation, Cengage India Private Limited

REFERENCE BOOKS

1. K. L. P Mishra, N. Chandrashekaran (2003), Theory of Computer Science-Automata Languages and Computation, 2nd edition, Prentice Hall of India, India.

CSE-102-RC-1240 Research and Publication Ethics [3-1-0]

Course Objectives (COBs)

The main objectives of this course are to:

1. **COB1:** Introduce the philosophy, ethics, and principles of research and scholarly communication.
2. **COB2:** Develop an understanding of research integrity, intellectual honesty, and responsible conduct of research.
3. **COB3:** Familiarize scholars with publication ethics, plagiarism, and citation practices.
4. **COB4:** Enable learners to identify unethical practices and predatory journals in academic publishing.
5. **COB5:** Promote awareness about open access, copyright, and licensing issues in research dissemination.

Course Outcomes (COs)

After successful completion of this course, the scholars will be able to:

CO Code	Course Outcome Description	Bloom's Level
CO1	Explain the principles and importance of research ethics and integrity in academia.	Understanding
CO2	Identify ethical issues and violations in research practices, including fabrication, falsification, and plagiarism.	Analyzing
CO3	Evaluate the authenticity and credibility of journals and publishers to avoid predatory practices.	Evaluating
CO4	Demonstrate understanding of open access publishing models, copyrights, and licensing norms.	Understanding

CO Code	Course Outcome Description	Bloom's Level
CO5	Integrate ethical principles in writing, reviewing, and disseminating scholarly research.	Applying

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	3	1	2	1	1	2	2	3
CO2	3	3	3	3	2	2	1	3	3	2	2	2
CO3	2	2	2	3	2	3	3	2	3	3	2	3
CO4	3	3	2	2	3	2	3	1	1	2	1	2
CO5	3	2	1	1	2	3	3	2	2	2	3	2
Average	2.8	2.5	1.8	2.2	2.4	2.2	2.4	1.8	1.6	2.2	2	2.4

1: Low 2: Medium 3: High -: No Correlation

UNIT – I

Philosophy and Ethics: Introduction to Philosophy: definition, nature, scope, concept, branches Ethics: definition, moral philosophy, nature of moral judgment and reactions.

UNIT – II

Scientific Conduct: Ethics with respect to science and research; Intellectual honesty and research integrity, copyright, Scientific misconduct: falsification, fabrication and Plagiarism (FFP); Redundant Publication: duplication and overlapping publication, salami slicing; Selective reporting and misrepresentation of data.

UNIT – III

Publication Ethics: definition, introduction and importance Best practice/standard setting initiative and guidelines: COPE, WAME, etc. Conflict and interest

Publication misconduct: definition, concept, problems that leads to unethical behaviour and vice versa, type Violation of publication ethics, authorship and contributorship, Identification of publication misconduct, complaint and appeals Predatory publisher and journals Avoiding Plagiarism. Preparing documents for MoUs, Confidentiality Agreements.

UNIT – IV

Open access publishing: Open access publication and initiatives SHERPA/RoMEO online resource to check publisher copyright and self-archiving policies Software tool to identify predatory publication developed by SPPU Journal finder/journal suggestion tools viz. JANE, Elsevier Journal finder, Springer, Journal Suggester, etc.

UNIT – V

Group Discussion: Subject Specific Ethical Issues FFP, authorship Conflict interest, Complaints and appeals: examples and fraud from India and abroad

Software tools: Use of plagiarism software like turnitin, Urkund and other open source software tools

Database: Indexing database, Citation database: web of science, scopus, etc.

Research metrics: Impact factor of Journal as per journal citation report, SNIP,SJR,IPP, Cite Score Metrics: h-index, g-index, i-10 index, altmetrics

Recommended Books

1. Nicholas H. Steneck. Introduction to the Responsible Conduct of Research. Office of Research Integrity. 2007. Available at: https://ori.hhs.gov/sites/default/files/rcrintro.pdf

2. The Student's Guide to Research Ethics By Paul Oliver Open University Press, 2003
3. Responsible Conduct of Research By Adil E. Shamoo; David B. Resnik Oxford University Press, 2003
4. Ethics in Science Education, Research and Governance Edited by Kambadur Muralidhar, Amit Ghosh Ashok Kumar Singhvi. Indian National Science Academy, 2019.
5. Anderson B.H., Dursaton, and Poole M.: Thesis and assignment writing, Wiley Eastern 1997.
6. BijornGustavii: How to write and illustrate scientific papers? Cambridge University Press.
7. Bordens K.S. and Abbott, B.b.: Research Design and Methods, Mc Graw Hill, 2008.
8. Graziano, A., M., and Raulin, M.,L.: Research Methods – A Process of Inquiry, Sixth Edition, Pearson, 2007.

CSE -CC-4710: INTRODUCTION TO MACHINE LEARNING

Credit:4(L3–T0–P1)

(Theory – 45 Hours; Tutorial: 0 Hours; Practical – 30 Hours)

Learning Objectives

1. Understand the fundamentals of machine learning, including its definition, evaluation methods for networks, and the handling of datasets, encompassing concepts like feature sets, dataset division into test, train, and validation sets, and techniques like cross-validation.
2. Explore the basics of machine learning, including its applications and underlying processes, and gain insight into various machine learning techniques such as supervised learning, unsupervised learning, and reinforcement learning, through real-life examples.
3. Develop proficiency in supervised learning techniques such as classification and regression, including algorithms like K-Nearest Neighbor, Linear Regression, Logistic Regression, and Support Vector Machine (SVM), and learn evaluation measures like SSE, MME, R2, confusion matrix, precision, recall, F-Score, and ROC-Curve.
4. Gain expertise in unsupervised learning techniques, including clustering methods such as Hierarchical, Agglomerative Clustering, Divisive clustering, and Partitional Clustering with K-means clustering, to discover patterns and structures in data.
5. Explore miscellaneous topics including dimensionality reduction techniques like PCA, LDA, ICA, introduction to Deep Learning, Gaussian Mixture Models, Natural Language Processing (NLP), and Computer Vision, expanding knowledge and understanding of advanced machine learning concepts and applications.

Course Outcomes

On completion of this course the students will be able to:

CO1. Develop a comprehensive understanding of machine learning fundamentals.
CO2. Gain practical knowledge of machine learning techniques.
CO3. Acquire proficiency in handling datasets and feature sets.
CO4. Explore advanced topics in machine learning, including dimensionality reduction techniques like PCA, LDA, and ICA.
CO5. Develop practical problem-solving skills through real-life examples and applications of machine learning techniques.

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	3	1	1	2	3	1	2	1	1	2	2	3
CO2	3	3	3	3	2	2	1	3	3	2	2	2
CO3	2	2	2	3	2	3	3	2	2	3	2	3
CO4	3	3	2	2	3	3	3	1	1	2	1	2
CO5	3	2	1	1	2	3	3	2	2	2	3	2
Average	2.8	2.2	1.8	2.2	2.4	2.4	2.4	1.8	1.8	2.2	2	2.4

1: Low 2: Medium 3: High -: No Correlation

UNIT – I

Introduction : What Is Machine Learning?, How Do We Define Learning?, How Do We Evaluate Our Networks?, How Do We Learn Our Network?, What are datasets and how to handle them?, Feature sets, Dataset division: test, train and validation sets, cross validation.

(10 Hours Lecture + 6 Hours Practical ,CO1)

UNIT – II

Basics of machine learning: Applications of Machine Learning, processes involved in Machine Learning.

Introduction to Machine Learning Techniques: Supervised Learning, Unsupervised Learning and Reinforcement Learning, Real life examples of Machine Learning.

(10 Hours Lecture + 6 Hours Practical ,CO2)

UNIT – III

Supervised learning : Classification and Regression: K-Nearest Neighbor, Linear Regression, Logistic Regression, Support Vector Machine (SVM), Evaluation Measures: SSE, MME, R2, confusion matrix, precision, recall, F-Score, ROC-Curve.

(10 Hours Lecture + 6 Hours Practical ,CO3)

UNIT – IV

Unsupervised learning : Introduction to clustering, Types of Clustering: Hierarchical, Agglomerative Clustering and Divisive clustering; Partitional Clustering - K-means clustering.

(10 Hours Lecture + 6 Hours Practical ,CO4)

UNIT – V

Miscellaneous: Dimensionality reduction techniques: PCA, LDA, ICA. Introduction to Deep Learning, Gaussian Mixture Models, Natural Language Processing, Computer Vision.

(5 Hours Lecture + 6 Hours Practical ,CO5)

Recommended Books

1. Introduction to Machine Learning, By Jeeva Jose, Khanna Book Publishing Co., 2020.
2. Machine Learning for Dummies, By John Paul Mueller and Luca Massaron, For Dummies,2016.
3. Machine Learning, By Rajeev Chopra, Khanna Book Publishing Co., 2021.
4. Machine Learning: The New AI, By Ethem Alpaydin, The MIT Press, 2016.
5. Machine Learning, Tom M. Mitchell, McGraw Hill Education, 2017.
6. https://www.udacity.com/course/intro-to-machine-learning--ud120
7. https://www.coursera.org/learn/machine-learning-duke

Major 18(4)- DSE-1
(any one)

1. PROGRAMMING WITH MATLAB (3-0-1)
2. BCA-DE-352: Data Analytics (3-0-1)
3. BCA-DE-353: Computer Ethics (3-0-1)
4. R FOR DATA SCIENCE (3-0-1)

CSE -DE-4710: PROGRAMMING WITH MATLAB

Credit:4(L3–T0–P1)

(Theory – 45 Hours; Tutorial: 0 Hours; Practical – 30 Hours)

Learning Objectives

1. To enhance programming knowledge in Research and Development with MATLAB software.
2. To provide a working introduction to the MATLAB technical computing environment viz. Themes of data analysis, visualization, programming etc.
3. To provide a working introduction Advanced plotting techniques in MATLAB
4. To provide a working introduction Procedures and Functions in MATLAB
5. To provide a working introduction Spectral Analysis in MATLAB

Course Outcomes

On completion of this course the students will be able to:

CO1. Learn to apply R MATLAB for breaking a complex task up into smaller, simpler tasks for data processing.
CO2. Able to Tabulate results, analyze and visualize data
CO3. Able to understand Advanced plotting techniques in MATLAB
CO4. Able to understand working introduction Procedures and Functions in MATLAB
CO5. Able to understand Spectral Analysis in MATLAB

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3	2	3	2	2	3	2	1	2	1
CO2	1	3	3	1	3	1	1	1	1	1	1	3
CO3	2	1	3	2	2	1	2	3	2	2	1	1
CO4	3	3	2	3	1	3	1	3	2	1	3	3
CO5	3	1	3	1	3	1	3	2	3	1	2	1
Average	2	2	2.8	1.8	2.4	1.6	1.8	2.4	2	1.2	1.8	1.8

1: Low 2: Medium 3: High -: No Correlation

UNIT – I

Introduction to MATLAB Programming Environment: Overview of MATLAB and its applications in engineering, science, and data analysis ; Introduction to MATLAB programming environment, including the MATLAB desktop, command window, and script editor ; Basic syntax and commands in MATLAB for performing mathematical operations, creating variables, and accessing help documentation ; Hands-on exercises to familiarize students with the MATLAB interface and basic programming concepts.

(5 Hours Lecture + 6 Hours Practical ,CO1)

UNIT – II

Graph Plots and Visualization in MATLAB : Introduction to plotting functions in MATLAB for creating 2D and 3D plots, including line plots, scatter plots, bar plots, and surface plots

Customizing plot appearance using formatting options, labels, titles, and annotations

Advanced plotting techniques in MATLAB, such as subplotting, axis manipulation, and adding legends; Practical exercises and assignments to reinforce graph plotting skills and visualization techniques.

(10 Hours Lecture + 6 Hours Practical ,CO2)

UNIT – III

Procedures and Functions in MATLAB : Understanding the concept of procedures and functions in MATLAB for code organization and reusability; Writing and defining user-defined functions in MATLAB for performing specific tasks or calculations ; Passing arguments to functions and returning values for efficient data processing ; Utilizing built-in MATLAB functions and libraries to enhance programming efficiency and productivity.

(10 Hours Lecture + 6 Hours Practical ,CO3)

UNIT – IV

Control Statements and Manipulating Text in MATLAB : Exploring control statements in MATLAB, including if-else statements, switch-case statements, and loops (for, while) ; Using control statements for flow control and decision-making in MATLAB programs ; Manipulating text data in MATLAB, including string manipulation, searching, and formatting ; Applying control statements and text manipulation techniques to solve practical problems and tasks.

(10 Hours Lecture + 6 Hours Practical ,CO4)

UNIT – V

GUI Interface, Discrete Linear Systems, and Spectral Analysis in MATLAB: Introduction to creating graphical user interfaces (GUIs) in MATLAB for interactive program development. Understanding discrete linear systems and their representation in MATLAB, including signal processing techniques and filter design; Introduction to spectral analysis methods in MATLAB, including Fourier analysis, FFT (Fast Fourier Transform), and frequency domain analysis; Application of GUIs, discrete linear systems, and spectral analysis techniques to real-world engineering and scientific problems through projects and case studies.

(10 Hours Lecture + 6 Hours Practical ,CO5)

Recommended Books

1. Stormy Attaway, MATLAB: A Practical Introduction to Programming and Problem Solving, 3rd edition, Elsevier, 2013
2. Hunt, Brian R., Ronald L. Lipsman, and Jonathan M. Rosenberg. A guide to MATLAB: for beginners and experienced users. Cambridge university press, 2014.
3. Gilat, A., MATLAB: An introduction with applications (4th Ed). New York: Wiley, 2012.
4. Stephen J. Chapman, MATLAB Programming for Engineers, 6E,Cengage Learning India Pvt. Ltd., 2019

CSE -DE-4720: DATA ANALYTICS

Credit:4(L3–T0–P1)

(Theory – 45 Hours; Tutorial: 0 Hours; Practical – 30 Hours)

Learning Objectives

1. Understand the fundamentals of social network and web data analysis, including graph theory concepts and basic measures for individuals and networks, to effectively analyze complex social and web structures.
2. Learn to utilize web analytics tools and methodologies, such as click stream analysis and A/B testing, to assess website performance, user behavior, and engagement metrics for optimization.
3. Develop proficiency in web search and retrieval techniques, including search engine optimization (SEO) and web crawling, indexing, and ranking algorithms, to enhance web visibility and search engine rankings.
4. Explore advanced topics in network analysis, such as link analysis and network evolution, to understand the dynamics of network connectivity and evolution over time in social and web contexts.
5. Gain insights into social connections and their dynamics, including affiliation, identity, and diffusion

of innovation, to analyze patterns of social involvement and information dissemination in online networks.

Course Outcomes

On completion of this course the students will be able to:

CO1. Develop an understanding of social network and web data, including methods for data collection and analysis.
CO2. Gain proficiency in web analytics tools and techniques, such as click stream analysis, A/B testing, and online surveys, enabling the evaluation of website performance and user behavior for optimization and improvement.
CO3. Acquire knowledge of web search and retrieval mechanisms.
CO4. Explore advanced topics in network analysis, including link analysis, random graphs, and network evolution.
CO5. Understand the dynamics of social connections, including affiliation and identity, as well as connection search, collapse, robustness, and diffusion of innovation.

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	3	2	3	1	3	2	1	1	3	3
CO2	1	3	3	2	1	1	3	3	3	3	1	2
CO3	1	3	1	3	3	3	1	2	1	3	2	1
CO4	1	1	2	1	1	3	3	1	2	3	2	3
CO5	1	3	2	1	1	1	1	1	3	1	3	2
Average	1.2	2.2	2.2	1.8	1.8	1.8	2.2	1.8	2	2.2	2.2	2.2

1: Low 2: Medium 3: High -: No Correlation

UNIT – I
Introduction – Social network and Web data and methods, Graph and Matrices, Basic measures for individuals and networks, Information Visualization.

(5 Hours Lecture + 6 Hours Practical ,CO1)

UNIT – II
Web Analytics tools: Click Stream Analysis, A/B testing, Online Surveys.

(10 Hours Lecture + 6 Hours Practical ,CO2)

UNIT – III
Web Search and Retrieval: Search Engine Optimization, Web Crawling and indexing, Ranking Algorithms, Web traffic models.

(10 Hours Lecture + 6 Hours Practical ,CO3)

UNIT – IV

Making Connection: Link Analysis, Random Graphs and Network evolution.

(10 Hours Lecture + 6 Hours Practical ,CO4)

UNIT – V

Social Connects: Affiliation and identity

Connection: Connection Search, Collapse, Robustness Social involvements and diffusion of innovation.

(10 Hours Lecture + 6 Hours Practical ,CO5)

Recommended Books

1. Hansen, Derek, Ben Sheiderman, Marc Smith. 2011. Analyzing Social Media Networks with NodeXL: Insights from a Connected World. Morgan Kaufmann, 304.
2. Avinash Kaushik. 2009. Web Analytics 2.0: The Art of Online Accountability.
3. Easley, D. & Kleinberg, J. (2010). Networks, Crowds, and Markets: Reasoning About a Highly Connected World. New York: Cambridge University Press. http://www.cs.cornell.edu/home/kleinber/networks-book/
4. Wasserman, S. & Faust, K. (1994). Social network analysis: Methods and applications. New York: Cambridge University Press. Monge, P. R. & Contractor, N. S. (2003). Theories of communication networks. New York: Oxford University Press.

CSE -DE-4730: COMPUTER ETHICS

Credit:4(L3–T1–P0)

(Theory – 45 Hours; Tutorial: 15; Practical – 0 Hours)

Learning Objectives

1. Recognize milestones in computing, networking, and information storage and retrieval
2. Be familiar with the language and content of ethical discourse
3. Understand modern debates surrounding intellectual property
4. Appreciate the threats to privacy posed by modern information gathering techniques
5. Be familiar with a range of other ethical issues raised by modern information technology and relevant to computer professionals

Course Outcomes

On completion of this course the students will be able to:

CO1. Describe and distinguish between the various ethical theories which can be used to form the basis of solutions to moral dilemmas in computing.

CO2. Identify traditional and current Issues related to Computers, Information Systems, Ethics, Society and Human Values;

CO3. Identify and define the components of a structured plan for solving ethical problems and, in the process, will be able to understand the basis for her/his own ethical system.

CO4. Given several examples of professional codes of ethics related to computing, the student will be able to compare and contrast these examples, discussing their commonalties, differences, and implications.

CO5. Develop skills of critical analysis and applying ethical principles to situations and dialectical thinking

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	3	1	2	3	2	3	2	1	3
CO2	1	2	2	3	3	1	1	2	1	1	3	3
CO3	1	1	2	3	1	3	2	3	1	1	1	3
CO4	1	2	3	1	1	1	2	3	2	3	1	1
CO5	1	1	1	2	2	2	3	2	2	3	3	1
Average	1	1.4	1.8	2.4	1.6	1.8	2.2	2.4	1.8	2	1.8	2.2

1: Low 2: Medium 3: High -: No Correlation

UNIT – I

The Need for Computer Ethics Training and Historical Milestones.

(10 Hours Lecture ,CO1)

UNIT – II

Defining the Field of Computer Ethics, Computer ethics codes, Sample Topics in Computer Ethics : Computer crime and computer security; Software theft and intellectual property rights; Computer hacking and the creation of viruses; Computer and information system failure ; Invasion of privacy. Privacy in the Workplace and on the Internet ;Social implications of artificial intelligence and expert systems; The information technology salesman issues.

(10 Hours Lecture + 5 Hours Tutorial ,CO2)

UNIT – III

Transparency and Virtual Ethics, Free Speech, Democracy, Information Access.

(10 Hours Lecture + 5 Hours Tutorial ,CO3)

UNIT – IV

Developing the Ethical Analysis Skills and Professional Values, Privacy, Accountability, Government Surveillance.

(10 Hours Lecture + 5 Hours Tutorial ,CO4)

UNIT – V

Boundaries of Trust, Trust Management, Wikipedia, Virtual Trust, Plagiarism in Online Environment, Intellectual Property, Net neutrality.

(10 Hours Lecture ,CO5)

Recommended Books

1. Deborah G.Johnson, Helen Nissenbaum, Computing, Ethics & Social Values, Prentice Hall, (1995).
2. Richard A. Spinello, Herman T. Tavani, Readings in Cyberethics, Jones and Bartlett Publishers, (2001).
3. Simon Rogerson, Terrell Ward Bynum, Computer Ethics and Professional Responsibility, Blackwell, (2004)

CSE -DE-4740: R FOR DATA SCIENCE

Credit:4(L3–T0–P1)

(Theory – 45 Hours; Tutorial: 0 Hours; Practical – 30 Hours)

Learning Objectives

1. Introduce the basics of programming in R for data analytics.
2. Introduce good practices of workflows and reproducibility in data science.
3. To develop skills independently in programming and data science workflow.
4. Introduce the fundamental principles of writing scripts in R and how they are applied in practice for data analytics.
5. Introduce the interfacing R with other programming languages such as C/C++, Python

Course Outcomes

On completion of this course the students will be able to:

CO1. Understand the basics in R programming in terms of constructs, control statements, string functions
CO2. Understand the use of R for Big Data analytics
CO3. Learn to apply R programming for Big data processing.
CO4. Able to apply the R programming from a statistical perspective
CO5. Able to write scripts in R

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	3	1	1	1	1	2	3	3	1
CO2	1	3	1	2	1	2	3	1	3	2	3	2
CO3	1	2	1	2	1	3	2	3	2	1	1	1
CO4	2	3	1	1	2	2	3	3	2	1	1	2
CO5	1	3	2	3	2	3	2	3	1	1	3	2
Average	1.6	2.8	1.2	2.2	1.4	2.2	2.2	2.2	2	1.6	2.2	1.6

1: Low 2: Medium 3: High -: No Correlation

UNIT – I

Introduction to R : Overview of R programming language; Installing and setting up R environment ; Basic R syntax and data types; Introduction to RStudio IDE for R programming.

(5 Hours Lecture + 6 Hours Practical ,CO1)

UNIT – II

Matrices, Arrays, and Lists in R: Understanding matrices, arrays, and lists as data structures in R; Creating and manipulating matrices, arrays, and lists; Performing basic operations and functions on matrices, arrays, and lists; Exploring advanced techniques for working with multidimensional data in R.

(10 Hours Lecture + 6 Hours Practical ,CO2)

UNIT – III

Data Frames in R : Introduction to data frames as a fundamental data structure in R for handling tabular data ; Importing and exporting data from/to external sources ; Data manipulation and transformation using *dplyr* and *tidyr* packages ; Exploratory data analysis (EDA) techniques for understanding and summarizing data frames

(10 Hours Lecture + 6 Hours Practical ,CO3)

UNIT – IV

Object-Oriented Programming (OOP) with R : Overview of object-oriented programming concepts in R ; Creating and working with classes and objects in R ; Implementing inheritance, polymorphism, and encapsulation in R ; Utilizing S3 and S4 methods for function dispatching and method resolution

(10 Hours Lecture + 6 Hours Practical ,CO4)

UNIT – V

Interfacing R to Other Languages : Introduction to interfacing R with other programming languages such as C/C++, Python, and Java ; Understanding the benefits and limitations of interfacing R with external languages ; Practical applications of interfacing R with other languages for performance optimization and extending R's capabilities ; Hands-on exercises and projects demonstrating the integration of R with external languages for real-world data analysis tasks

(10 Hours Lecture + 6 Hours Practical ,CO5)

Recommended Books

1. Norman Matloff, The Art of R Programming: A Tour of Statistical Software Design, No Starch Press, 2011

2. Jared P. Lander, R for Everyone: Advanced Analytics and Graphics, Addison-Wesley Data & Analytics Series, 2013.

3. Mark Gardener, Beginning R – The Statistical Programming Language, Wiley, 2013

4. Robert Knell, Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R, Amazon Digital South Asia Services Inc, 2013

Major 19(4))-DSE-2

1. BCA-DE-360 : Soft Computing (3-0-1)
2. BCA-DE-362: Data Mining (3-0-1)
3. BCA-DE-363: Cloud Computing (3-0-1)
4. BCA-DE-364: Internet of Things(3-0-1)

CSE -DE-4760:SOFT COMPUTING

Credit:4(L3–T0–P1)

(Theory – 45 Hours; Tutorial: 0 Hours; Practical – 30 Hours)

Learning Objectives

1. To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2. To implement soft computing based solutions for real-world problems.
3. To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
4. To provide students hand-on experience on MATLAB to implement various strategies.
5. To give students knowledge of Genetic Algorithms

Course Outcomes

On completion of this course the students will be able to:

CO1. Identify and describe soft computing techniques and their roles in building intelligent machines
CO2. Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
CO3. Apply genetic algorithms to combinatorial optimization problems.
CO4. Evaluate and compare solutions by various soft computing approaches for a given problem.
CO5. Apply fuzzy sets and fuzzy logic in Genetic Algorithms

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	2	3	3	1	2	3	2	2	1
CO2	2	2	3	3	3	2	2	2	1	2	3	3
CO3	1	3	2	3	3	2	3	3	2	1	2	2
CO4	1	1	1	1	3	1	3	1	3	1	3	1
CO5	2	1	2	1	1	2	2	1	3	2	1	3
Average	1.8	1.6	2	2	2.6	2	2.2	1.8	2.4	1.6	2.2	2

1: Low 2: Medium 3: High -: No Correlation

UNIT – I

Introduction to Soft Computing and Neural Networks: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics.

(5 Hours Lecture + 6 Hours Practical ,CO1)

UNIT – II

Fuzzy Logic: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

(10 Hours Lecture + 6 Hours Practical ,CO2)

UNIT – III

Neural Networks: Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks.

Radial Basis Function Networks : Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks.

(10 Hours Lecture + 6 Hours Practical ,CO3)

UNIT – IV

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

(10 Hours Lecture + 6 Hours Practical ,CO4)

UNIT – V

Matlab/Python Lib: Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic.

(10 Hours Lecture + 6 Hours Practical ,CO5)

Recommended Books

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

CSE -DE-4770: DATA MINING

Credit:4(L3–T0–P1)

(Theory – 45 Hours; Tutorial: 0 Hours; Practical – 30 Hours)

Learning Objectives

1. To introduce students to the basic concepts and techniques of Data Mining.
2. To introduce a wide range of clustering, estimation, prediction, and classification algorithms.
3. To introduce mathematical statistics foundations of the Data Mining Algorithms.
4. To introduce basic principles, concepts and applications of data warehousing.
5. To introduce Applications and other DM Techniques

Course Outcomes

On completion of this course the students will be able to:

CO1. Identify the key processes of data mining, data warehousing and knowledge discovery process.
CO2. Understand the basic principles and algorithms used in practical data mining and their strengths and weaknesses.
CO3. Apply data mining techniques to solve problems in other disciplines in a mathematical way.
CO4. Apply clustering, estimation, prediction, and classification algorithms.

CO5. Apply concepts and applications of data warehousing

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	3	1	3	2	2	2	2	3	1
CO2	1	2	3	1	1	2	3	3	3	1	3	2
CO3	3	1	1	3	2	1	1	1	3	3	2	2
CO4	2	2	3	1	1	2	3	3	1	2	2	2
CO5	3	2	3	3	2	3	1	3	2	2	3	3
Average	2	1.6	2.6	2.2	1.4	2.2	2	2.4	2.2	2	2.6	2

1: Low 2: Medium 3: High -: No Correlation

UNIT – I
Introduction, Data Mining Issues, Data Mining Metrics, Data Mining from a Database Perspective.

(5 Hours Lecture + 6 Hours Practical ,CO1)

UNIT – II
Classification: Statistical-Based Algorithms, Decision Tree -Based Algorithms, Neural Network -Based Algorithms, Rule-Based Algorithms, Combining Techniques.

Clustering: Similarity and Distance Measures, Hierarchical Algorithms, Partitioned Algorithms, Clustering Large Databases, Clustering with Categorical Attributes.

(10 Hours Lecture + 6 Hours Practical ,CO1)

UNIT – III
Association Rules: Basic Algorithms, Advanced Association Rule Techniques, Measuring the Quality of Rules.

(10 Hours Lecture + 6 Hours Practical ,CO2)

UNIT – IV
Introduction to Data Warehousing: Definition, difference between database system and data warehouse, multidimensional data model, data

cubes, process architecture.

(10 Hours Lecture + 6 Hours Practical ,CO3)

UNIT – V
Applications and other DM Techniques: Mining Event Sequences, Visual DM, Text Mining, Web Mining.

(10 Hours Lecture + 6 Hours Practical ,CO4)

Recommended Books

1. Ville, Decision Trees for Business Intelligence and Data Mining: Using SAS Enterprise Miner, SAS, 2006.
2. Pang-Ning Tan, Introduction to Data Mining, Addison Wesley, 2006.
3. J. Han and M. Kamber, Data Mining: Concepts and Techniques, Morgan Kaufman, 2001.
4. Tom Soukup, Davidson, Visual Data Mining: Techniques and Tools for Data Visualization and Mining, Wiley, 2002.
5. Alex Berson, Stephen J. Smith, Data Warehousing, Data Mining, and OLAP, MGH, 1998.

CSE -DE-4780: CLOUD COMPUTING

Credit:4(L3–T0–P1)

(Theory – 45 Hours; Tutorial: 0 Hours; Practical – 30 Hours)

Learning Objectives

1. Provide with the fundamentals and essentials of Cloud Computing.
2. Provide a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios.
3. Enable exploring some important cloud computing driven commercial systems and applications.
4. Expose themselves to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.
5. Enable exploring some important Cloud security fundamentals

Course Outcomes

On completion of this course the students will be able to:

CO1. Analyze the trade-offs between deploying applications in the cloud and over the local infrastructure.
CO2. Compare the advantages and disadvantages of various cloud computing platforms.
CO3. Deploy applications over commercial cloud computing infrastructures such as Amazon Web Services, Windows Azure, and GoogleApp Engine.
CO4. Program data intensive parallel applications in the cloud.
CO5. Analyze the performance, scalability, and availability of the underlying cloud technologies and software.

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	1	3	1	3	1	3	1	1	3	3
CO2	3	1	2	2	3	2	1	3	1	1	1	2
CO3	1	3	1	1	3	3	3	2	1	2	1	1
CO4	3	1	3	2	2	1	2	3	1	3	3	2
CO5	2	3	1	2	1	1	2	3	1	1	1	2
Average	2.2	2.2	1.6	2	2	2	1.8	2.8	1	1.6	1.8	2

1: Low 2: Medium 3: High -: No Correlation

UNIT – I

Definition, characteristics, components, Cloud service provider, the role of networks in Cloud computing, Cloud deployment modelsprivate, public & hybrid, Cloud service models, multitenancy, Cloud economics and benefits, Cloud computing platforms - IaaS: Amazon

EC2, PaaS: Google App Engine, Microsoft Azure, SaaS.

(5 Hours Lecture + 6 Hours Practical ,CO1)

UNIT – II

Virtualization concepts , Server virtualization, Storage virtualization, Storage services, Network virtualization, Service virtualization, Virtualization management, Virtualization technologies and architectures, virtual machine, Measurement and profiling of virtualized

applications. Hypervisors: KVM, Xen, VMware hypervisors and their features.

(10 Hours Lecture + 6 Hours Practical ,CO2)

UNIT – III

Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. MapReduce and extensions: Parallel computing, the map-Reduce model, Parallel efficiency of MapReduce, Relational operations using Map-Reduce, Enterprise batch processing using

MapReduce.

(10 Hours Lecture + 6 Hours Practical ,CO3)

UNIT – IV

Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud. Cloud computing security architecture: General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro - architectures; Identity Management and Access control, Autonomic security, Security challenges : Virtualization security management - virtual threats, VM Security Recommendations, VM - Specific Security techniques, Secure Execution Environments and Communications in cloud.

(10 Hours Lecture + 6 Hours Practical ,CO4)

UNIT – V

Implementing real time application over cloud platform, Issues in Inter-cloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment. Cloud Middleware. Mobile Cloud Computing. Inter Cloud issues. A grid of clouds, Sky computing, load balancing, resource optimization, resource dynamic reconfiguration, Monitoring in Cloud.

(10 Hours Lecture + 6 Hours Practical ,CO5)

Recommended Books

1. Gautam Shroff, Enterprise Cloud Computing, Cambridge publication
2. Ronald Krutz and Russell Dean Vines, Cloud Security, Wiley-India
3. Dr. Kumar Saurabh, Cloud Computing, Wiley Publication

CSE -DE-4790: INTERNET OF THINGS

Credit:4(L3–T0–P1)

(Theory – 45 Hours; Tutorial: 0 Hours; Practical – 30 Hours)

Learning Objectives

1. Understand the definition and significance of the Internet of Things
2. Discuss the architecture, operation, and business benefits of an IoT solution
3. Examine the potential business opportunities that IoT can uncover

4. Explore the relationship between IoT, cloud computing, and big data
5. Identify how IoT differs from traditional data collection systems.

Course Outcomes

On completion of this course the students will be able to:

CO1. Learn the concepts of Sensors, Wireless Network and Internet
CO2. Learn and implement use of Devices in IoT technology.
CO3. Learn the different IoT Technologies like Micro-controller, Wireless communication like Bluetooth, GPRS, Wi-Fi and Storage and embedded systems
CO4. Understand how to program on embedded and mobile platforms including different Microcontrollers like ESP8266 and Raspberry Pi
CO5. Understand Arduino and Android programming

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	2	3	2	3	3	3	3	3
CO2	3	1	3	2	1	1	3	2	3	2	3	1
CO3	3	1	1	1	1	2	3	2	3	2	3	1
CO4	1	1	1	2	1	2	1	2	2	3	1	2
CO5	2	2	1	3	2	1	3	2	1	2	3	1
Average	2.4	1.6	1.6	1.8	1.4	1.8	2.4	2.2	2.4	2.4	2.6	1.6

1: Low 2: Medium 3: High -: No Correlation

UNIT – I

Introduction to IoT, Sensors and Actuators: Introduction to IoT: Definition, Characteristics, Applications, Evolution, Enablers, Connectivity Layers, Addressing, Networking and Connectivity Issues, Network Configurations, Multi-Homing, Sensing: Sensors and Transducers, Classification, Different Types of Sensors, Errors, Actuation: Basics, Actuator Types- Electrical, Mechanical Soft Actuators.

(5 Hours Lecture + 6 Hours Practical ,CO1)

UNIT – II

Introduction to Networking, Communication Protocols and Machine-to-Machine Communication : Basics of Networking, Communication Protocols, Sensor Network, Machine to Machine Communication (IoT Components, Inter-Dependencies, SoA, Gateways, Comparison Between IoT& Web, Difference Protocols, Complexity of Networks, Wireless Networks, Scalability, Protocol Classification, MQTT & SMQTT, IEEE 802.15.4, Zigbee).

(10 Hours Lecture + 6 Hours Practical ,CO2)

UNIT – III

Arduino Programming: Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators With Arduino (Python Programming and Raspberry Pi) Introduction to Python Programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi, Implementation of IoT with Raspberry Pi.

(10 Hours Lecture + 6 Hours Practical ,CO3)

UNIT – IV

Data Analytics and Cloud Computing: Data Handling and Analytics, Cloud Computing Fundamentals, Cloud Computing Service Model, Cloud Computing Service Management and Security, Sensor-Cloud Architecture, View and Dataflow.

(10 Hours Lecture + 6 Hours Practical ,CO4)

UNIT – V

FOG Computing and Case Studies: FOG Computing: Introduction, Architecture, Need, Applications and Challenges. Industrial IoT, Case Studies: Agriculture, Healthcare, Activity Monitoring.

(10 Hours Lecture + 6 Hours Practical ,CO5)

Recommended Books

1. Pethuru Raj and Anupama C. Raman,The Internet of Things: Enabling Technologies, Platforms, and Use Cases, CRC Press.
2. A.Bahga and Vijay Madisetti, Internet of Things: A Hands-on Approach, Universities Press
3. Adrian McEwen, Designing the Internet of Things, Wiley Publishers, 2013,

Daniel Kellmereit, The Silent Intelligence: The Internet of Things. 2013.

CSE -DE-47110: CRYPTOGRAPHY THEORY AND PRACTICE

Credit:4(L3–T1–P0)

(Theory – 45 Hours; Tutorial: 15 Hours; Practical – 0 Hours)

Learning Objectives

1. To understand the mathematics behind Cryptography.
2. To understand the security concerns and vulnerabilities
3. To familiarize with different types of cryptosystems
4. To create an awareness for the design of various cryptographic primitives
5. To analyze different types of attacks on various cryptosystems

Course Outcomes

On the completion of this course students will be able to perform the following tasks:

CO1. Implement the concepts of number theory in designing crypto systems.
CO2. To design public and private key cryptosystems.
CO3. To do cryptanalysis of various cryptosystems.
CO4. To do vulnerability assessments of tools using cryptosystems.
CO5. Test different types of attacks on various cryptosystems

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	1	3	3	3	1	3	3	1	1
CO2	1	3	1	1	2	3	1	2	1	1	3	2
CO3	2	2	1	1	1	2	2	2	1	3	2	3
CO4	2	2	1	1	1	3	1	2	3	2	2	1
CO5	2	2	2	1	1	1	3	2	3	1	3	3
Average	1.8	2.4	1.4	1	1.6	2.4	2	1.8	2.2	2	2.2	2

1: Low 2: Medium 3: High -: No Correlation

UNIT –I

Basics of Algebra and Number Theory: Integer ArithmeticModular Arithmetic- Algebraic structures – Prime Numbers - Fermat's and Euler's Theorem – Factorization - Chinese Remainder Theorem - Linear and Quadratic Congruence - Discrete Logarithms.

(5 Hours Lecture + 5 Hours Tutorial ,CO1)

UNIT –II

Introduction to Security:-Security Goals – Security services (Confidentiality, Integrity, Authentication, Non-repudiation, Access control) – Security Mechanisms (Encipherment, Data Integrity, Digital Signature, Authentication Exchange, Traffic Padding, Routing Control, Notarization, Access control) -Security Principles. Introduction to Cryptography:- Kerckhoff's Principle -Classification of CryptosystemsCryptanalytic attacks- Cipher Properties (Confusion, Diffusion).

(10 Hours Lecture + 5 Hours Tutorial ,CO2)

UNIT –III

Traditional Secret Key Ciphers:- Substitution Ciphers (mono alphabetic ciphers, poly alphabetic ciphers)-Transposition Ciphers-Stream and Block Ciphers. Modern Secret Key Ciphers:- Substitution Box-Permutation Box-Product Ciphers

(10 Hours Lecture ,CO3)

UNIT –IV

Data Encryption Standard (DES) (Fiestel and Non-Fiestel Ciphers, Structure of DES, DES Attacks, 2-DES, 3-DES) - Advanced Encryption Standard (AES) (Structure, Analysis)- Cryptographic Hash Functions– Properties - Secure Hash Algorithm-Message Authentication Code (MAC).

(10 Hours Lecture + 5 Hours Tutorial ,CO4)

UNIT –V

Public Key Cryptosystems (PKC): - Types of PKC –Trapdoor - one way functions -RSA Cryptosystem (Integer Factorisation Trapdoor, Key Generation, Encryption, Decryption) - El Gamal Cryptosystem (Discrete Logarithm Trapdoor, Key Generation, Encryption, Decryption) - Diffie-Hellman Key Exchange Protocol, Man in the Middle attack on Diffie-Hellman Protocol.

(10 Hours Lecture ,CO5)

Recommended Books

1. Douglas R. Stinson, “Cryptography: Theory and Practice”, Third Edition, CRC Press.
2. William Stallings, “Cryptography and Network Security – Principles and Practices”, Pearson Education, Fourth Edition, 2006.

CSE -DE-47120: IMAGE AND VIDEO PROCESSING

Credit: 4(L3–T1–P0)

(Theory – 45 Hours; Tutorial: 15 Hours; Practical – 0 Hours)

Learning Objectives

1. To provide the basic understanding of the digital image formation and visualization.
2. To provide the visualization of relationships between spatial and frequency.
3. To provide the understanding of mapping the signal processing techniques to the digital image.
4. To provide an idea of multimedia data (image, video).
5. To provide an exposure to various image and video compression standards.

Course Outcomes

On the completion of this course students will be able to perform the following tasks:

CO1. The students shall be able to apply the knowledge gained during the course to solve various real-time problems.
CO2. The students shall be able to develop new state of the art image and video processing method.
CO3. The students shall be able to develop generic tools using different image filtering techniques.
CO4. The students shall be able to enhance the biomedical images for better information retrieval from the images.
CO5. The students shall be able to understand various image and video compression standards

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	3	1	3	2	3	1	3	2	1
CO2	2	2	3	3	1	2	3	1	1	1	3	1
CO3	2	3	2	1	3	3	1	3	3	1	2	1
CO4	3	2	1	2	2	1	1	2	1	2	3	3
CO5	3	1	2	1	2	3	3	3	1	2	3	1
Average	2.6	2	1.8	2	1.8	2.4	2	2.4	1.4	1.8	2.6	1.4

1: Low 2: Medium 3: High -: No Correlation

UNIT -I

Basics of digital image processing, Structure of the Picture Information, luminance and chrominance components, RGB components, Transform Coding, Discrete Cosine Transforms – 1 D and 2D. Energy compaction.

(5 Hours Lecture + 5 Hours Tutorial ,CO1)

UNIT -II

Image Enhancement - Spatial Domain Processing: Digital Negative, Contrast Stretching, Thresholding, Gray Level Slicing, Bit Plane Slicing, Log Transform and Power Law Transform. Neighborhood Processing: Averaging filters, Order statistics filters,High pass filters and High boost filters, Filtering in frequency domain: Smoothing and Sharpening filters, Image Segmentation, Image Restoration & Construction, Morphological Image Processing, Image quality assessments.

(10 Hours Lecture + 5 Hours Tutorial ,CO2)

UNIT -III

Digital Video Sampling and Interpolation, Video Frame Classifications, I, P and B frames, Notation, Motion Estimation and compensation, Application of motion estimation in video coding, Video Enhancement and Restoration, Video quality Assessment.

(10 Hours Lecture + 5 Hours Tutorial ,CO3)

UNIT -IV

Data Compression: Lossless Compression and Lossy Compression, Optimal codes, Construction algorithms of source codes - Huffman Codes, Error Resilient Codes–types, construction and applications, Basics of Image Compression, Joint Photographic Expert Group (JPEG) compression, Basics of Video Compression, Inter-frame and Intraframe redundancy, Video Coding Standard – H.263++.

(10 Hours Lecture ,CO4)

UNIT -V

Image and Video Segmentation, Biomedical Image Processing, Image Annotation, Video Annotation, Video surveillance.

(10 Hours Lecture ,CO5)

Recommended Books

1. K. Sayood, Introduction to data compression, Elsevier, 5 th edition, 2017.
2. Digital Image Processing (3rd Edition) by Willam K. Pratt, John Willey & Sons

CSE -DE-47130: COMPUTATIONAL NEUROSCIENCE

Credit:4(L3–T1–P0)

(Theory – 45 Hours; Tutorial: 15 Hours; Practical – 0 Hours)

Learning Objectives

1. To introduce the biological and mathematical perspective of neurons and neuron signals.
2. To understand the various models and their mechanism of actions.
3. To introduce the application of Hebian Plasticity.
4. To understand the functions of the neuroscience models through case studies.
5. To understand the basis of using the principles of neuroscience in modeling multi layer perceptros networks.

Course Outcomes

On the completion of this course students will be able to perform the following tasks:

CO1. Explain the principles of the working of neurons and neurons signaling models in relation to computational neuroscience.
CO2. Explain and use different computational neuroscience models in solving real world problems.
CO3. Formulate mathematical functions corresponding to the neuroscience models for performance optimizations in the applications.
CO4. Optimize and design new architecture perceptron models for performance evaluation.
CO5. design multi-layer perceptros networks

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2	2	2	3	3	3	2	1
CO2	1	3	1	2	3	2	2	3	1	3	3	1
CO3	2	3	2	2	3	1	3	3	3	3	3	3
CO4	3	2	3	2	3	1	3	3	1	3	2	2
CO5	1	1	3	2	1	3	1	3	1	2	2	1
Average	2	2.4	2.2	2.2	2.4	1.8	2.2	3	1.8	2.8	2.4	1.6

1: Low 2: Medium 3: High -: No Correlation

UNIT -I

History of neuroscience,History of computational neuroscience,mathematical modeling of neuroscience.

(5 Hours Lecture + 5 Hours Tutorial ,CO1)

UNIT -II

Linear algebra - eigenvalues and eigenvectors for symmetric matrices,Quadratic forms, solving a system of linear equations - 3 cases,Dynamical systems - types of fixed pts, bifurcation map in terms of trace and determinant,Phase plane analysis - null clines - Hopf bifurcation and limit cycles.

(10 Hours Lecture + 5 Hours Tutorial ,CO2)

UNIT -III

Neuron - axons, dendrites etc, the four components of Neural Signaling,Electrophysiology - Nernst potential, resting potential, Goldman-HodgkinKatz voltage equation, outline of the Hodgkin Huxley model,modeling ion channel kinetics, activation and inactivation gates.

(10 Hours Lecture + 5 Hours Tutorial ,CO3)

UNIT -IV

Derivation of the cable equation - defining axial, radial resistance and membrane capacitance, defining quantities in terms of per unit length,Solution for Finite cable: sealed end, killed end and arbitrary boundary conditions,Time-

dependent solution for impulse input. Propagation delay, pseudovelocity. Relation between cable diameter and conduction velocity.Modeling synaptic transmission.

(10 Hours Lecture ,CO4)

UNIT -V

Fitzhugh-Nagumo neuron model - phase-plane analysis, showing excitability, bistability and oscillations,Cellular correlates of learning. Hebbian learning, Long-term Potentiation (LTP) and Long-term Depression (LTD),Case studies: Past tense learning, NetTalk, biological plausibility of backpropagation algorithm.

(10 Hours Lecture ,CO5)

Recommended Books

1. Computational Neuroscience, Edited by Eric Schwartz.
2. Thomas Trappenberg, Fundamentals of Computational Neuroscience, oxford University Press, June 2002
3. Dayan, Peter, and L. F. Abbott.Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems. Cambridge, MA: MIT Press, 2001. ISBN: 9780262041997.

CSE -DE-47140: DEEP LEARNING BY MATHEMATICS

Credit:4(L3–T1–P0)

(Theory – 45 Hours; Tutorial: 15 Hours; Practical – 0 Hours)

Learning Objectives

1. To present the mathematical, statistical and computational challenges of building neural networks
2. To study the background mathematical concepts of deep learning
3. To enable the students to know deep learning techniques to support real-time applications
4. To educate the students on how mathematical formulations can be optimized for changing the deep learning model performance.
5. To visualize in graphical form the changes in the gradients and loss function performance of deep learning models.

Course Outcomes

On the completion of this course students will be able to perform the following tasks:

CO1. Able to understand the mathematics behind functioning of artificial neural networks.
CO2. Able to perform the matrix operations for finding the feature reduction set.
CO3. Able to identify the mathematical flow in computing the gradients in the backpropagation in feedforward multi layer network models.
CO4. Able to design and deploy simple TensorFlow-based deep learning solutions to classification problems
CO5. Able to understand how mathematical formulations can be optimized for changing the deep learning model performance

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	2	3	2	2	2	1	3	1	1
CO2	2	2	3	3	2	2	3	1	3	1	1	2
CO3	2	2	1	3	1	1	2	2	1	1	2	3
CO4	2	2	2	3	3	2	3	2	1	3	2	1
CO5	3	3	3	2	3	3	1	2	3	1	1	2
Average	2.2	2.4	2.4	2.6	2.4	2	2.2	1.8	1.8	1.8	1.4	1.8

1: Low 2: Medium 3: High -: No Correlation

UNIT -I

Applied Math and Machine Learning Basics: Linear Algebra: Scalars, Vectors, Matrices and Tensors , Multiplying Matrices and Vectors , Identity and Inverse Matrices, Linear Dependence and Span , norms, special matrices and vectors. (Lecture 10)

(5 Hours Lecture + 5 Hours Tutorial ,CO1)

UNIT -II

Eigen decompositions. Numerical Computation: Overflow and under flow, poor conditioning, Gradient Based Optimization, Constraint optimization.

(10 Hours Lecture + 5 Hours Tutorial ,CO2)

UNIT -III

Vector Norms, L-Norms and Distance Matrix, Covariance matrices, Mahalanobis distance,Kullback-Leibler divergence,Principal component analysis, Singular value decomposition and pseudoinverse. (Lecture 15)

(10 Hours Lecture + 5 Hours Tutorial ,CO3)

UNIT -IV

Differential Calculus: Rules for exponential and logarithms,minima & maxima, partial derivatives,chain rule for partial derivatives, Gradients: Calculating and visualizing.

Matrix Calculus: Vector and Scalar function, Jacbobians and Hessians, Matrix Calculus derivatives.

(10 Hours Lecture ,CO4)

UNIT -V

Data flow in Neural Networks, Backpropagation, Gradient Descent: Stochastic,momentum,Adaptive gradient descent. (Lecture 10)

(10 Hours Lecture ,CO5)

Recommended Books:

1. Math for Deep Learning, Ronald T. Kneusel

CSE -DE-4810: SPEECH AND NATURAL LANGUAGE PROCESSING

Credit: 4(L3–T1–P0)

(Theory – 45 Hours; Tutorial: 15 Hours; Practical – 0 Hours)

Learning Objectives

1. Teach students the leading trends and systems in natural language processing.
2. Make them understand the concepts of morphology, syntax, semantics and pragmatics of the language and that they are able to give the appropriate examples that will illustrate the above mentioned concepts.
3. Teach them to recognize the significance of pragmatics for natural language understanding.
4. Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.
5. Enable students to be capable to describe the application based on Speech Coding

Course Outcomes

On completion of this course the students will be able to:

CO1. Understand approaches to syntax and semantics in NLP.
CO2. Understand approaches to discourse, generation, dialogue and summarization within filters.
CO3. Understand current methods for statistical approaches to machine translation.
CO4. Understand machine learning techniques used in NLP, including Hidden Markov Models and

probabilistic context-free grammars

CO5. Understand clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP.

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2	2	1	2	3	2	3	1	3
CO2	1	3	1	1	1	2	3	3	1	2	3	3
CO3	3	3	2	1	1	2	2	1	1	2	3	2
CO4	3	3	2	3	3	2	1	3	1	2	2	2
CO5	1	3	2	1	2	1	1	3	2	2	2	1
Average	2.2	3	1.6	1.6	1.8	1.6	1.8	2.6	1.4	2.2	2.2	2.2

1: Low 2: Medium 3: High -: No Correlation

UNIT – I

Discrete Signals and Systems: A Review – Introduction to DFT – Properties of DFT – Circular Convolution – Filtering methods based on DFT – FFT Algorithm – Decimation in time algorithm, Decimation in frequency algorithm – z-transform – Filter Design : FIR and IIR.

(5 Hours Lecture + 5 Hours Tutorial ,CO1)

UNIT – II

Analogy and Physiology of Speech Production mechanism: Lungs, Larynx, vocal Tract – Categorization of Speech Sounds – Elements of a language: vowels, Nasals, Fricatives, plosives. Speech perception; Voiced and Unvoiced sounds.

(10 Hours Lecture + 5 Hours Tutorial ,CO2)

UNIT – III

Spectral Analysis of Speech: Formant Frequency, Fundamental Frequency, Power spectral analysis, PSD, Energy Spectra – Analysis and Synthesis of Pole-Zero Speech Models, Linear Prediction of Speech Signal – Cepstral Frequency, Mel-cepstra, Homomorphic signal Processing-Homomorphic Filtering.

(10 Hours Lecture + 5 Hours Tutorial ,CO3)

UNIT – IV

Speech Coding: Optimum scalar and vector quantization, waveform coding, vecoders – Speech recognition – Dynamic time warping, Hidden Markov Model – Speaker verification and Identification – Speech synthesis: Text-to-speech system, synthesizer techniques, HMM-based synthesis, sine-wave synthesis.

(10 Hours Lecture ,CO4)

UNIT – V

Brief Review of Regular Expressions and Automata; Finite State Transducers; Word level Morphology and Computational Phonology; Basic Text to Speech; Part of Speech Tagging; Parsing with CFGs.

(10 Hours Lecture ,CO5)

Recommended Books

1. John G. Proakis, Dimitris K Manolakis, Digital Signal Processing, Pearson Education
2. S.Salivahanan, A. Vallavaraj, C. Gnanapriya, DigitalSignal Processing, TMH
3. Lawrence Rabiner and Biing-Hwang Juang, Fundamentals of Speech Recognition, Pearson Education.
4. T.E.Quatieri, Speech Signal Processing, Pearson Education
5. Ben Gold , Nelson Morgan and Dan Ellis, Speech and Audio Signal Processing: Processing and Perception of Speech and Music, WILEY Publication

CSE -DE-4820: INTRODUCTION TO MOBILE APPLICATION DEVELOPMENT

Credit: 4(L3–T1–P0)

(Theory – 45 Hours; Tutorial: 15 Hours; Practical – 0 Hours)

Learning Objectives

1. understanding of the Android platform, including its architecture, components, and development environment setup.
2. necessary skills to set up and utilize essential development tools such as the Android SDK and Eclipse IDE for building Android applications.
3. develop their first Android application from scratch, demonstrating proficiency in building and deploying basic Android applications.
4. comprehend the structure and components of Android applications, including the Android Manifest file, which governs various aspects of application behavior and settings.
5. groundwork for further exploration into Android programming, providing students with a solid understanding of Object-Oriented Programming (OOP) principles in Java, essential for Android app development.

Course Outcomes

On completion of this course the students will be able to:

CO1. Understanding of Android Building Blocks
CO2. Mastery of Object-Oriented Programming (OOP) Principles
CO3. Apply Design and Terminology Proficiency
CO4. Integrate various Android components seamlessly, leveraging intents, intent filters, and permissions to enhance the functionality and user experience.
CO5. Design intuitive and visually appealing user interfaces using layouts, screen elements, animations, and other UI design principles specific to Android applications.

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1	3	3	1	1	3	3	2
CO2	3	2	3	3	2	2	1	2	3	3	3	2
CO3	2	2	3	3	2	1	3	1	1	2	2	1
CO4	1	3	3	2	1	1	2	1	3	1	1	3
CO5	1	2	2	3	2	3	2	1	3	2	3	1

Average	2	2.2	2.6	2.6	1.6	2	2.2	1.2	2.2	2.2	2.4	1.8

1: Low 2: Medium 3: High -: No Correlation

UNIT – I

Introduction and Basics of Android, android Versions, Features of android, architecture of android, the android market, Setting up development environment -android studio, android sdk, Android Virtual Device (AVD)

(5 Hours Lecture + 5 Hours Tutorial ,CO1)

UNIT – II

Basic Building blocks Activities, Fragments, and Intents: understanding Activities, Activity Lifecycle, Application Manifest, Activity Example, Intents, Intent example, Fragments, life Cycle of a Fragment

(10 Hours Lecture + 5 Hours Tutorial ,CO2)

UNIT – III

Introduction to Android User Interface: Styles & Themes, Views and View groups, Types of Layout: Frame Layout, Linear Layout, Relative Layout ,Table Layout, scroll View, Grid Layout ,constraint layout, units of measurement, display orientation, action bar.

(10 Hours Lecture + 5 Hours Tutorial ,CO3)

UNIT – IV

Basic UI Design: Text View ,Edit Text ,Button , Image Button , Check Box , Toggle Button , Radio Button , Radio Group, Toggle Button, Progress Bar ,AutoComplete Text Box ,timepickerView,DatepickerView,listViewView,spinnerView,Specialized fragment types, Alert Dialogs & Toast, Image View, Image Switcher view, Grid View, Web View, using menus With Views.

(10 Hours Lecture ,CO4)

UNIT – V

Data Persistence: saving and loading user preferences, persisting data to files, Creating and using databases, Introducing SQLite. Content Providers: sharing Data in android, using a Content provider. Web Services: Receiving HTTP Response (XML, JSON), Parsing JSON and XML, Using Web View. Messaging: SMS Messaging, sending email, Location: Based Services- Displaying Maps, Google API for Maps, getting location Data

(10 Hours Lecture ,CO5)

Recommended Books

1. Beginning Android Programming with Android Studio 4th Edition, J.F. DiMarzio, Wiley &Son s.
2. Android Programming for Beginners, John Horton, Packt Publishing.

3. Professional Android 4 Application Development by Reto Meier.

CSE -DE-4830: EMBEDDED SYSTEM

Credit:4(L3–T1–P0)

(Theory – 45 Hours; Tutorial: 15 Hours; Practical – 0 Hours)

Learning Objectives

1. Provide students the concepts of various processors used in embedded system
2. Familiarize students with the concepts of I/O programming and memory management in embedded systems
3. Train students to design new embedded applications.
4. Familiarize students with the idea of different embedding techniques.

Course Outcomes

On the completion of this course students will be able to perform the following tasks:

CO1. Analyze different embedded processor architecture such as 8085, 8051, 8086.
CO2. Distinguish different Concurrency control and Scheduling methodologies used in embedded technology.
CO3. Explain different I/O programming.
CO4. Design of systems on RTOS based embedded software in developing a complex embedded system product.
CO5. understand Scheduling in Embedded Systems

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	2	1	3	3	1	1	3
CO2	3	1	3	3	3	3	1	1	1	2	1	2
CO3	2	3	1	1	3	3	3	2	3	1	3	1
CO4	1	2	3	1	1	2	1	3	3	3	3	3
CO5	3	2	2	1	1	3	3	3	3	3	1	3
Average	2.4	2	2.2	1.6	2	2.6	1.8	2.4	2.6	2	1.8	2.4

1: Low 2: Medium 3: High -: No Correlation

UNIT -I

Processors for embedded systems: Definition of embedded system, Types of processor used in embedded systems, 8 bit processors 8085, 8051 and PIC 18FXX: - Architecture and instruction set. 16 bit: - 8086 32 bit: - 80386 architecture and instruction set, ARM based processor architecture and instruction set.

(5 Hours Lecture + 5 Hours Tutorial ,CO1)

UNIT -II

I/O programming: Operating systems for embedded systems, Real time operating systems Issues

Synchronization, transfer rate and latency.Polled I/O issues. Interrupt driven I/O. ISR. Response time interrupt controller. Software interrupts and exceptions. Buffering of data and queuing of interrupt requests.

(10 Hours Lecture + 5 Hours Tutorial ,CO2)

UNIT -III

Concurrency control: Foreground/Background systems, Thread state and serialization, latency, prevention of interrupt overruns. Concurrent execution of threads, context switch, non-preemptive multitasking, preemptive multitasking. Critical sections:- disabling interrupts, disabling ask switch, spin lock, mutex and semaphore.

(10 Hours Lecture + 5 Hours Tutorial ,CO3)

UNIT -IV

Scheduling in Embedded Systems: Conventional scheduling, deadline driven scheduling, rate monotonic scheduling, deadlock, watchdog timer.

(10 Hours Lecture ,CO4)

UNIT -V

Memory Management: Static allocation, dynamic allocation. Recursion and dynamic allocation. shared memory, reentrant functions.

(10 Hours Lecture ,CO5)

Recommended Books

1. Daniel W Lewis; Fundamentals of Embedded Software; Pearson Education
2. David E. Simon; An Embedded Software Primer; Pearson Education

CSE -DE-4840: DATABASE SECURITY

Credit:4(L3–T1–P0)

(Theory – 45 Hours; Tutorial: 15 Hours; Practical – 0 Hours)

Learning Objectives

CO1: Understands the application of security concepts to database technology and demonstrate the ability to work hands-on.

CO2: To understand the fundamentals of cybersecurity, and how it relates to database systems.

CO3: To learn to implement administration policies for users

CO4: To describe database security models and their advantages or disadvantages.

CO5: TO discuss auditing fundamentals and implement auditing. Implement access controls for database use, including virtual private database.

Course Outcomes

On the completion of this course students will be able to perform the following tasks:

1. Avoid unauthorized data observation.
2. Avoid unauthorized data modification.
3. Ensure the data confidentiality.
4. Prove that the data integrity is preserved.
5. Prove that, only authorized user has access to the data.

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	2	3	2	2	3	2	3	3
CO2	1	2	1	3	3	2	3	2	3	2	1	3
CO3	2	3	1	2	3	3	3	2	3	3	1	1
CO4	1	1	3	2	2	2	3	1	2	1	3	1
CO5	2	2	1	2	2	3	1	2	3	1	1	3
Average	1.8	2	1.4	2.2	2.4	2.6	2.4	1.8	2.8	1.8	1.8	2.2

1: Low 2: Medium 3: High -: No Correlation

UNIT -I

Security Fundamentals: Introduction to Cybersecurity, Cyberattacks, Basic concepts:Threats, Risks,Vulnerability,threat model, thrust model,security model,bug, worm, virus, rootkits.

(5 Hours Lecture + 5 Hours Tutorial ,CO1)

UNIT -II

Database Hardening techniques, Web and user privacy,Privacy protecting techniques,Anti theft models and algorithms, Web server security, Host security for servers and securing web applications.

(10 Hours Lecture + 5 Hours Tutorial ,CO2)

UNIT -III

Database Security:Advances in access control, access control for XML, Database Issues in Trust Management and Trust Negotiation, Security in Data Warehouses and OLAP Systems.Injection Attacks: Injecting into Interpreted Contexts, SQL Injection, NoSQL Injection, XPath Injection, LDAP Injection, XML Injection, Http Injection, Mail Service Injection.

(10 Hours Lecture + 5 Hours Tutorial ,CO3)

UNIT -IV

Security Re-engineering for Databases: Concepts and Techniques, Database Watermarking for Copyright Protection, User Attacks: Inducing User Actions, Capturing Cross-Domain Data, Client-Side Injection Attacks, Local Privacy Attacks, ActiveX Control attacks, Browser Attacks.

(10 Hours Lecture ,CO4)

UNIT -V

Future Trends Privacy in Database Publishing: A Bayesian Perspective, Privacy enhanced Location-based Access Control, Efficiently Enforcing the Security and Privacy Policies in a Mobile Environment.

(10 Hours Lecture ,CO5)

Recommended Books

1. Web Security, Privacy and Commerce Simson GArfinkel, Gene Spafford, O'Reilly.
2. Handbook on Database security applications and trends Michael Gertz, Sushil Jajodia
3. Michael Gertz and Sushil Jajodia (Editors), Handbook of Database Security: Applications and Trends , ISBN-10: 0387485325. Springer, 2007