

MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)

B.Tech. in Computer Science & Engineering

Scheme of Instruction and Examination

(Choice Based Credit System)

Applicable from the Academic Year 2022-23

V Semester

S. No.	Course Code	Course Title	Instructions			Examination			Credits
			Hours Per Week			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE		
1	CS501PC	Algorithm Design and Analysis	3	0	0	40	60	3	3
2	CS502PC	Computer Networks	3	0	0	40	60	3	3
3	CS503PC	DevOps	3	0	0	40	60	3	3
4	CS/IT51XPE	Professional Elective-I	3	0	0	40	60	3	3
5	CS/IT52XPE	Professional Elective -II	3	0	0	40	60	3	3
6	CS551PC	Computer Networks Lab	0	0	2	40	60	3	1
7	CS552PC	DevOps Lab	0	0	2	40	60	3	1
8	CS/IT52XPE	Professional Elective –II Lab	0	0	2	40	60	3	1
9	CS553PC	UI design- Flutter	0	0	2	40	60	3	1
10	EN551HS	Advanced English Communication Skills Laboratory	0	0	2	40	60	3	1
11	MC501HS	Intellectual Property Rights	3	0	0	40	60	3	0
12	MC501ES	Cyber Security	3	0	0	40	60	3	0
Total Hours/Marks/Credits			21	0	10	480	720	-	20
	MC502ES	Artificial Intelligence (Other branches)	3	0	0	40	60	3	0

VI Semester

S. No.	Course Code	Course Title	Instructions			Examination			Credits
			Hours Per Week			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE		
1	CS601PC	Machine Learning	3	0	0	40	60	3	3
2	CS602PC	Formal Languages and Automata Theory	3	0	0	40	60	3	3
3	CS603PC	Artificial Intelligence	3	0	0	40	60	3	3
4	CS/IT63XPE	Professional Elective – III	3	0	0	40	60	3	3
5	CS62XOE	Open Elective-I	3	0	0	40	60	3	3
6	CS651PC	Machine Learning Lab	0	0	2	40	60	3	1
7	CS652PC	Artificial Intelligence Lab	0	0	2	40	60	3	1
8	CS/IT61XPE	Professional Elective-III Lab	0	0	2	40	60	3	1
9	CS653PC	Industrial Oriented Mini Project/ Internship/ Skill Development Course (Big data-Spark)	0	0	4	-	100	-	2
Total Hours/Marks/Credits			18	0	10	320	580	-	20
10	MC601BS	Environmental Science (Lateral Entry Students)	3	0	0	40	60	3	0
	MC501ES / MC602ES	Cyber Security (Other branches)	3	0	0	40	60	3	0
	MC502ES / MC601ES	Artificial Intelligence (Other branches)	3	0	0	40	60	3	0

L: Lecture T: Tutorial D: Drawing P: Practical CIE - Continuous Internal Evaluation SEE - Semester End Examination

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VII Semester

S. No.	Course Code	Course Title	Instructions			Examination			Credits
			Hours Per Week			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE		
1	CS701PC	Cryptography and Network Security	3	0	0	40	60	3	3
2	CS702PC	Compiler Design	3	0	0	40	60	3	3
3	CS74XPE	Professional Elective -IV	3	0	0	40	60	3	3
4	CS75XPE	Professional Elective -V	3	0	0	40	60	3	3
5	CS72XOE	Open Elective - II	3	0	0	40	60	3	3
6	CS751PC	Cryptography and Network Security Lab	0	0	2	40	60	3	1
7	CS752PC	Compiler Design Lab	0	0	2	40	60	3	1
8	CS753PC	Project Stage – I	0	0	6	100	-	-	3
Total Hours/Marks/Credits			15	0	10	380	420	-	20

VIII Semester

S. No.	Course Code	Course Title	Instructions			Examination			Credits
			Hours Per Week			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE		
1	MS801HS	Organizational Behaviour	3	0	0	40	60	3	3
2	CS86XPE	Professional Elective – VI	3	0	0	40	60	3	3
3	CS82XOE	Open Elective – III	3	0	0	40	60	3	3
4	CS851PC	Project Stage – II including Seminar	0	0	22	40	60	-	11
Total Hours/Marks/Credits			9	0	22	160	240	-	20

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

*MC – Satisfactory/Unsatisfactory	
#Skill Course - 1 credit with 2 Practical Hours	
Professional Elective - I	
IT512PE	Quantum Computing
CS511PE	Advanced Computer Architecture
CS512PE	Principles of Programming Languages
CS513PE	Embedded Systems
Professional Elective - II	
CS521PE	Data Analytics
IT522PE	Software Testing Methodologies
CS522PE	Natural Language Processing
CS523PE	Data Science
# Courses in PE - II and PE - II Lab must be in 1-1 correspondence.	
Professional Elective - III	
CS631PE	Full Stack Development
CS632PE	Internet of Things
CS633PE	Mobile Application Development
IT631PE	Data Mining
# Courses in PE - III and PE - III Lab must be in 1-1 correspondence.	
Professional Elective -IV	
CS741PE	Graph Theory
CS742PE	Advanced Operating Systems
CS743PE	Soft Computing
CS744PE	Cloud Computing
CS745PE	Adhoc and Sensor Networks
Professional Elective -V	
CS751PE	Advanced Algorithms
CS752PE	Agile Methodology
CS753PE	Robotic Process Automation
CS754PE	Blockchain Technology
CS755PE	Software Process & Project Management
Professional Elective – VI	
CS861PE	Computational Complexity
CS862PE	Distributed Systems
CS863PE	Deep Learning
CS864PE	Human Computer Interaction
CS865PE	Cyber Forensics

Open Elective – I	
CS621OE	Data Structures
CS622OE	Database Management Systems
Open Elective – II	
CS721OE	Operating Systems
CS722OE	Software Engineering
Open Elective – III	
CS821OE	Algorithms Design and Analysis
CS822OE	Introduction to Computer Networks

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2	CS502PC	Computer Networks	3	0	0	40	60	3	3
3	CS503PC	DevOps	3	0	0	40	60	3	3
4	CS/IT51XPE	Professional Elective-I	3	0	0	40	60	3	3
5	CS/IT52XPE	Professional Elective -II	3	0	0	40	60	3	3
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12	MC501ES	Cyber Security	3	0	0	40	60	3	0
Total Hours/Marks/Credits			21	0	10	480	720	-	20
	MC502ES	Artificial Intelligence (Other branches)	3	0	0	40	60	-	0

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Professional Elective – I

IT512PE	Quantum Computing
CS511PE	Advanced Computer Architecture
CS512PE	Principles of Programming Languages
CS513PE	Embedded Systems

Professional Elective – II

CS521PE	Data Analytics
IT522PE	Software Testing Methodologies
CS522PE	Natural Language Processing
CS523PE	Data Science

Professional Elective – II Lab

CS524PE	Data Analytics Lab
IT524PE	Software Testing Methodologies Lab
CS525PE	Natural Language Processing Lab
CS526PE	Data Science Lab

L	T	P	C
3	0	0	3

B.Tech. V Semester

CS501PC: ALGORITHM DESIGN AND ANALYSIS
(Common to CSE, CSE (Data Science))

Prerequisites:

- A course on “Computer Programming and Data Structures”
- A course on “Advanced Data Structures”

Course Objectives:

- Introduces the notations for analysis of the performance of algorithms.
- Introduces the data structure disjoint sets.
- Describes major algorithmic techniques (divide-and-conquer, greedy, Dynamic Programming, backtracking and branch and bound methods) and mention problems for which each technique is appropriate
- Describes how to evaluate and compare different algorithms using worst-, average-, and best-case analysis.
- Explains the difference between tractable and intractable problems, and introduces the Problems that are P, NP and NP complete.

Course Outcomes:

Student will be able to:

- Acquire the knowledge of algorithm analysis and its notations that are applied on the problems solved by divide and conquer paradigm.
- Use greedy approach to solve an appropriate problem for optimal solution.
- Apply dynamic programming approach to solve suitable problems
- Apply the concept of back tracking, branch and bound paradigm for real time problems.
- Analyze the complexity of problems and differentiate that in terms of P and NP problems with examples.

Unit I:

Introduction: Algorithm, Pseudo code for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Asymptotic Notation- Big oh notation, Omega notation, Theta notation and Little oh notation.

Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort, Stassen’s matrix multiplication.

Unit II:

Sets and Disjoint Set Unions: Introduction, Union and Find Operations with algorithms.

Greedy method: General method, applications-Job sequencing with deadlines, knapsack problem, Minimum cost spanning trees-Prim and rascal’s Algorithm, Single source shortest path problem.

Unit III:

Dynamic Programming: General method, applications- Multistage Graphs, Optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, The Traveling Sales Person problem, Reliability design.

Unit IV:

Backtracking: General method, applications- The 8-Queens problem, sum of subsets problem, graph coloring, Hamiltonian cycles.

Branch and Bound: General method, applications - 0/1 knapsack problem- LC Branch and Bound solution, FIFO Branch and Bound solution, Travelling sales person problem

Unit V:

NP-Hard and NP-Complete problems: Basic concepts, Nondeterministic algorithms, The classes NP - Hard and NP-Complete, Cook's theorem, NP-Hard Graph Problems-Clique Decision Problem (CDP), Node cover decision problem.

Text Books:

1. Ellis Horowitz, Satraj Sahni and Sanguthevar Rajasekharam, Fundamentals of Computer Algorithms, Galgotia publications Pvt. Ltd, Second Edition, 2007.
2. Aho, Ullman and Hopcroft, Design and Analysis of algorithms, Pearson education, Reprint 2002.

Reference Books:

1. R.C.T.Lee, S.S.Tseng, R.C.Chang and T.T Sai, Introduction to Design and Analysis of Algorithms A strategic approach, Mc Graw Hill, 2005.
2. Algorithm Design: Foundations, Analysis and Internet Examples, M.T. Goodrich and R.Tamassia, John Wiley and sons.
3. Introduction to Algorithms, 3rd Ed, T. H. Cormen, C.E. Leiserson, R. L. Rivest, and Clifford Stein, PHI Pvt. Ltd., Pearson Education.

L	T	P	C
3	0	0	3

CS502PC: COMPUTER NETWORKS
(Common to CSE, CSBS, CSE(AI&ML), CSE (Data Science))

Course Objectives:

- The objective of the course is to equip the students with a general overview of the concepts and fundamentals of computer networks.
- Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers.

Course Outcomes:

- Gain the knowledge of the basic computer network technology.
- Gain the knowledge of the functions of each layer in the OSI and TCP/IP reference model.
- Identify and analyze various routing algorithms, congestion control algorithms.
- Outline the transport layer protocols like TCP and UDP.
- List and examine the applications of HTTP, WWW, DNS, Email, FTP and the underlying protocols.

UNIT - I

Network Hardware: Local Area Networks, Metropolitan Area Networks, Wide Area Networks, Internetwork. Network software: Protocol Hierarchies, Design Issues for the Layers, Connection-Oriented and Connectionless Services. **Reference Models:** OSI, TCP/IP Reference models, Comparison of OSI and TCP/IP Models Example Networks: ARPANET, Internet. **Physical Layer: Guided Transmission media:** Magnetic Media, Twisted pairs, Coaxial Cable, Fiber Optics, Unguided Transmission Media: Radio waves, Microwaves, Infrared.

UNIT - II

Data link layer: Design issues, Framing: Character Count, Character Stuffing, Bit Stuffing Error Detection and Correction: Block Codes, Simple Parity Check, LRC, Hamming Distance, Checksum, Hamming Code, CRC, **Elementary data link protocols:** simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channel. **Sliding Window protocols:** Pipelining, Piggybacking, A one-bit sliding window protocol, A protocol using Go-Back-N, A protocol using Selective Repeat, **Medium Access sub layer:** The channel allocation problem, Multiple access protocols: ALOHA, Carrier sense multiple access protocols, collision free protocols. Wireless LANs, Connecting devices at the data link layer.

UNIT - III

Network Layer: Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing, Link State Routing, **Congestion Control Algorithms:** Approaches to Congestion Control, Traffic aware routing, Admission Control, Traffic throttling, Load shedding. **Quality of Service:** Traffic Shaping, Packet scheduling, Admission Control, Integrated services, Differentiated Services, Internetworking, **Network layer in the Internet:** IPv4 protocol, IP Addresses, IPv6 protocol, Internet Control Protocols: ICMP, ARP, RARP, BOOTP, and DHCP.

UNIT - IV

Transport Layer: Transport Services: Services provided to Upper layer, Transport service primitives, Berkeley Sockets Elements of Transport protocols: Addressing, Error and Flow Control, Multiplexing, Crash Recovery, Connection management. **Internet Transport Protocols: TCP:** Service Model, TCP Protocol, Segment header, TCP Connection establishment and Release, TCP Connection management, TCP Sliding Window, Timer management, TCP Congestion Control. **UDP:** Protocol, UDP Header

UNIT - V

Application Layer: Domain name system- DNS Name Space, Resource records, Name Servers. SNMP, **Electronic Mail:** Architecture and Services, User Agent, Message Formats, Message Transfer, Final Delivery. SMTP, POP3, ICMP. **File transfers:** FTP, TFTP, Telnet.

TEXT BOOKS:

1. Computer Networks -- Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson Education/PHI, 2011.
2. Data Communications and Networking – Behrouz A. Forouzan. Fifth Edition TMH, 2017.

REFERENCE BOOKS:

1. An Engineering Approach to Computer Networks-S. Keshav, 2nd Edition, Pearson Education
2. “Data and Computer Communications” by William Stallings 9th Edition, Pearson Education 2010.TCP/IP Illustrated” by W. Richard Stevens, Addison-Wesley Professional 2nd edition 2011.

L	T	P	C
3	0	0	3

CS503PC: DevOps**Course Objectives:**

- Describe the agile relationship between development and IT operations.
- Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
- Implement automated system update and DevOps lifecycle.

Course Outcomes:

- Identify components of Devops environment.
- Describe Software development models and architectures of DevOps.
- Apply different project management, integration, testing and code deployment tool.
- Investigate different DevOps Software development models.
- Assess various Devops practices.
- Collaborate and adopt Devops in real-time projects.

UNIT - I

Introduction: Introduction, Agile development model, DevOps, and ITIL. DevOps process and Continuous Delivery, Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples

UNIT - II

Software development models and DevOps: DevOps Lifecycle for Business Agility, DevOps, and Continuous Testing. DevOps influence on Architecture: Introducing software architecture, the monolithic scenario, Architecture rules of thumb, The separation of concerns, Handling database migrations, Microservices, and the data tier, DevOps, architecture, and resilience.

UNIT - III

Introduction to project management: The need for source code control, The history of source code management, Roles and code, source code management system and migrations, Shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab.

UNIT - IV

Integrating the system: Build systems, Jenkins build server, managing build dependencies, Jenkins plugins, and file system layout, The host server, build slaves, Software on the host, Triggers, Job chaining and build pipelines, build servers and infrastructure as code, building by dependency order, Build phases, Alternative build servers, Collating quality measures.

UNIT - V

Testing Tools and automation: Various types of testing, Automation of testing Pros and cons, Selenium - Introduction, Selenium features, JavaScript testing, Testing backend integration points, Test-driven development, REPL-driven development

Deployment of the system: Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible, Deployment tools: Chef, Salt Stack and Docker

TEXT BOOKS:

1. Joakim Verona. Practical Devops, Second Edition. Ingram short title; 2nd edition (2018). ISBN- 10: 1788392574
2. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

REFERENCE BOOKS:

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10.

B.Tech. V Semester

L	T	P	C
3	0	0	3

IT512PE - Quantum Computing
(Professional Elective-I)
(Common to CSE, IT)

Course Objectives:

- To introduce the fundamentals of quantum computing
- The problem-solving approach using finite dimensional mathematics

Course Outcomes:

- Understand basics of quantum computing
- Understand the concept of Linear Algebra, Quantum Mechanics
- Understand physical implementation of Qubit
- Understand Quantum algorithms and their implementation
- Understand the Impact of Quantum Computing on Cryptography

UNIT – I:

History of Quantum Computing: Importance of Mathematics, Physics and Biology. Introduction to Quantum Computing: Bits Vs Qubits, Classical Vs Quantum logical operations

UNIT – II:

Background Mathematics: Basics of Linear Algebra, Hilbert space, Probabilities, and measurements. Background Physics: Paul's exclusion Principle, Superposition, Entanglement and super-symmetry, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis.

Background Biology: Basic concepts of Genomics and Proteomics (Central Dogma)

UNIT – III:

Qubit: Physical implementations of Qubit. Qubit as a quantum unit of information. The Bloch sphere Quantum Circuits: single qubit gates, multiple qubit gates, designing the quantum circuits. Bell states.

UNIT – IV:

Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor's factorization algorithm, Grover's search algorithm.

UNIT – V:

Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation. Quantum Information and Cryptography: Comparison between classical and quantum information theory. Quantum Cryptography, Quantum teleportation

TEXT BOOKS:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge

REFERENCE BOOKS:

1. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation, and Information, Vol. I: Basic Concepts, Vol II
3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms

L	T	P	C
3	0	0	3

B.Tech. V Semester

CS511PE- ADVANCED COMPUTER ARCHITECTURE
(Professional Elective-I)
(Common to CSE, IT)

Prerequisites: Computer Organization**Course Objectives:**

- To impart the concepts and principles of parallel and advanced computer architectures.
- To develop the design techniques of Scalable and multithreaded Architectures.
- To Apply the concepts and techniques of parallel and advanced computer architectures to design modern computer systems

Course Outcomes:

- Gain knowledge of Computational models and Computer Architectures.
- Concepts of parallel computer models.
- Scalable Architectures, Pipelining, Superscalar processors, multiprocessors

UNIT – I

Theory of Parallelism, Parallel computer models, The State of Computing, Multiprocessors and Multi computers, Multi vector and SIMD Computers, PRAM and VLSI models, Architectural development tracks, Program and network properties, Conditions of parallelism, Program partitioning and Scheduling, Program flow Mechanisms, System interconnect Architectures.

UNIT – II

Principals of Scalable performance, Performance metrics and measures, Parallel Processing Applications, Speed up performance laws, Scalability Analysis and Approaches, Hardware Technologies, Processes and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.

UNIT – III

Bus Cache and Shared memory, Backplane bus systems, Cache Memory organizations, Shared Memory Organizations, Sequential and weak consistency models, Pipelining and superscalar Techniques, Linear Pipeline Processors, Non-Linear Pipeline Processors, Instruction Pipeline design, Arithmetic pipeline design, superscalar pipeline design.

UNIT – IV

Parallel and Scalable Architectures, Multiprocessors and Multicomputer, Multiprocessor system Interconnects, cache coherence and synchronization mechanism, Three Generations of Multi computers, Message-passing Mechanisms, Multivector and SIMD computers, Vector Processing Principals, Multivector Multiprocessors, Compound Vector processing, SIMD computer Organizations, The connection machine CM-5.

UNIT – V

Scalable, Multithreaded and Dataflow Architectures, Latency-hiding techniques, Principals of Multithreading, Fine-Grain Multicomputers, Scalable and multithreaded Architectures, at a flow and hybrid Architectures

TEXT BOOK:

1. Advanced Computer Architecture Second Edition, Kai Hwang, Tata McGraw Hill Publishers.

REFERENCE BOOKS:

1. Computer Architecture, Fourth edition, J. L. Hennessy and D.A. Patterson. ELSEVIER.
2. Advanced Computer Architectures, S.G. Shiva, Special Indian edition, CRC, Taylor & Francis.
3. Introduction to High Performance Computing for Scientists and Engineers, G. Hager and G. Wellein, CRC Press, Taylor & Francis Group.
4. Advanced Computer Architecture, D. Sima, T. Fountain, P. Kacsuk, Pearson education.
5. Computer Architecture, B. Parhami, Oxford Univ. Press.

B.Tech. V Semester

L	T	P	C
3	0	0	3

CS512PE- Principles of Programming Languages
(Professional Elective-I)
(Common to CSE, IT)

Course Objectives:

- Introduce important paradigms of programming languages
- To provide conceptual understanding of high-level language design and implementation
- Topics include programming paradigms; syntax and semantics; data types, expressions and statements; subprograms and blocks; abstract data types; concurrency; functional and logic programming languages and scripting languages

Course Outcomes:

- Acquire the skills for expressing syntax and semantics informal notation
- Identify and apply a suitable programming paradigm for a given computing application
- Gain knowledge of and able to compare the features of various programming languages

Unit – I: Preliminary Concepts:

Reasons for Studying Concepts of Programming Languages, Programming Domains, Language Evaluation Criteria, Influences on Language Design, Language Categories, Language Design Trade- Offs, Implementation Methods, Programming Environments Syntax and Semantics: General Problem of Describing Syntax and Semantics, Formal Methods of Describing Syntax, Attribute Grammars, Describing the Meanings of Programs.

Unit – II: Names, Bindings, and Scopes:

Introduction, Names, Variables, Concept of Binding, Scope, Scope and Lifetime, Referencing Environments, Named Constants.

Data Types : Introduction, Primitive Data Types, Character String Types, User Defined Ordinal Types, Array, Associative Arrays, Record, Union, Tuple Types List Types, Pointer and Reference Types, Type Checking, Strong Typing, Type Equivalence

Expressions and Statements: Arithmetic Expressions, Overloaded Operators, Type Conversions, Relational and Boolean Expressions, Short Circuit Evaluation, Assignment Statements, Mixed-Mode Assignment

Control Structures: Introduction, Selection Statements, Iterative Statements, Unconditional Branching, Guarded Commands.

Unit –III: Subprograms and Blocks:

Fundamentals of Sub-Programs, Design Issues for Subprograms, Local Referencing Environments, Parameter Passing Methods, Parameters that Are Subprograms, Calling Subprograms Indirectly, Overloaded Subprograms, Generic Subprograms; Design Issues for Functions, User Defined Overloaded Operators, Closures, Coroutines.

Implementing Subprograms: General Semantics of Calls and Returns, Implementing Simple Subprograms, Implementing Subprograms with Stack-Dynamic Local Variables, Nested Subprograms, Blocks, Implementing Dynamic Scoping

Abstract Data Types: The Concept of Abstraction, Introductions to Data Abstraction, Design Issues, Language Examples, Parameterized ADT, Encapsulation Constructs, Naming Encapsulations

Unit – IV: Concurrency:

Introduction, Introduction to Subprogram Level Concurrency, Semaphores, Monitors, Message Passing, Java Threads, Concurrency in Function Languages, Statement Level Concurrency.

Exception Handling and Event Handling: Introduction, Exception Handling in Ada, C++, Java, Introduction to Event Handling, Event Handling with Java and C#.

Unit – V: Functional Programming Languages:

Introduction, Mathematical Functions, Fundamentals of Functional Programming Language, LISP, Support for Functional Programming in Primarily Imperative Languages, Comparison of Functional and Imperative Languages

Logic Programming Language: Introduction, an Overview of Logic Programming, Basic Elements of Prolog, Applications of Logic Programming.

Scripting Language: Pragmatics, Key Concepts, Case Study: Python –Values and Types, Variables, Storage and Control, Bindings and Scope, Procedural Abstraction, Data Abstraction, Separate Compilation, Module Library. (TextBook2)

Text Books:

1. Robert. W. Sebesta, “Concepts of Programming Languages”, 10th Edition, Pearson Education.
2. D.A.Watt, “Programming Language Design Concepts”, Wiley Dreamtech, 2007.

Reference Books:

1. A.B.Tucker, R.E.Noonan, “Programming Languages”, TMH, 2nd Edition
2. K.C.Louden, “Programming Languages”, Thomson, 2003, 2nd Edition

L	T	P	C
3	0	0	3

**CS513PE: Embedded Systems
(Professional Elective-I)**

Prerequisites:

- A course on “Digital Logic Design and Microprocessors”
- A course on “Computer Organization and Architecture”

Course Objectives:

- To provide an overview of principles of Embedded System
- To provide a clear understanding of role of firmware, operating systems in correlation with hardware systems.

Course Outcomes:

- Expected to understand the selection procedure of processors in the embedded domain.
- Design procedure of embedded firm ware.
- Expected to visualize the role of real time operating systems in embedded systems.
- Expected to evaluate the correlation between task synchronization and latency issues

UNIT - I

Introduction to Embedded Systems:

Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification of Embedded Systems, Major application areas, Purpose of Embedded Systems, Characteristics and Quality attributes of Embedded Systems.

UNIT - II

The Typical Embedded System:

Core of the Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware, Other System components.

UNIT - III

Embedded Firmware Design and Development:

Embedded Firmware Design, Embedded Firmware Development Languages, Programming in Embedded C.

UNIT - IV

RTOS Based Embedded System Design:

Operating System basics, Types of Operating Systems, Tasks, Process, Threads, Multiprocessing and Multi-tasking, Task Scheduling, Threads-Processes-Scheduling putting them together, Task Communication, Task Synchronization, Device Drivers, how to choose an RTOS

UNIT - V

Integration and Testing of Embedded Hardware and Firmware:

Integration of Hardware and Firmware, Boards Bring upThe Embedded System Development Environment: The Integrated Development Environment (IDE), Types of files generated on Cross- Compilation, Disassembler/ Decompiler, Simulators, Emulators and Debugging, Target Hardware Debugging, Boundary Scan.

TEXT BOOKS:

1. Shibu K V, "Introduction to Embedded Systems", Second Edition, McGraw Hill

REFERENCE BOOKS:

1. Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGraw-Hill
2. Frank Vahid and Tony Givargis, "Embedded Systems Design" - A Unified Hardware/Software Introduction, John Wiley Lyla, "Embedded Systems" –Pearson
3. David E.Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.

L	T	P	C
3	0	0	3

B.Tech. V Semester

CS521PE- DATA ANALYTICS
(Professional Elective-II)
(Common to CSE, IT)

Course Objectives:

- To explore the fundamental concepts of data analytics.
- To learn the principles and methods of statistical analysis
- Discover interesting patterns, analyze supervised and unsupervised models, and estimate the accuracy of the algorithms.
- To understand the various search methods and visualization techniques.

Course Outcomes:

After completion of this course students will be able to

- Understand the impact of data analytics for business decisions and strategy
- Carry out data analysis/statistical analysis
- To carry out standard data visualization and formal inference procedures
- Design Data Architecture
- Understand various Data Sources

UNIT - I

Data Management: Design Data Architecture and manage the data for analysis, understand various sources of Data like Sensors/Signals/GPS etc. Data Management, Data Quality (noise, outliers, missing values, duplicate data) and Data Processing & Processing.

UNIT - II

Data Analytics: Introduction to Analytics, Introduction to Tools and Environment, Application of Modelling in Business, Databases & Types of Data and variables, Data Modelling Techniques, Missing Imputations etc. Need for Business Modelling.

UNIT - III

Regression – Concepts, Blue property assumptions, Least Square Estimation, Variable Rationalization, and Model Building etc. Logistic Regression: Model Theory, Model fit Statistics, Model Construction, Analytics applications to various Business Domains etc.

UNIT - IV

Object Segmentation: Regression Vs Segmentation – Supervised and Unsupervised Learning, Tree Building – Regression, Classification, Overfitting, Pruning and Complexity, Multiple Decision Trees etc. Time Series Methods: Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average Energy etc and Analyze for prediction

UNIT - V

Data Visualization: Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.

TEXT BOOKS:

1. Student's Handbook for Associate Analytics –Data Mining Concepts and Techniques, Han, Kamber, 3rd Edition, Morgan Kaufmann Publishers.

REFERENCE BOOKS:

1. Introduction to Data Mining, Tan, Steinbach and Kumar, Addison Wesley, 2006.
2. Data Mining Analysis and Concepts, M. Zaki and W. Meira
3. Mining of Massive Datasets, Jure Leskovec Stanford Univ. Anand Rajaraman Millway Labs Jeffrey D Ullman Stanford Univ.

B.Tech. V Semester

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IT522PE- Software Testing Methodologies
(Professional Elective-II)
(Common to CSE, IT)

Prerequisites:

- Software Engineering

Course Objectives:

- To provide knowledge of the concepts in software testing such as testing process, criteria, strategies, and methodologies.
- To develop skills in software test and management using. To study the fundamental concepts of software testing which includes objectives, process, criteria, strategies, and methods.
- To discuss various software testing types and levels of testing like black and white box testing along with levels unit test, integration, regression, and system testing.
- To learn the domain testing, path testing and logic-based testing to explore the testing process easier.

Course Outcomes:

- Understand purpose of testing and path testing
- Understand strategies in data flow testing and domain testing
- Develop logic-based test strategies
- Implement test cases using any testing automation tool
- Understand graph matrices and its applications

UNIT – I: Introduction

Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs Flow graphs and Path testing: Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT – II: Transaction Flow Testing

Transaction flows, transaction flow testing techniques.

Data Flow testing: Basics of data flow testing, strategies in data flow testing, application of data flow testing.

Domain Testing: domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains, and testability.

UNIT – III: Paths, Path products and Regular expressions

Path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.

Logic Based Testing: overview, decision tables, path expressions, kv charts, specifications.

UNIT – IV: State, State Graphs and Transition testing

State, State Graphs and Transition testing: state graphs, good & bad state graphs, state testing, Testability tips

UNIT – V: Graph Matrices and Application

Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Student should be given an exposure to a tool like Jmeter/selenium/soapUI/Catalon).

TEXT BOOKS:

1. Baris Beizer, “Software Testing techniques”, Dreamtech, second edition.
2. Dr. K. V. K. K. Prasad, “Software Testing Tools”, Dreamtech.

REFERENCE BOOKS:

1. Brian Marick, “The craft of software testing”, Pearson Education.
2. SPD, “Software Testing Techniques”, Oreille
3. Edward Kit, “Software Testing in the Real World”, Pearson.
4. Perry, “Effective methods of Software Testing”, JohnWiley.
5. Meyers, “Art of Software Testing”, John Wiley.

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**CS522PE: NATURAL LANGUAGE PROCESSING
(Professional Elective-II)**

Prerequisites: Data structures, finite automata and probability theory

Course Objectives:

- To introduce the fundamental concepts and techniques of natural language processing (NLP).
- To gain an in-depth understanding of the computational properties of natural languages.
- To study commonly used algorithms for processing linguistic information.
- To examine NLP models and algorithms using both the traditional and the more recent approaches.
- To Introduce to some of the problems and solutions of NLP and their relation to linguistics and statistics.

Course Outcomes:

- Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.
- To carry out proper experimental methodology for training and evaluating empirical NLP systems
- Able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.
- Able to design, implement, and analyze NLP algorithms
- Able to design different language modeling Techniques.

UNIT – I

Finding the Structure of Words: Words and Their Components, Issues and Challenges, Morphological Models
Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches

UNIT – II

Syntax Analysis: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues.

UNIT – III

Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software.

UNIT – IV

Predicate-Argument Structure, Meaning Representation Systems, Software.

UNIT – V

Discourse Processing: Coherence, Building hierarchical discourse structure, Reference Resolution Language Modelling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modelling Problems, Multilingual and Cross lingual Language Modelling

TEXT BOOKS:

1. Multilingual natural Language Processing Applications: From Theory to Practice –Daniel M. Bikel and Imed Zitouni, Pearson Publication
2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary, Oxford University Press

REFERENCE BOOKS:

1. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications
2. Python Natural Language Processing Cookbook –Zhenya Antic, Pearson Publications, IBM Press
3. Natural Language Processing – Ela Kumar, I.K. International publishing house pvt. Ltd.

B.Tech. V Semester

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CS523PE: DATA SCIENCE
(Professional Elective-II)
(Common to CSE, IT)

Course Objectives:

- To learn concepts, techniques, and tools they need to deal with various facets of data science practice, including data collection and integration
- To exploring data analysis, predictive modeling, descriptive modeling, data product creation, evaluation, and effective communication
- To understand the basic knowledge of algorithms and reasonable programming experience and some familiarity with basic linear algebra and basic probability and statistics
- To identify the importance of recommendation systems and data visualization techniques

Course Outcomes:

- Understand basic terms what Statistical Inference means. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data
- Discuss the significance of exploratory data analysis (EDA) in data science and to apply basic tools (plots, graphs, summary statistics) to carry out EDA
- Apply basic machine learning algorithms and to identify common approaches used for Feature Generation
- Analyze fundamental mathematical and algorithmic ingredients that constitute a Recommendation Engine and to Build their own recommendation system using existing components

Unit – I

Introduction to Data Science, Big Data and Data Science hype and getting past the hype Datafication, Current landscape of perspectives, Skill sets needed, Statistical Inference, Populations and samples, Statistical modeling, probability distributions, fitting a model - Intro to R

Unit – II

Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs, and summary statistics) of EDA - Philosophy of EDA - The Data Science Process - Case Study: Real Direct (online real estate firm) - Three Basic Machine Learning Algorithms, Linear Regression - k-Nearest Neighbours (k- NN) - k-means

Unit – III

One More Machine Learning Algorithm and Usage in Applications - Motivating application: Filtering Spam - Why Linear Regression and k-NN are poor choices for Filtering Spam - Naive Bayes and why it works for Filtering Spam

Unit – IV

Data Wrangling: APIs and other tools for scrapping the Web - Feature Generation and Feature Selection (Extracting Meaning from Data) - Motivating application: user (customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests

Unit – V

Data Visualization - Basic principles, ideas and tools for data visualization 3 - Examples of inspiring (industry) projects
- Exercise: create your own visualization of a complex dataset - Data Science and Ethical Issues - Discussions on privacy, security, ethics - A look back at Data Science - Next-generation data scientists

Suggested Readings:

1. Doing Data Science, Straight Talk from The Frontline. Cathy O’Neil and Rachel Schutt, O’Reilly, 2014
2. Mining of Massive Datasets v2.1, Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, Cambridge University Press, 2014
3. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, 2013 (ISBN 0262018020)

Reference Books:

1. Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani and Jerome Friedman, 2nd Edition, 2009 (ISBN 0387952845)
2. Foundations of Data Science, Avrim Blum, John Hopcroft and Ravindran Kannan
3. Data Mining and Analysis: Fundamental Concepts and Algorithms, Mohammed J. Zaki and Wagner Miera Jr. Cambridge University Press, 2014
4. Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber and Jian Pei, 3rd Edition, 2011 (ISBN 0123814790).

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B.Tech. V Semester

CS551PC: COMPUTER NETWORKS LAB
(Common to CSE, CSBS, CSE(AI&ML), CSE (Data Science))

Course Objectives:

- To understand the working principle of various communication protocols.
- To understand the network simulator environment and visualize a network topology and observe its performance
- To analyze the traffic flow and the contents of protocol frames

Course Outcomes:

- Implement data link layer framing methods
- Analyze error detection and error correction codes.
- Implement and analyze routing and congestion issues in network design.
- Implement Encoding and Decoding techniques used in presentation layer.
- To be able to work with different network tools.

List of Experiments:

1. Write a program to implement framing.
 - i. Fixed framing, ii. Variable framings
2. Write a program to implement stuffing techniques.
 - i. Bit-stuffing ii. Character stuffing
3. Write a program to implement checksum
4. Write a program to compute CRC code for the polynomial CRC-12
5. Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism.
6. Write a program to implement classful addressing.
7. Write a program to implement classless addressing.
8. Write a program to implement Dijkstra's algorithm to compute the shortest path through a network
9. Write a program to divide a given network into n-sub networks using CISCO Packet Tracer.
10. Implement distance vector routing algorithm for obtaining routing tables at each node.
11. Write a program to implement Link state routing
12. Write a program for congestion control using Leaky bucket algorithm
13. Implement data encryption and data decryption.
14. Basic Trouble shooting commands ipconfig,ping ,tracert,nslookup,arp etc.

TEXT BOOK:

1. Computer Networks – Andrew S Tanenbaum, David.j.Wetherall, 5th Edition. Pearson Education/PHI,2011.

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B.Tech. V Semester**CS552PC: DevOps Lab****Course Objectives:**

- Describe the agile relationship between development and IT operations.
- Understand the skill sets and high-functioning teams involved in
- DevOps and related methods to reach a continuous delivery capability
- Implement automated system update and DevOps lifecycle

Course Outcomes:

- Identify components of Devops environment
- Apply different project management, integration, testing and code deployment tool
- Investigate different DevOps Software development, models
- Demonstrate continuous integration and development using Jenkins.

List of Experiments:

1. Write code for a simple user registration form for an event.
2. Explore Git and GitHub commands.
3. Practice Source code management on GitHub. Experiment with the source code written in exercise 1.
4. Jenkins installation and setup, explore the environment.
5. Demonstrate continuous integration and development using Jenkins.
6. Explore Docker commands for content management.
7. Develop a simple containerized application using Docker.
8. Integrate Kubernetes and Docker
9. Automate the process of running containerized application developed in exercise 7 using Kubernetes.
10. Install and Explore Selenium for automated testing.
11. Write a simple program in JavaScript and perform testing using Selenium.
12. Develop test cases for the above containerized application using selenium.

TEXT BOOKS:

1. Verona. Practical Dev ops, Second Edition. Ingram short title; 2nd edition (2018).ISBN-10: 1788392574
2. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

REFERENCE BOOKS / LEARNING RESOURCES:

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley
2. EdurekaDevOps Full Course - https://youtu.be/S_0q75eD8Yc

B.Tech. V Semester

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CS524PE: DATA ANALYTICS LAB
(Professional Elective –II Lab)
(Common to CSE, IT)

Course Objectives:

- To learn the principles and methods of statistical analysis
- To explore the fundamental concepts of preprocessing Methods
- Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.
- To understand the various visualization techniques.

Course Outcomes:

- Implement numerical and Statistical analysis on various data source
- Apply Data Preprocessing Methods on Raw Data
- Implement Regression Techniques on data for Prediction
- Implement and evaluate the performance of Supervised and Unsupervised Models
- Implementation of Data visualization techniques

List of Experiments:

1. To perform data import/export (CSV, XLS, TXT) operations using Data frames in Python.
2. To perform statistical operations (Mean, Median, Mode and Standard deviation) using python
3. To get the input from user and perform numerical operations (MAX, MIN, AVG, SUMMARY)
4. To perform data pre-processing operations i) Handling Missing data ii) Min-Max normalization
5. Implementation of Tree Building-Linear Regression
6. Implementation of Tree Building-Logistic Regression
7. Implementation of KN classification and plot the result
8. To Perform K-Means Clustering operations and visualize for iris Data set
9. Implementation of Tree Building –Decision Tree Algorithm
10. Implementation of Tree Multiple Decision Trees
11. Implementation of Time Series Models
12. Implementation of Data visualization techniques (Pixel-Oriented, Geometric, etc..) using python

Text Books:

1. Student's Handbook for Associate Analytics
2. Data Mining Concepts and Techniques, Han, Kamber, 3 rd Edition, Morgan Kaufmann Publishers

B.Tech. V Semester

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IT524PE: Software Testing Methodologies Lab
(Professional Elective –II Lab)
(Common to CSE, IT)

Course Objectives:

- To provide knowledge of Software Testing Methods.
- To develop skills in software test automation and management using latest tools

Course Outcomes:

- Design and develop the best test strategies in accordance with the development model.
- Design and develop GUI, Bitmap and database checkpoints
- Develop database checkpoints for different checks
- Perform batch testing with and without parameter passing
- Perform Data driven batch Perform batch testing with and without parameter passing

List of Experiments:

1. Recording in context sensitive mode and analog mode
2. GUI checkpoint for single property
3. GUI checkpoint for single object/window
4. GUI checkpoint for multiple objects
 - a) Bitmap checkpoint for object/window
 - b) Bitmap checkpoint for screen area
5. Database checkpoint for Default check
6. Database check point for custom check
7. Database checkpoint for runtime record check
8.
 - a) Data driven test for dynamic test data submission
 - b) Data driven test through flat files
 - c) Data driven test through front grids
 - d) Data driven test through excel test
9.
 - a) Batch testing without parameter passing
 - b) Batch testing with parameter passing
10. Data driven batch
11. Silent mode test execution without any interruption
12. Test case for calculator in windows application

TEXT BOOKS:

1. Software Testing techniques, Baris Beizer, 2nd Edition, Dreamtech.
2. Software Testing Tools, Dr. K.V.K.K.Prasad, Dreamtech.

REFERENCE BOOKS:

1. The craft of software testing, Brian Marick, Pearson Education.
2. Software Testing Techniques – SPD(Oreille)
3. Software Testing in the Real World, Edward Kit, Pearson.
4. Effective methods of Software Testing, Perry, John Wiley.
5. Art of Software Testing, Meyers, John Wiley.

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B.Tech. V Semester

CS525PE: NATURAL LANGUAGE PROCESSING LAB
(Professional Elective –II Lab)

Prerequisites: Machine Learning, Linguistics, Statistics and Probability.

Course Objectives:

- Learn and apply various text preprocessing techniques
- Learn and apply popular NLP libraries and frameworks, such as NLTK and PyTorch.
- Explore a range of NLP applications such as PoS Tagging and Chunking

Course Outcomes:

- Ability to learn linguistic structure and creation or prediction of words based on learned patterns or models.
- To represent internal structure and formation of words.
- To capture contextual relationships between adjacent words for improved language modeling.
- Building a POS Tagger in NLP, is the accurate labeling of each word in a given text with its part-of-speech.
- Identification and grouping of consecutive words into syntactically meaningful units or chunks, aiding in higher-level linguistic analysis and information extraction from text.

List of Experiments:

1. Word Analysis
2. Word Generation
3. Morphology
4. N-Grams
5. N-Grams Smoothing
6. POS Tagging: Hidden Markov Model
7. POS Tagging: Viterbi Decoding
8. Building POS Tagger
9. Chunking
10. Building Chunker

Text Books:

1. Practical Natural Language Processing: A Comprehensive Guide to building Real-World NLP Systems, First Edition by Anuj Gupta, Bohisattwa Majumber, SowmyaVajjala
2. Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit, First Edition by Steven Bird, Ewan Klein, Edward Loper

Reference Books:

1. Taming Text, First Edition, by Steven Bird, Ewan Klein, and Edward

B.Tech. V Semester

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CS526PE: DATA SCIENCE LAB
(Professional Elective –II Lab)
(Common to CSE, IT)

Course Objectives

- Understand the R Programming Language.
- Exposure on Solving data science problems.
- Understand The classification and Regression Model

Course Outcomes

- Illustrate the use of various data structures.
- Analyze and manipulate Data using Pandas
- Creating static, animated, and interactive visualizations using Matplotlib.
- Understand the implementation procedures for the machine learning algorithms.
- Apply appropriate data sets to the Machine Learning algorithms
- Identify and apply Machine Learning algorithms to solve real-world problems.

LIST OF EXPERIMENTS:**1) R AS CALCULATOR APPLICATION**

- a) Using with and without R objects on console
- b) Using mathematical functions on console
- c) Write an R script, to create R objects for calculator application and save in a specified location in disk

2) DESCRIPTIVE STATISTICS IN R

- a) Write an R script to find basic descriptive statistics using summary
- b) Write an R script to find subset of dataset by using subset ()

3) READING AND WRITING DIFFERENT TYPES OF DATASETS

- a) Reading different types of data sets (.txt, .csv) from web and disk and writing in file in specific disk location.
- b) Reading Excel data sheet in R.
- c) Reading XML dataset in R.

4) VISUALIZATIONS

- a) Find the data distributions using a box and scatter plot.
- b) Find the outliers using a plot.
- c) Plot the histogram, bar chart and pie chart on sample data

5) CORRELATION AND COVARIANCE

- a) Find the correlation matrix.
- b) Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data.
- c) Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data

6) REGRESSION MODEL

Import a data from web storage. Name the dataset and now do Logistic Regression to find out relation between variables that are affecting the admission of a student in a institute based on his or her GRE score, GPA obtained and rank of the student. Also check the model is fit or not. require (foreign), require (MASS).

7) MULTIPLE REGRESSION MODEL

Apply multiple regressions, if data have a continuous independent variable. Apply on above dataset.

8) REGRESSION MODEL FOR PREDICTION

Apply regression Model techniques to predict the data on above dataset

9) CLASSIFICATION MODEL

- a) Install relevant packages for classification.
- b) Choose a classifier for classification problems.
- c) Evaluate the performance of the classifier.

10) CLUSTERING MODEL

- a) Clustering algorithms for unsupervised classification.
- b) Plot the cluster data using R visualizations.

Text Books:

1. Doing Data Science, Straight Talk from The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly,2014
2. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, 3rd ed. The Morgan Kaufmann Series in Data Management Systems.
3. K G Srinivas, G M Siddesh, "Statistical programming in R", Oxford Publications.

Reference Books:

1. Yanchang Zhao, "R and Data Mining: Examples and Case Studies", Elsevier, 1st Edition, 2012

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CS553PC- UI-DESIGN-FLUTTER
(Common to CSE, IT, CSBS, CSE(AI&ML))

Course Objectives:

- Learns to Implement Flutter Widgets and Layouts
- Understands Responsive UI Design and with Navigation in Flutter
- Knowledge on Widgets and customize widgets for specific UI elements, Themes
- Understand to include animation apart from fetching data

Course Outcomes:

- Implements Flutter Widgets and Layouts
- Responsive UI Design and with Navigation in Flutter
- Create custom widgets for specific UI elements and also Apply styling using themes and custom styles.
- Design a form with various input fields, along with validation and error handling
- Fetches data and write code for unit Test for UI components and also animation

List of Experiments:

Students need to implement the following experiments

1. a) Install Flutter and Dart SDK.
b) Write a simple Dart program to understand the language basics.
2. a) Explore various Flutter widgets (Text, Image, Container, etc.).
b) Implement different layout structures using Row, Column, and Stack widgets.
3. a) Design a responsive UI that adapts to different screen sizes.
b) Implement media queries and breakpoints for responsiveness.
4. a) Set up navigation between different screens using Navigator.
b) Implement navigation with named routes.
5. a) Learn about statefull and stateless widgets.
b) Implement state management using set State and Provider.
6. a) Create custom widgets for specific UI elements.
b) Apply styling using themes and custom styles.
7. a) Design a form with various input fields.
b) Implement form validation and error handling.
8. a) Add animations to UI elements using Flutter's animation framework.
b) Experiment with different types of animations (fade, slide, etc.).
9. a) Fetch data from a REST API.
b) Display the fetched data in a meaningful way in the UI.

10. a) Write unit tests for UI components.
- b) Use Flutter's debugging tools to identify and fix issues.

TEXT BOOK:

1. Marco L. Napoli, Beginning Flutter: A Hands-on Guide to App Development.

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B.Tech. V Semester

EN551HS: Advanced English Communication Skills Laboratory
(Common to CSE, IT, CSBS, CSE (AI&ML) & CSE (Data Science))

Introduction:

The introduction of the Advanced English Communication Skills Lab is considered essential at the B.Tech 3rd year level. At this stage, the students need to prepare themselves for their career which may require them to listen to, read, speak, and write in English both for their professional and interpersonal communication in the globalized context.

The proposed course should be a laboratory course to enable students to use appropriate English and perform the following:

1. Gathering ideas and information to organize ideas relevantly and coherently.
2. Making oral presentations.
3. Writing formal letters.
4. Transferring information from non-verbal to verbal texts and vice-versa.
5. Writing project/research reports/technical reports.
6. Participating in group discussions.
7. Engaging in debates.
8. Facing interviews.
9. Taking part in social and professional communication.

Course Objectives:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

1. Improve the students' fluency in English, with a focus on vocabulary.
2. Enable them to listen to English spoken at normal conversational speed by educated English speakers.
3. Respond appropriately in different socio-cultural and professional contexts.
4. Communicate their ideas relevantly and coherently in writing.
5. Prepare the students for placements.

Course Outcomes:

Students will be able to:

1. Enhance listening proficiency and reading comprehension and cultivate critical thinking ability.
2. Acquire essential vocabulary and develop strategic planning skills for effective technical writing and gain expertise in E-Correspondence and (N) etiquette.
3. Understand the nuances of oral skills (Speaking skills), gain competence in delivering effective presentations, employing suitable language and body language.
4. Communicate confidently in group discussions and enhance the employability skills of students.
5. Apply effective techniques and strategies for successful job interviews.

Syllabus:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

1. **Activities on Listening and Reading Comprehension:** Active Listening – Development of Listening Skills Through Audio clips - Benefits of Reading – Methods and Techniques of Reading – Basic Steps to Effective

Reading – Common Obstacles – Discourse Markers or Linkers - Sub- skills of reading - Reading for facts, negative facts and Specific Details- Guessing Meanings from Context, Inferring Meaning - Critical Reading — Reading Comprehension – Exercises for Practice.

2. **Activities on Writing Skills:** Vocabulary for Competitive Examinations - Planning for Writing – Improving Writing Skills - Structure and presentation of different types of writing – Free Writing and Structured Writing - Letter Writing – Writing a Letter of Application – Resume vs. Curriculum Vitae – Writing a Résumé – Styles of Résumé - e-Correspondence – Emails – Blog Writing - (N)etiquette – Report Writing – Importance of Reports – Types and Formats of Reports– Technical Report Writing– Exercises for Practice.
3. **Activities on Presentation Skills** – Dealing with Glossophobia or stage fear, starting a conversation – responding appropriately and relevantly – using the right language and body language – Role Play in different situations including Seeking Clarification, Making a Request, Asking for and Refusing Permission, Participating in a Small Talk – Oral presentations (individual and group) through JAM sessions- PPTs – Importance of Presentation Skills – Planning, Preparing, Rehearsing and Making a Presentation - Understanding Nuances of Delivery - Presentations through Posters/Projects/Reports – Checklist for Making a Presentation and Rubrics of Evaluation.
4. **Activities on Group Discussion (GD):** Types of GD and GD as a part of a Selection Procedure - Dynamics of Group Discussion - myths and facts (Dos and Don'ts) of GD - Intervention, Summarizing - Modulation of Voice, Body Language, Relevance, Fluency and Organization of Ideas - GD Strategies – Exercises for Practice.
5. **Activities on Interview Skills:** Concept and Process - Interview Preparation Techniques - Types of Interview Questions – Pre-interview Planning, Opening Strategies, Answering Strategies - Interview Through Tele-conference & Video-conference - Mock Interviews.

Suggested Books:

1. Effective Technical Communication by M Ashraf Rizvi. McGraw Hill Education (India) Pvt. Ltd. 2nd Edition
2. Academic Writing: A Handbook for International Students by Stephen Bailey, Routledge, 5th Edition.

Reference Books:

1. Rizvi, M. Ashraf (2018). *Effective Technical Communication*. (2nded). McGraw Hill Education (India) Pvt. Ltd.
2. Suresh Kumar, E. (2015). *Engineering English*. Orient BlackSwan Pvt. Ltd.
3. Bailey, Stephen. (2018). *Academic Writing: A Handbook for International Students*. (5th Edition). Routledge.
4. Koneru, Aruna. (2016). *Professional Communication*. McGraw Hill Education (India) Pvt. Ltd.
5. Raman, Meenakshi & Sharma, Sangeeta. (2015). *Technical Communication, 3E: Principles and Practice*. Oxford University Press.
6. Anderson, Paul V. (2007). *Technical Communication*. Cengage Learning Pvt. Ltd. New Delhi.
7. McCarthy, Michael; O'Dell, Felicity & Redman, Stuart. (2017). *English Vocabulary in Use Series*. Cambridge University Press
8. Sen, Leela. (2009). *Communication Skills*. PHI Learning Pvt Ltd., New Delhi.
9. Elbow, Peter. (1998). *Writing with Power*. Oxford University Press.
10. Goleman, Daniel. (2013). *Emotional Intelligence: Why it can matter more than IQ*. Bloomsbury Publishing.
11. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.
12. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
13. How to Write and Speak Better, Reader's Digest, 2003.
14. TOEFL Reading & Writing Workout, The Princeton Review.
15. How to prepare for Group Discussions and Interviews by Harimohan Prasad and Rajneesh Prasad, TataMcGrawHill.
16. Keep Talking, Frederick Klippel, Cambridge University Press, South Asian edition (6 May 2010).
17. Objective English, Edgar Thorpe & Showick Thorpe, Pearson; 5th edition (1 August 2013).
18. Communication Skills for Engineers, Sunitha Mishra, C.Murali Krishna, Pearson; 4th Edition.

B.Tech. V Semester

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MC501HS: Intellectual Property Rights
(Common to *EEE, CSE, IT, CSBS, CSE (AI&ML) & CSE (Data Science)*)

Course Objectives: The objectives of the course are:

1. To enable the students to have an overview of Intellectual Property Rights.
2. To provide comprehensive knowledge to the students regarding Trademarks Registration process and law related to it.
3. To disseminate knowledge on Copyrights, its related rights, and recent developments.
4. To make the students understand Patent Regime in India and abroad.
5. To understand the framework of Trade secrets.

Course Outcomes: By the end of the course students shall:

1. Gain knowledge on Intellectual property rights and their importance.
2. Understand Indian and International Trademark Law and procedure for registration of Trademarks.
3. Acquire knowledge on Copyright Law, and the privileges awarded to the copyright owners.
4. Familiarized with the process of acquiring the patent and relevant laws.
5. Learn the importance of trade secrets for business sustainability.

UNIT – I: INTRODUCTION TO INTELLECTUAL PROPERTY

Introduction of IPR-Meaning of intellectual property, types of intellectual property-trademarks, copyrights, patents, trade secrets, importance of intellectual property rights, International organizations- WTO-WIPO-USPTO-INTA, International Conventions, agencies and treaties- Paris Convention-Berne Convention- Madrid Protocol-NAFTA-PCT-GATT-TRIPS.

UNIT – II: TRADEMARKS

Trademarks: Purpose and functions of Trademarks-Categories of marks, acquisition of trademark rights - Protectable matter - Selecting and evaluating Trademark- Trademark registration process – Trademark Infringement - Remedies for infringement of Trademarks-New developments in Trademark Law- International Trademarks Law.

UNIT III: COPYRIGHT

Copyrights-Fundamentals of Copyright Law - Requirements of Copyrightability - Originality of material, fixation of material, Authorship works, exclusions from copyright protection- Rights of Copyright Owner-Right of reproduction of copyrighted work, right to do derivative works ,right to distribute copies of the copyrighted work, right to perform the work publicly, right to display the copyrighted work, – Copyright Ownership issues – Joint Works, Works made for Hire, Specially commissioned works, Copyright Registration - Notice of Copyright – Copyright Infringement - Remedies for infringement in Copyrights- New developments in Copyright Law- International Copyright Law.

UNIT IV: PATENTS

Concept of Patent - Classification – Utility Patents – Design Patents and Plant Patents, Patent searching process-Types of Patent Applications-Patent Registration Process, Ownership, Transfer, Assignment and Licensing of Patent-Patent Infringement, Remedies for Infringement of Patents, New developments in Patent Law- International Patent Law.

UNIT – V: TRADE SECRETS & LAW OF UNFAIR COMPETITION

Trade Secrets: Trade secret law, determination of trade secret status, measures for protecting trade secret status-Liability for misappropriation of trade secrets, protection for submissions, trade secret litigation. New developments in Trade secrets Law - International Trade Secret law.

Law of Unfair Competition: Passing off, Misappropriation, Right of publicity, Dilution of trademarks, Product disparagement, False advertising, Internet Piracy.

TEXT BOOKS:

1. Deborah. E.Bouchoux, Intellectual property, Cengage learning India Pvt.Ltd., 4th edition, 2013.
2. Prabuddha Ganguli, Intellectual property right, Tata McGraw Hill Publishing Company, 8th edition, 2016.

REFERENCES

1. Richard Stim, Intellectual Property, Cengage learning India Pvt. Ltd. 3rd edition, 2017
2. Vinod.V. Sope, Managing Intellectual Property, Asoka K. Ghosh, 2nd edition, 2010.

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MC501ES: CYBER SECURITY
(Common to CSE, IT, CSBS)

Course Objectives:

- To familiarize various types of cyber-attacks and cyber-crimes
- To give an overview of the cyber laws
- To study the defensive techniques against these attacks

Course Outcomes:

- The students will be able to understand cyber-attacks, types of cybercrimes, cyber laws and how to protect them self and ultimately the entire Internet community from such attacks.

UNIT - I

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defence, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

UNIT - II

Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

UNIT - III

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT- IV

Cyber Security: Organizational Implications: Introduction cost of cybercrimes and IPR issues, web Threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

Cybercrime and Cyber terrorism: Introduction, intellectual property in cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

UNIT - V

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

Cybercrime: Examples and Mini-Cases Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances.

Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

TEXT BOOKS:

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

REFERENCES:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu, J. David Irwin, CRC Press T&F Group.

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B.Tech. V Semester

MC502ES: Artificial Intelligence
(Common to all branches except CSE, IT, CSBS, CSE(AI&ML))

Course Objectives:

- To train the students to understand different types of AI agents, various AI search algorithms, fundamentals of knowledge representation, building of simple knowledge-based systems and to apply knowledge representation, reasoning.
- Study of Markov Models enable the student ready to step into applied AI.

UNIT - I

Introduction: AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents **Basic Search Strategies:** Problem Spaces, Uninformed Search (Breadth-First, Depth-First Search, Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best-First, A*), Constraint Satisfaction (Backtracking, Local Search)

UNIT - II

Advanced Search: Constructing Search Trees, Stochastic Search, A* Search Implementation, Minimax Search, Alpha-Beta Pruning
Basic Knowledge Representation and Reasoning: Propositional Logic, First-Order Logic, Forward Chaining and Backward Chaining, Introduction to Probabilistic Reasoning, Bayes Theorem

UNIT - III

Advanced Knowledge Representation and Reasoning: Knowledge Representation Issues, Non-monotonic Reasoning, Other Knowledge Representation Schemes
Reasoning Under Uncertainty: Basic probability, Acting Under Uncertainty, Bayes' Rule, Representing Knowledge in an Uncertain Domain, Bayesian Networks

UNIT - IV

Learning: What Is Learning? Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples, Winston's Learning Program, Decision Trees.

UNIT - V

Expert Systems: Representing and Using Domain Knowledge, Shell, Explanation, Knowledge Acquisition.

TEXT BOOK:

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivasankar B. Nair, The McGraw Hill publications, Third Edition, 2009

REFERENCE BOOKS:

1. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice-Hall, 2010.
2. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th ed., 2009.

MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)

B.Tech. in Computer Science & Engineering

Scheme of Instruction and Examination

(Choice Based Credit System)

Applicable from the Academic Year 2022-23

VI Semester

S. No.	Course Code	Course Title	Instructions			Examination			Credits
			Hours Per Week			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE		
1	CS601PC	Machine Learning	3	0	0	40	60	3	3
2	CS602PC	Formal Languages and Automata Theory	3	0	0	40	60	3	3
3	CS603PC	Artificial Intelligence	3	0	0	40	60	3	3
4	CS/IT63XPE	Professional Elective – III	3	0	0	40	60	3	3
5	CS62XOE	Open Elective-I	3	0	0	40	60	3	3
6	CS651PC	Machine Learning Lab	0	0	2	40	60	3	1
7	CS652PC	Artificial Intelligence Lab	0	0	2	40	60	3	1
8	CS/IT61XPE	Professional Elective-III Lab	0	0	2	40	60	3	1
9	CS653PC	Industrial Oriented Mini Project/ Internship/ Skill Development Course (Big data-Spark)	0	0	4	-	100	-	2
Total Hours/Marks/Credits			18	0	10	320	580	-	20
10	MC601BS	Environmental Science (Lateral Entry Students)	3	0	0	40	60	3	0
	MC501ES / MC602ES	Cyber Security (Other branches)	3	0	0	40	60	-	0
	MC502ES / MC601ES	Artificial Intelligence (Other branches)	3	0	0	40	60	3	0

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Professional Elective – III

CS631PE	Full Stack Development
CS632PE	Internet of Things
CS633PE	Mobile Application Development
IT631PE	Data Mining

Professional Elective – III Lab

CS611PE	Full Stack Development Lab
CS612PE	Introduction to Internet of Things Lab
CS613PE	Mobile Application Development Lab
IT611PE	Data Mining lab

Open Elective-I

CS621OE	Data Structures
CS622OE	Database Management Systems

B.Tech. VI Semester

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3	0	0	3

CS601PC - Machine Learning
(Common to CSE, CSE (Data Science))

Prerequisites: 1. Data Structures 2. Knowledge on statistical methods

Course Objectives:

- This course explains machine learning techniques such as decision tree learning, Bayesian learning etc.
- To understand computational learning theory.
- To study the pattern comparison techniques.

Course Outcomes:

- Understand the concepts of computational intelligence like machine learning
- Ability to get the skill to apply machine learning techniques to address the real time problems in different areas
- Understand the Neural Networks and its usage in machine learning application.

Unit - I

Introduction: Learning- types of machine learning, Perspectives and issues in machine learning, bias variance trades off, testing machine learning algorithms, confusion matrix, accuracy metrics, turning data into probabilities. Dimensionality reduction- Linear discriminant analysis, principal component analysis, Factor analysis, independent component analysis.

UNIT - II

Supervised Learning: Decision Tree Learning – Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, Information Gain, Gini Index. issues in decision tree learning, overfitting, pruning.

Instance-Based Learning- Introduction, k-nearest neighbours' algorithm, remarks on lazy and eager learning.

UNIT – III

Neural Networks: The perceptron- learning rate, bias, perceptron learning algorithm, linear separability- Exclusive-OR function, backpropagation algorithm, initialization of weights, MLP in practice, deriving back propagation, radial basis functions. An illustrative example: face recognition.

UNIT- IV

Bayesian learning – Introduction, Conditional probability, Joint probability, Bayes theorem, maximum likelihood hypotheses for predicting probabilities, Bayes optimal classifier, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks.

Support vector machines, optimal separation kernels, SVM algorithm.

UNIT - V

Unsupervised learning- Clustering, Hierarchical and partitional clustering, k means algorithm, ensemble learning-Boosting Bagging. Reinforcement Learning – Introduction, the learning task, Q-learning, non- deterministic, rewards and actions, temporal difference learning.

TEXT BOOKS:

1. Machine Learning – Tom M. Mitchell, - MGH
2. Ethem Alpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press, 2015

REFERENCE BOOKS:

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis.
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B.Tech. VI Semester

CS602PC: Formal languages and Automata Theory**Course Objectives:**

- To provide introduction to some of the central ideas of theoretical computer science from the perspective of formal languages.
- To introduce the fundamental concepts of formal languages, grammars and automata theory.
- To classify machines by their power to recognize languages.
- To employ finite state machines to solve problems in computing.
- To understand deterministic and non-deterministic machines.
- To understand the differences between decidability and undesirability.

Course Outcomes:

- Able to understand the concept of abstract machines and their power to recognize the languages.
- Able to employ finite state machines for Modelling and solving computing problems.
- Able to design context free grammars for formal languages.
- Able to distinguish between decidability and undecidability.
- Able to gain proficiency with mathematical tools and formal methods.

UNIT – I

Introduction to Finite Automata: Structural Representations, Automata and Complexity, the Central Concepts of Automata Theory – Alphabets, Strings, Languages, Problems.

Deterministic Finite Automata: Definition of DFA, how a DFA Process Strings, The language of DFA. Nondeterministic Finite Automata: Formal Definition, an application: Text Search, Conversion of NFA to DFA.

Finite Automata with Epsilon-Transitions: Formal Definition, epsilon-closure, conversion of NFA with ϵ - transitions to DFA.

Moore and Melay machines: Definition of Moore and Melay machines, conversion of Melay to Moore machine and vice-versa.

UNIT – II

Regular Expressions: Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Conversion of Finite Automata to Regular Expressions.

Pumping Lemma for Regular Languages: Statement of the pumping lemma, Applications of the Pumping Lemma.

Closure Properties of Regular Languages: Closure properties of Regular languages, Decision Properties of Regular Languages, Equivalence and Minimization of Automata.

UNIT – III

Context-Free Grammars: Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Sentential Forms, Parse Tree, Applications of Context- Free Grammars, Ambiguity in Grammars and Languages.

Normal Forms for Context- Free Grammars: Eliminating useless symbols, Eliminating Unit productions, Eliminating ϵ -productions, Chomsky Normal form and Greibach Normal form.

UNIT – IV

Push Down Automata: Definition of the Pushdown Automaton, the Language of a PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata.

Pumping Lemma for Context-Free Languages: Statement of pumping lemma, Applications.

Closure Properties of Context-Free Languages: Closure properties of CFL's, Decision Properties of CFL's.

UNIT – V

Turing Machines: Introduction to Turing Machine, Types of Turing machines, Formal Description, Instantaneous description, the language of a Turing machine, halting problem.

Undecidability: Undecidability, A Language that is Not Recursively Enumerable, An Undecidable Problem That is RE, Undecidable Problems about Turing Machines, Recursive languages, Properties of recursive languages, Post's Correspondence Problem, Modified Post Correspondence problem, Other Undecidable Problems, Counter machines, Universal Turing machine.

TEXT BOOKS:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, 3rd Edition, Pearson Education.
2. K.L.P Mishra and N. Chandrashekar, Theory of Computer Science – Automata, Languages and computation, 2nd Edition, PHI.

REFERENCE BOOKS:

1. John C Martin, Introduction to Languages and The Theory of Computation, TMH.
2. Daniel I.A. Cohen, John Wiley, Introduction to Computer Theory,
3. Michael Sipser, Introduction to the Theory of Computation, 3rd Edition, Cengage Learning.

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CS603PC - Artificial Intelligence

Prerequisites:

1. Programming for problem solving, Data Structures.

Course Objectives:

- To learn the distinction between optimal reasoning Vs. human like reasoning
- To understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
- To learn different knowledge representation techniques.
- To understand the applications of AI, namely game playing, theorem proving, and machine learning.

Course Outcomes:

- Understand search strategies and intelligent agents
- Understand different adversarial search techniques
- Apply propositional logic, predicate logic for knowledge representation
- Apply AI techniques to solve problems of game playing, and machine learning.

UNIT - I

Introduction to AI, Intelligent Agents, problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform cost search, Depth-first search, Iterative deepening Depth-first search, Bidirectional search, Informed (Heuristic) Search Strategies: Greedy best-first search, A* search, Heuristic Functions, Beyond Classical Search: Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces

UNIT - II

Problem Solving by Search-II and Propositional Logic

Adversarial Search: Games, Optimal Decisions in Games, Alpha–Beta Pruning, Imperfect Real-Time Decisions. Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems. Propositional Logic: Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses, Forward and backward chaining, Effective Propositional Model Checking, Agents Based on Propositional Logic.

UNIT - III

Logic and Knowledge Representation

First-Order Logic: Representation, Syntax and Semantics of First-Order Logic, Using First-Order Logic, Knowledge Engineering in First-Order Logic.

Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

UNIT - IV

Knowledge Representation: Ontological Engineering, Categories and Objects, Events. Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information.

Classical Planning: Definition of Classical Planning, Algorithms for Planning with State-Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches.

UNIT - V

Uncertain knowledge and Learning Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use **Probabilistic Reasoning:** Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First-Order Probability, Other Approaches to Uncertain Reasoning; Dempster-Shafer theory.

TEXT BOOK:

1. Artificial Intelligence: A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.

REFERENCE BOOKS:

1. Artificial Intelligence, 3rd Edn, E. Rich and K. Knight (TMH)
2. Artificial Intelligence, 3rd Edn., Patrick Henry Winston, Pearson Education.
3. Artificial Intelligence, Shivani Goel, Pearson Education.
4. Artificial Intelligence and Expert system, Patterson, Pearson Education

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B.Tech. VI Semester

CS631PE – Full Stack Development
Professional Elective – III
(Common to CSE, IT, CSE(AI&ML) (PE-II), CSE (Data Science)

Pre-Requisites:

- Object Oriented Programming
- Web Technologies

Course Objectives:

- Students will become familiar to implement fast, efficient, interactive and scalable web applications using run time environment provided by the full stack components.

Course Outcomes:

- Understand Full stack components for developing web application.
- Apply packages of NodeJS to work with Data, Files, Http Requests and Responses.
- Use MongoDB data base for storing and processing huge data and connects with NodeJS application.
- Design faster and effective single page applications using Express and Angular.
- Create interactive user interfaces with react components.

UNIT-I

Introduction to Full Stack Development:

Understanding the Basic Web Development Framework- User, Browser, Webserver, Backend Services, Full Stack Components - Node.js, MongoDB, Express, React, Angular. Java Script Fundamentals, NodeJS- Understanding Node.js, Installing Node.js, Working with Node Packages, creating a Node.js Application, Understanding the Node.js Event Model, Adding Work to the Event Queue, Implementing Callbacks.

UNIT-II

Node.js:

Working with JSON, Using the Buffer Module to Buffer Data, Using the Stream Module to Stream Data, Accessing the File System from Node.js- Opening, Closing, Writing, Reading Files and other File System Tasks. Implementing HTTP Services in Node.js- Processing URLs, Processing Query Strings and Form Parameters, Understanding Request, Response, and Server Objects, Implementing HTTP Clients and Servers in Node.js, Implementing HTTPS Servers and Clients. Using Additional Node.js Modules-Using the os Module, Using the util Module, Using the dns Module, Using the crypto Module.

UNIT-III

MongoDB:

Need of NoSQL, Understanding MongoDB, MongoDB Data Types, Planning Your Data Model, Building the MongoDB Environment, Administering User Accounts, Configuring Access Control, Administering Databases, Managing Collections, Adding the MongoDB Driver to Node.js, Connecting to MongoDB from Node.js, Understanding the Objects Used in the MongoDB Node.js Driver, Accessing and Manipulating Databases, Accessing and Manipulating Collections

UNIT-IV

Express and Angular:

Getting Started with Express, Configuring Routes, Using Requests Objects, Using Response Objects. Angular: importance of

Angular, Understanding Angular, creating a Basic Angular Application, Angular Components, Expressions, Data Binding, Built-in Directives, Custom Directives, Implementing Angular Services in Web Applications.

UNIT-V

React:

Need of React, Simple React Structure, The Virtual DOM, React Components, Introducing React Components, Creating Components in React, Data and Data Flow in React, Rendering and Life Cycle Methods in React, Working with forms in React, integrating third party libraries, Routing in React.

TEXT BOOKS:

1. Brad Dayley, Brendan Dayley, Caleb Dayley., Node.js, MongoDB and Angular Web Development, 2nd Edition, Addison-Wesley, 2019.
2. Mark Tielens Thomas, React in Action, 1st Edition, Manning Publications.

REFERENCE BOOKS:

1. Vasan Subramanian, Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, 2nd Edition, Apress, 2019.
2. Chris Northwood, The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer', 1st edition, Apress, 2018.
3. Kirupa Chinnathambi, Learning React: A Hands-On Guide to Building Web Applications Using React and Redux, 2nd edition, Addison-Wesley Professional, 2018.

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B.Tech. VI Semester

CS632PE – Internet of Things
Professional Elective – III
(Common to CSE, CSBS)

Pre-Requisites: Computer organization, Computer Networks**Course Objectives:**

- To introduce the terminology, technology and its applications
- To introduce the concept of M2M (machine to machine) with necessary protocols
- To introduce the Python Scripting Language which is used in many IoT devices
- To introduce the Raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of web-based services on IoT devices

Course Outcomes:

- Interpret the impact and challenges posed by IoT networks leading to new architectural Models.
- Compare and contrast the deployment of smart objects and the technologies to connect them to network.
- Appraise the role of IoT protocols for efficient network communication.
- Identify the applications of IoT in Industry.

UNIT - I

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels and Deployment Templates Domain Specific IoTs – Home automation, Environment, Agriculture, Health and Lifestyle

UNIT - II

IoT and M2M – M2M, Difference between IoT and M2M, SDN and NFV for IoT, IoT System Management with NETCOZF, YANG- Need for IoT system Management, Simple Network management protocol, Network operator requirements, NETCONF, YANG, IoT Systems Management with NETCONF-YANG

UNIT - III

IoT Systems – Logical design using Python-Introduction to Python – Python Data types & Data structures, Control flow, Functions, Modules, Packaging, File handling, Data/Time operations, Classes, Exception, Python packages of Interest for IoT

UNIT - IV

IoT Physical Devices and Endpoints - Raspberry Pi, Linux on Raspberry Pi, Raspberry Pi Interfaces, Programming Raspberry PI with Python, Other IoT devices. IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs, WAMP-AutoBahn for IoT, Xively Cloud for IoT, Python web application framework –Django, Designing a RESTful web API

UNIT V

Case studies- Home Automation, Environment-weather monitoring-weather reporting- air pollution monitoring, Agriculture.

TEXT BOOK:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madiseti, Universities Press, 2015, ISBN: 9788173719547.

REFERENCE BOOK:

1. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.

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B.Tech. VI Semester

CS633PE – Mobile Application Development
Professional Elective –III
(Common to CSE, IT, CSE (Data Science))

Course Objectives:

- To demonstrate their understanding of the fundamentals of Android operating systems.
- To improve their skills of using Android software development tools.
- To demonstrate their ability to develop software with reasonable complexity on mobile platform.
- To demonstrate their ability to deploy software to mobile devices.
- To demonstrate their ability to debug programs running on mobile devices

Course Outcomes:

- Student understands the working of Android OS Practically.
- Student will be able to develop Android user interfaces
- Student will be able to develop, deploy and maintain the Android Applications

UNIT – I:

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

UNIT – II:

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

UNIT – III:

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

UNIT – IV:

Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference

UNIT – V:

Database – Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and etindelg data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update)

TEXT BOOKS:

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012.
2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013.

REFERENCE BOOK:

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013.

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IT631PE – Data Mining
Professional Elective – III
(Common to CSE, IT)

Course Objectives:

- Students will become acquainted with both the strengths and limitations of various datamining techniques like Association, Classification, Cluster and Outlier analysis.

Course Outcomes:

- Understand the need of data mining and pre-processing techniques.
- Perform market basket analysis using association rule mining.
- Utilize classification techniques for analysis and interpretation of data.
- Identify appropriate clustering and outlier detection techniques to handle complex data.
- Understand the mining of data from web, text and time series data.

UNIT – I: Introduction to Data Mining:

What Data mining? Kinds of Data, Knowledge Discovery process, Data Mining Functionalities, Kinds of Patterns, Major Issues in Data Mining. Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity, Data Pre-processing: Major Tasks in Data Pre-processing, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

UNIT – II: Association Analysis:

Basic Concepts, Market Basket Analysis, Apriori Algorithm, FP-growth, From Association Analysis to Correlation Analysis, Pattern Mining in Multilevel Associations and Multidimensional Associations.

UNIT– III: Classification:

Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Metrics for Evaluating Classifier Performance, Ensemble Methods, Multilayer Feed- Forward Neural Network, Support Vector Machines, k-Nearest-Neighbor Classifiers.

UNIT – IV: Cluster Analysis:

Requirements for Cluster Analysis, Overview of Basic Clustering Methods, Partitioning Methods-k-Means, k-Medoids, Hierarchical Methods- AGENES, DIANA, BIRCH, Density- Based Method-DBSCAN, Outlier Analysis: Types of Outliers, Challenges of Outlier Detection, and Overview of Outlier Detection Methods

UNIT – V: Advanced Concepts:

Web Mining- Web Content Mining, Web Structure Mining, Web Usage Mining, Spatial Mining- Spatial Data Overview, Spatial Data Mining Primitives, Spatial Rules, Spatial Classification Algorithm, Spatial Clustering Algorithms, Temporal Mining- Modeling Temporal Events, Time Series, Pattern Detection, Sequences, Temporal Association Rules.

TEXT BOOKS :

1. Jiawei Han, Micheline Kamber, Jian Pei., Data Mining: Concepts and Techniques, 3rd Edition, Morgan Kaufmann/Elsevier, 2012.
2. Margaret H Dunham, Data Mining Introductory and Advanced Topics, 2nd Edition, Pearson Education, India, 2006.

REFERENCE BOOKS:

1. Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.
2. Pang-Ning Tan, Michael Steinbach, Anuj Karpatne and Vipin Kumar, Introduction to Data Mining, 2nd Edition, Pearson Education India, 2021.
3. Amitesh Sinha, Data Warehousing, Thomson Learning, India, 2007.

B.Tech. VI Semester

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CS621OE: DATA STRUCTURES

Open Elective – I

Prerequisites: Programming for Problem Solving.

Course Objectives:

- Exploring basic data structures such as stacks and queues.
- Introduces a variety of data structures such as trees and graphs
- Introduces sorting and searching

Course Outcomes

- Ability to select the data structures that efficiently model the information in a problem.
- Ability to assess the difference between static and dynamic data structures
- Understand and implement different types of trees
- Understand the various graph traversal techniques and their applications
- Ability to analyse the various searching and sorting techniques

Unit I:

Introduction to Data Structures, abstract data types, types of data structures, introduction to Arrays, examples **Linear Data Structures** - Stacks- array representations, operations on stacks, stack applications-infix to postfix conversion, evaluation of postfix expression

Queues- operations, array representations, operations on Queues, applications

Unit II:

Linear Data Structures – Disadvantages of Static Allocation, Dynamic Memory Allocation, Singly linked list implementation- insertion, deletion and searching operations

Doubly linked list implementation, insertion, deletion and searching operations

Unit III: Non-Linear Data Structures

Trees: Binary tree-properties and different types

Search Trees: Binary Search Trees- Definition, Implementation, Operations- Searching, Insertion and Deletion

AVL Trees- Definition, Height of an AVL Tree, Operations – Insertion example, Red –Black trees- Properties, examples.

Unit IV: Non-Linear Data Structures

Graphs: Graph Implementation Methods, Graph Traversal Methods – BFS and DFS

Hash Table Representation: hash functions, collision resolution-separate chaining, open addressing-linear probing, quadratic probing, double hashing, and rehashing, extendible hashing.

Unit V:

Searching: Linear Search and Binary Search

Sorting: Quick Sort, Heap Sort, External Sorting- Model for external sorting, Merge Sort.

TEXT BOOKS:

1. Fundamentals of Data Structures in C, 2 nd Edition, E. Horowitz, S. Sahni and Susan Anderson Freed, Universities Press.
2. An Introduction to Data Structures with Application, 2nd edition by Jean-Paul Tremblay, Paul Sorenson, McGraw Hill publications..

REFERENCE BOOKS:

1. Data Structures: A Pseudocode Approach with C, 2 nd Edition, R. F. Gilberg and B.A. Forouzan, Cengage Learning.
2. Data Structures using C – A. S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson Education.

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B.Tech. VI Semester

CS622OE–Data Base Management Systems
Open Elective – I

Prerequisites: A course on “Data Structures”.

Course Objectives:

- To understand the basic concepts and the applications of database systems.
- To master the basics of SQL and construct queries using SQL.
- Topics include data models, database design, relational model, relational algebra, transaction control, concurrency control, storage structures and access techniques.

Course Outcomes:

- Gain knowledge of fundamentals of DBMS, database design and normal forms
- Master the basics of SQL for retrieval and management of data.
- Be acquainted with the basics of transaction processing and concurrency control.
- Familiarity with database storage structures and access techniques

Unit I:

Database System Applications : A Historical Perspective, File Systems versus a DBMS, the DataModel, Levels of Abstraction in a DBMS, Data Independence, Structure of a DBMS

Introduction to Database Design: Database Design and ER Diagrams, Entities, Attributes, and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design With the ER Model.

Unit II:

Introduction to the Relational Model: Integrity constraint over relations, enforcing integrity constraints, querying relational data, logical database design, introduction to views, destroying/altering tables and views. Relational Algebra, Tuple relational Calculus, Domain relational calculus

Unit III:

SQL: QUERIES, CONSTRAINTS, TRIGGERS: form of basic SQL query, UNION, INTERSECT, and EXCEPT, Nested Queries, aggregation operators, NULL values, complex integrity constraints in SQL, triggers and active databases.

Schema Refinement: Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, First, Second, Third normal forms, BCNF, lossless join decomposition, multivalued dependencies, Fourth normal form, Fifth normal form

Unit IV:

Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, testing for serializability, Lock Based Protocols, Timestamp Based Protocols, Validation- Based Protocols, Multiple Granularity, Recovery and Atomicity, Log–Based Recovery, Recovery with Concurrent Transactions.

Unit V:

Data on External Storage, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing, Tree based Indexing, Comparison of File Organizations, Indexes- Intuitions for tree Indexes, Indexed Sequential Access Methods (ISAM), B+ Trees: A Dynamic Index Structure.

TEXT BOOKS:

1. Database System Concepts, Silberschatz, Korth, McGraw hill, V edition.3rd Edition
2. Introduction to Database Systems, C. J. Date, Pearson Education

REFERENCE BOOKS:

1. Database Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7thEdition.
2. Fundamentals of Database Systems, ElmasriNavrate, Pearson Education
3. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, Tata McGraw Hill

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B.Tech. VI Semester

CS651PC – Machine Learning Lab
(Common to CSE, CSE (Data Science))

Pre-Requisites: Python programming

Course Objectives:

- To get an overview of the various machine learning techniques and can able to demonstrate them using python.

Course Outcomes:

After completion of course, students would be able to:

- Understand and apply data preprocessing techniques
- Understand complexity of Machine Learning algorithms and their limitations.
- Understand modern notions in data analysis-oriented computing.
- Be capable of confidently applying common Machine Learning algorithms in practice and implementing their own.
- Be capable of performing experiments in Machine Learning using real-world data.

1. Write a program to demonstrate the following in python Numpy: Indexing, Array, Slicing.
2. Write a program to demonstrate the following in python Pandas: Series, DataFrames, read .csv files, analysing data.
3. Write a program to demonstrate the following in python Matplotlib: pyplot, markers, line, labels, grid, subplots.
4. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
5. Implement Random Forest classification in python.
6. Implement k-nearest neighbour classification using python.
7. Implement linear regression using python.
8. Implement Naïve Bayes theorem to classify English text
9. Implement an algorithm to demonstrate the significance of genetic algorithm.
10. Implement the finite words classification system using Back-propagation algorithm.

TEXT BOOKS:

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.
2. Python Machine Learning, Sebastian Raschka, PACKT publishing, 2015

REFERENCES:

1. Machine Learning – Tom M. Mitchell, - MGH, 1997
2. Pattern recognition and Machine Learning, C. M. Bishop, Springer, 2007.
3. Introduction to Machine Learning, E. Alpaydin, MIT Press, 3rd Edition, 2014

B.Tech. VI Semester

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CS652PC -Artificial Intelligence Lab**Course Outcomes**

- To Use Control Structures and Operators to write basic Python programming
- To Analyze object-oriented concepts in Python
- To Evaluate the AI models pre-processed through various feature engineering algorithms by Python Programming.
- To Develop the code for the recommender system using Natural Language processing
- To Design various reinforcement algorithms to solve real-time complex problems.

List of Experiments:

1. Write a Program to Implement Breadth First Search using Python.
2. Write a Program to Implement Depth First Search using Python.
3. Write a Program to Implement Tic-Tac-Toe game using Python.
4. Write a Program to Implement 8-Puzzle problem using Python.
5. Write a Program to Implement Water-Jug problem using Python.
6. Write a Program to Implement Travelling Salesman Problem using Python.
7. Write a Program to Implement Tower of Hanoi using Python.
8. Write a Program to Implement Monkey Banana Problem using Python.
9. Write a Program to Implement Alpha-Beta Pruning using Python.
10. Write a Program to Implement 8-Queens Problem using Python.

TEXT BOOK:

1. Artificial Intelligence a Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.

REFERENCE BOOKS:

1. Artificial Intelligence, 3rd Edn, E. Rich and K. Knight (TMH)
2. Artificial Intelligence, 3rd Edn. Patrick Henny Winston, Pearson Education.
3. Artificial Intelligence, Shivani Goel, Pearson Education.

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B.Tech. VI Semester

CS611PE–Full Stack Development Lab
Professional Elective – III Lab
(Common to CSE, IT, CSE (Data Science))

Pre-Requisites:

1. Object Oriented Programming
2. Web Technologies

Course Objectives:

- Introduce fast, efficient, interactive and scalable web applications using run time environment provided by the full stack components.

Course Outcomes:

- Design flexible and responsive Web applications using Node JS, React, Express and Angular.
- Perform CRUD operations with MongoDB on huge amount of data.
- Develop real time applications using react components.
- Use various full stack modules to handle http requests and responses.

List of Experiments

1. Create an application to setup node JS environment and display “Hello World”.
2. Create a Node JS application for user login system.
3. Write a Node JS program to perform read, write and other operations on a file.
4. Write a Node JS program to read form data from query string and generate response using NodeJS
5. Create a food delivery website where users can order food from a particular restaurant listed in the website for handling http requests and responses using NodeJS.
6. Implement a program with basic commands on databases and collections using MongoDB.
7. Implement CRUD operations on the given dataset using MongoDB.
8. Perform Count, Limit, Sort, and Skip operations on the given collections using MongoDB.
9. Develop an angular JS form to apply CSS and Events.
10. Develop a Job Registration form and validate it using angular JS.
11. Write an angular JS application to access JSON file data of an employee from a server using \$http service.
12. Develop a web application to manage student information using Express and Angular JS.
13. Write a program to create a simple calculator Application using React JS.
14. Write a program to create a voting application using React JS
15. Develop a leave management system for an organization where users can apply different types of leaves such as casual leave and medical leave. They also can view the available number of days using react application.
16. Build a music store application using react components and provide routing among the web pages.
17. Create a react application for an online store which consist of registration, login, product information pages and implement routing to navigate through these pages.

TEXT BOOKS:

1. Brad Dayley, Brendan Dayley, Caleb Dayley., Node.js, MongoDB and Angular Web Development, 2nd Edition, Addison-Wesley,2019.
2. Mark Tielens Thomas., React in Action, 1st Edition, Manning Publications.

REFERENCE BOOKS:

1. Vasan Subramanian, Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, 2nd Edition, Apress,2019.
2. Chris Northwood, The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer', 1st edition, Apress, 2018.
3. Brad Green& Seshadri. Angular JS. 1st Edition. O'Reilly Media, 2013.
4. Kirupa Chinnathambi, Learning React: A Hands-On Guide to Building Web Applications Using React and Redux, 2nd edition, Addison-Wesley Professional, 2018.

B.Tech. VI Semester

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CS612PE– Introduction to Internet of Things Lab
Professional Elective – III Lab

Course Objectives:

- To introduce the raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of distance sensor on IoT devices

Course Outcomes:

- Ability to introduce the concept of M2M (machine to machine) with necessary protocols and get awareness in implementation of distance sensor
- Get the skill to program using python scripting language which is used in many IoT devices

List of Experiments:

1. Using raspberry Pi
 - a) Calculate the distance using a distance sensor.
 - b) Basic LED functionality.
2. Using Arduino
 - a) Calculate the distance using a distance sensor.
 - b) Basic LED functionality.
 - c) Calculate temperature using a temperature sensor.
3. Installing OS on Raspberry Pi
 - a) Installation using PiImager
 - b) Installation using image file Downloading an Image
 - Writing the image to an SD card
 - using Linux
 - using Windows
 - Booting up Follow the instructions given in the URL
<https://www.raspberrypi.com/documentation/computers/getting-started.html>
4. Accessing GPIO pins using Python
 - a) Installing GPIO Zero library. First, update your repositories list:

```
sudo apt update
```

 Then install the package for Python 3:

```
sudo apt install python3-gpiozero
```
 - b) Blinking an LED connected to one of the GPIO pin
 - c) Adjusting the brightness of an LED Adjust the brightness of an LED (0 to 100, where 100 means maximum brightness) using the in-built PWM wavelength.

TEXT BOOKS:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madiseti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

REFERENCE BOOKS:

1. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer, 2016
2. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.

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CS613PE–Mobile Application Development Lab
Professional Elective – III Lab
(Common to CSE, IT, CSE (Data Science))

Course Objectives:

- To learn how to develop Applications in android environment.
- To learn how to develop user interface applications.
- To learn how to develop URL related applications.

Course Outcomes:

- Student understands the working of Android OS Practically.
- Student will be able to develop Android user interfaces
- Student will be able to develop, deploy and maintain the Android Applications.

List of Experiments

1. Create an Android application that shows Hello + name of the user and run it on an emulator.
 - i. Create an application that takes the name from a text box and shows hello message along with the name entered in text box, when the user clicks the OK button.
2. Create a screen that has input boxes for User Name, Password, Address, Gender (radio buttons for male and female), Age (numeric), Date of Birth (Date Picket), State (Spinner) and a Submit button. On clicking the submit button, print all the data below the Submit Button. Use (a) Linear Layout (b) Relative Layout and (c) Grid Layout or Table Layout.
3. Develop an application that shows names as a list and on selecting a name it should show the details of the candidate on the next screen with a “Back” button.
 If the screen is rotated to landscape mode (width greater than height), then the screen should show list on left fragment and details on right fragment instead of second screen with back button. Use Fragment transactions and Rotation event listener.
4. Develop an application that uses a menu with 3 options for dialing a number, opening a website and to send an SMS. On selecting an option, the appropriate action should be invoked using intents.
5. Develop an application that inserts some notifications into Notification area and whenever a notification is inserted, it should show a toast with details of the notification.
6. Create an application that uses a text file to store user names and passwords (tab separated fields and one record per line). When the user submits a login name and password through a screen, the details should be verified with the text file data and if they match, show a dialog saying that login is successful. Otherwise, show the dialog with Login Failed message.
7. Create a user registration application that stores the user details in a database table.
8. Create a database and a user table where the details of login names and passwords are stored. Insert some names and passwords initially. Now the login details entered by the user should be verified with the database and an appropriate dialog should be shown to the user
9. Create an admin application for the user table, which shows all records as a list and the admin can select any record for edit or modify. The results should be reflected in the table.
10. Develop an application that shows all contacts of the phone along with details like name, phone number, mobile number etc.
11. Create an application that saves user information like name, age, gender etc. in shared preference and retrieves them when the program restarts.

12. Create an alarm that rings every Sunday at 8:00 AM. Modify it to use a time picker to set alarm time.
13. Create an application that shows the given URL (from a text field) in a browser.

TEXT BOOKS:

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012
2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013

REFERENCE BOOK:

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013.

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B.Tech. VI Semester

IT611PE–Data Mining Lab
Professional Elective – III Lab
(Common to CSE, IT)

Prerequisite: A course on “Database Management System.”

Course Objectives:

- The course is intended to obtain hands-on experience using data mining software.
- Intended to provide practical exposure of the concepts in data mining algorithms.

Course Outcomes:

- Apply preprocessing statistical methods for any given raw data.
- Implement various algorithms for data mining in order to discover interesting patterns from large amounts of data.
- Implement various association analysis approaches
- Implement various classification algorithms
- Implement various clustering approaches

List of Experiments:

Experiments using Weka Tools / Python

1. Implement Data Pre-Processing Techniques
2. Implementation of Attribute oriented induction algorithm
3. Implementation of apriori algorithm
4. Implementation of FP –Growth algorithm
5. Implementation of Decision Tree Induction
6. Calculating Information gain measures
7. Classification of data using Bayesian approach
8. Classification of data using K–Nearest Neighbour Approach
9. Implementation of K–means algorithm
10. Implementation of PAM (Partition Around Medoids) algorithm

TEXT BOOKS:

1. Data Mining–Concepts and Techniques - JIAWEIHAN & MICHELINE KAMBER,Elsevier.
2. Data Warehousing, Data Mining & OLAP-Alex Berson and Stephen J. Smith – Tata Mc Graw-Hill Edition, Tenthreprint 2007

REFERENCE BOOK:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Anuj Karpatne, Introduction to DataMining, Pearson Education.

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B.Tech. VI Semester

CS653PC–Industrial Oriented Mini Project/ Internship/ Skill Development Course (Big data-Spark)

Course Objectives:

- The main objective of the course is to process Big Data with advance architecture like spark and streaming data in Spark

Course Outcomes:

- Develop MapReduce Programs to analyze large dataset Using Hadoop and Spark
- Write Hive queries to analyze large dataset Outline the Spark Ecosystem and its components
- Perform the filter, count, distinct, map, flatMap RDD Operations in Spark.
- Build Queries using Spark SQL
- Apply Spark joins on Sample Data Sets
- Make use of sqoop to import and export data from hadoop to database and vice- versa

List of Experiments:

1. To Study of Big Data Analytics and Hadoop Architecture
 - (i) know the concept of big data architecture
 - (ii) know the concept of Hadoop architecture

2. Loading DataSet in to HDFS for Spark Analysis Installation of Hadoop and cluster management
 - (i) Installing Hadoop single node cluster in ubuntu environment
 - (ii) Knowing the differencing between single node clusters and multi-node clusters
 - (iii) Accessing WEB-UI and the port number
 - (iv) Installing and accessing the environments such as hive and sqoop

3. File management tasks & Basic linux commands
 - (i) Creating a directory in HDFS
 - (ii) Moving forth and back to directories
 - (iii) Listing directory contents
 - (iv) Uploading and downloading a file in HDFS
 - (v) Checking the contents of the file
 - (vi) Copying and moving files
 - (vii) Copying and moving files between local to HDFS environment
 - (viii) Removing files and paths
 - (ix) Displaying few lines of a file
 - (x) Display the aggregate length of a file
 - (xi) Checking the permissions of a file
 - (xii) Zipping and unzipping the files with & without permission pasting it to a location
 - (xiii) Copy, Paste commands

4. Map-reducing
 - (i) Definition of Map-reduce
 - (ii) Its stages and terminologies
 - (iii) Word-count program to understand map-reduce (Mapper phase, Reducer phase, Drivercode)
5. Implementing Matrix-Multiplication with Hadoop Map-reduce
6. Compute Average Salary and Total Salary by Gender for an Enterprise.
7.
 - (i) Creating hive tables (External and internal)
 - (ii) Loading data to external hive tables from sql tables(or)Structured c.s.v using scoop
 - (iii) Performing operations like filterations and updations
 - (iv) Performing Join (inner, outer etc)
 - (v) Writing User defined function on hive tables
8. Create a sql table of employees Employee table with id,designation Salary table (salary ,dept id) Create external table in hive with similar schema of above tables,Move data to hive using scoop and load the contents into tables,filter a new table and write a UDF to encrypt the table with AES- algorithm, Decrypt it with key to show contents
9.
 - (i) Pyspark Definition(Apache Pyspark) and difference between Pyspark, Scala, pandas
 - (ii) Pyspark files and class methods
 - (iii) get(file name)
 - (iv) get root directory()
10. Pyspark -RDD'S
 - (i) what is RDD's?
 - (ii) ways to Create RDD
 - (iii)parallelized collections
 - (iv)external dataset
 - (v) existing RDD's
 - (vi)Spark RDD's operations (Count, foreach(), Collect, join,Cache())
11. Perform pyspark transformations
 - (i) map and flatMap
 - (ii)to remove the words, which are not necessary to analyze this text.
 - (iii)groupBy
 - (iv)What if we want to calculate how many times each word is coming in corpus ?
 - (v) How do I perform a task (say count the words 'spark' and 'apache' in rdd3) separatly oneach partition and get the output of the task performed in these partition ?
 - (vi)unions of RDD
 - (vii)join two pairs of RDD Based upon their key
12. Pyspark sparkconf-Attributes and applications
 - (i) What is Pyspark spark conf ()
 - (ii) Using spark conf create a spark session to write a dataframe to read details in a c.s.v andlater move that c.s.v to another location

TEXT BOOKS:

1. Spark in Action, Marko Bonaci and Petar Zecevic, Manning.
2. PySpark SQL Recipes: With HiveQL, Dataframe and Graphframes, Raju Kumar Mishra and Sundar Rajan Raman, Apress Media.

WEB LINKS:

1. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01330150584451891225182_shared/overview
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01258388119638835242_shared/overview
3. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0126052684230082561692_shared/overview

B.Tech. VI Semester

MC601BS: Environmental Science

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Course Objectives:

- To understand the importance of ecosystem and ecological balance.
- To understand the natural resources and their conservation.
- To understand the importance of biodiversity and its values.
- To gain knowledge about environmental pollution, effects and controlling measures.
- To study about global environmental problems and global issues.
- To understand the environmental policies, regulations, and sustainable development.

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

- Get the information about ecosystem and their usage and conservation.
- Learn different types of natural resources and take up the measures to protect the resources.
- Get the information about biodiversity and their usage and conservation.
- Get the information about the types of pollution, understand their effects and controlling measures.
- Gain the knowledge about current global environmental issues and initiations to be taken to protect the environment.
- Gain the knowledge about environmental acts, EIA, sustainable development and follow the rules and regulations.

UNIT - I

Ecosystems: Definition, scope, and importance of ecosystem. Classification, structure, and function of an ecosystem, food chains, food webs, and ecological pyramids. Flow of energy, biogeochemical cycles, bioaccumulation, biomagnification, ecosystem value, services and carrying capacity. Field visits.

UNIT - II

Natural Resources: Classification of resources: Living and non-living resources. **Water resources:** Use and over utilization of surface and ground water, floods and droughts. Dams: Benefits and problems. **Mineral resources:** Use and exploitation, environmental effects of extracting and using mineral resources. **Land resources and Forest resources.** **Energy resources:** Growing energy needs, renewable and non-renewable energy resources, use of alternate energy resources. Case studies.

UNIT - III

Biodiversity and Biotic Resources: Introduction, definition, genetic, species and ecosystem diversity. Values of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, hot spots of biodiversity. Field visit. Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts. Conservation of biodiversity: In - Situ and Ex -situ conservation. National biodiversity act.

UNIT - IV**Environmental Pollution and Control Technologies:**

Classification of pollution. **Air pollution:** Primary and secondary pollutants, automobile and industrial pollution. Ambient air quality standards. **Soil pollution:** Sources and types, impacts of modern agriculture, degradation of soil. **Solid waste:** Municipal solid waste management, composition and characteristics of e-waste and its management.

Pollution control technologies: Wastewater treatment methods: Primary, secondary and tertiary. Overview of air pollution control technologies, concepts of bioremediation.

Global Environmental issues and Global efforts: Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions /Protocols: Earth summit, Kyoto protocol and Montréal protocol. NAPCC-GoI Initiatives.

UNIT - V

Environmental Policy, Legislation & EIA: Environmental Protection Act, legal aspects Air Act- 1981, Water Act, biomedical waste management and handling rules, hazardous waste management and handling rules.

EIA: EIA structure, methods of baseline data acquisition. Concepts of environmental management plan (EMP).

Towards Sustainable Future: Concept of sustainable development goals, population and its explosion. Crazy consumerism, Environmental education, Human health, Environmental ethics. Concept of green building, Principles of green chemistry, Ecological footprint, Life cycle assessment (LCA), Low carbon life style.

TEXT BOOKS:

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: Towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008, PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New Age International publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.
6. Introduction to Environmental Science by Y. Anjaneyulu, BS Publications.

B.Tech. VI Semester

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MC501ES / MC602ES: Cyber Security
(Common to all branches except CSE, IT, CSBS)

Course objectives:

- To familiarize various types of cyber-attacks and cyber-crimes
- To give an overview of the cyber laws
- To study the defensive techniques against these attacks

Course Outcomes:

- The students will be able to understand cyber-attacks, types of cybercrimes, cyber laws and how to protect them self and ultimately the entire Internet community from such attacks.

UNIT - I

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defence, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

UNIT - II

Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

UNIT - III

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT- IV

Cyber Security: Organizational Implications: Introduction cost of cybercrimes and IPR issues, web Threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing, and the associated challenges for organizations.

Cybercrime and Cyber terrorism: Introduction, intellectual property in cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals

UNIT - V

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

Cybercrime: Examples and Mini-Cases Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances.

Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

TEXT BOOKS:

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

REFERENCES:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu, J. David Irwin, CRC Press T&F Group.

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B.Tech. VI Semester

MC502ES/ MC601ES: Artificial Intelligence
(Common to IT, CSBS)

Course Objectives:

- To train the students to understand different types of AI agents, various AI search algorithms, fundamentals of knowledge representation, building of simple knowledge-based systems and to apply knowledge representation, reasoning.
- Study of Markov Models enable the student ready to step into applied AI.

UNIT - I

Introduction: AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents

Basic Search Strategies: Problem Spaces, Uninformed Search (Breadth-First, Depth-First Search, Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best-First, A*), Constraint Satisfaction (Backtracking, Local Search)

UNIT - II

Advanced Search: Constructing Search Trees, Stochastic Search, A* Search Implementation, Minimax Search, Alpha-Beta Pruning

Basic Knowledge Representation and Reasoning: Propositional Logic, First-Order Logic, Forward Chaining and Backward Chaining, Introduction to Probabilistic Reasoning, Bayes Theorem

UNIT - III

Advanced Knowledge Representation and Reasoning: Knowledge Representation Issues, Non-monotonic Reasoning, Other Knowledge Representation Schemes

Reasoning Under Uncertainty: Basic probability, Acting Under Uncertainty, Bayes' Rule, Representing Knowledge in an Uncertain Domain, Bayesian Networks

UNIT - IV

Learning: What Is Learning? Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples, Winston's Learning Program, Decision Trees.

UNIT - V

Expert Systems: Representing and Using Domain Knowledge, Shell, Explanation, Knowledge Acquisition.

TEXT BOOK:

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivasankar B. Nair, The McGraw Hill publications, Third Edition, 2009

REFERENCE BOOKS:

1. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice-Hall, 2010.
2. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th ed., 2009.

MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)

B.Tech. in Computer Science & Engineering

Scheme of Instruction and Examination

(Choice Based Credit System)

Applicable from the Academic Year 2022-23

VII Semester

S. No.	Course Code	Course Title	Instructions			Examination			Credits
			Hours Per Week			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE		
1	CS701PC	Cryptography and Network Security	3	0	0	40	60	3	3
2	CS702PC	Compiler Design	3	0	0	40	60	3	3
3	CS74XPE	Professional Elective -IV	3	0	0	40	60	3	3
4	CS75XPE	Professional Elective -V	3	0	0	40	60	3	3
5	CS72XOE	Open Elective - II	3	0	0	40	60	3	3
6	CS751PC	Cryptography and Network Security Lab	0	0	2	40	60	3	1
7	CS752PC	Compiler Design Lab	0	0	2	40	60	3	1
8	CS753PC	Project Stage – I	0	0	6	100	-	-	3
Total Hours/Marks/Credits			15	0	10	380	420	-	20

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Professional Elective – IV

CS741PE	Graph Theory
CS742PE	Advanced Operating Systems
CS743PE	Soft Computing
CS744PE	Cloud Computing
CS745PE	Adhoc and Sensor Networks

Professional Elective – V

CS751PE	Advanced Algorithms
CS752PE	Agile Methodology
CS753PE	Robotic Process Automation
CS754PE	Blockchain Technology
CS755PE	Software Process & Project Management

Open Elective-II

CS721OE	Operating Systems
CS722OE	Software Engineering

L	T	P	C
3	0	0	3

B.Tech. VII Semester

CS701PC: Cryptography and Network Security

Course Objectives:

- Explain the objectives of information security.
- Explain the importance and application of each of confidentiality, integrity, authentication and availability.
- Understand various cryptographic algorithms.
- Understand the basic categories of threats to computers and networks.
- Describe public-key cryptosystem.
- Describe the enhancements made to IPv4 by IPSec.
- Understand Intrusions and intrusion detection.
- Discuss the fundamental ideas of public-key cryptography.
- Generate and distribute a PGP key pair and use the PGP package to send an encrypted e mail message.
- Discuss Web security and Firewalls.

Course Outcomes:

- Student will be able to understand basic cryptographic algorithms, message and web authentication and security issues.
- Ability to identify information system requirements for both of them such as client and server.
- Ability to understand the current legal issues towards information security.

UNIT - I

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security. Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, symmetric and asymmetric key cryptography, steganography.

UNIT - II

Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4. Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.

UNIT - III

Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme. Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure.

UNIT - IV

Transport-level Security: Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH). Wireless Network Security: Wireless Security, IEEE802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security.

UNIT - V

E-Mail Security: Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload.

Case Studies on Cryptography and security: Secure Multiparty Calculation, Virtual Elections, Single sign On, Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability.

TEXT BOOKS:

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition.
2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition.

REFERENCE BOOKS:

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition.
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH.
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning.
6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning.

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B.Tech. VII Semester

CS702PC: Compiler Design

Prerequisites: Formal Language and Automata Theory.

Course Objectives:

To Learn

- To understand the various phases in the design of a compiler.
- To understand the design of top-down and bottom-up parsers.
- To understand syntax directed translation schemes.
- To introduce lex and yacc tools.
- To develop algorithms to generate code for a target machine.

Course Outcomes:

- Ability to design, develop, and implement a compiler for any language.
- Able to use lex and yacc tools for developing a scanner and a parser.
- Able to design and implement LL and LR parsers.
- Able to design algorithms to perform code optimization to improve the performance of a program in terms of space and time complexity.
- Ability to design algorithms to generate machine code.

Unit I:

Introduction: Language Processors, The Structure of a compiler, Phases of Compilation, Language Processing System, the Science of building a compiler, programming language basics. Lexical Analysis: The Role of the Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, The Lexical-Analyzer Generator Lex, Design of a Lexical-Analyzer Generator.

Unit II:

Syntax Analysis: Introduction, writing a Grammar- Lexical Versus Syntactic Analysis, Eliminating Ambiguity, Elimination of Left Recursion, Left Factoring. Top-Down Parsing - Problems of Top-down Parsing, Recursive descent Parsing, Back Tracking-Brute Force Method, Non-Recursive Predictive Parsing, LL (1) Grammar.

Bottom-Up Parsing: Introduction to LR Parsing: Shift reduce Parsing, Operator Precedence Grammar, Simple LR, More Powerful LR Parsers, Look Ahead LR, Using Ambiguous Grammars, Parser Generators-YACC.

Unit III:

Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax-Directed Translation, Syntax-Directed Translation Schemes, and Implementing L-Attributed SDD's.

Intermediate-Code Generation: Variants of Syntax Trees, Three-Address Code, Three-Address Code Representations – Triples, Quadruples, Indirect Triples. Conversion of Popular Programming Languages Constructs into Three-Address Code, Types and Declarations, Type Checking.

Unit IV:

Run-Time Environments: Storage organization, Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management, Introduction to Garbage Collection, Mark-and-sweep Garbage Collection Algorithm, Introduction to Trace-Based Collection.

Code Generation: Object Code Forms, Machine Dependent Code Optimization, DAG Representation of Basic Blocks, Optimization of Intermediate Code by DAG, Issues in the Design of a Simple Code Generator, The Target Language, addresses in the Target Code, Code Generation Algorithm, Code Generation by DAG, Peephole Optimization, Register Allocation and Assignment.

Unit V:

Machine-Independent Optimizations: The Principal Sources of Optimization - Constant Folding, Copy Propagation, Dead Code Elimination, Algebraic Transformation, Strength reduction, Common Sub Expression Elimination. Loop Optimization Techniques – Loop Invariant Code Motion, Strength Reduction on induction variable, Loop Unrolling.

Basic Blocks and Flow Graphs: Local Optimization, Global Optimization, Data Flow Properties: Available Expressions, Reaching Definition, Live Variable Analysis.

TEXT BOOKS:

1. Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Pearson.
2. Principles of Compiler Design by V Raghavan, Mcgraw Hill Education.
3. The Theory and Practice of Compiler Writing, J. P. Tremblay and P. G. Sorenson, TMH

REFERENCE BOOKS:

1. Compiler Construction-Principles and Practice, Kenneth C Louden, Cengage Learning.
2. Modern compiler implementation in C, Andrew W Appel, Revised edition, Cambridge University Press.
3. Writing compilers and interpreters, R. Mak, 3rd edition, Wiley student edition.
4. lex&yacc – John R. Levine, Tony Mason, Doug Brown, O'reilly

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B.Tech. VII Semester

CS741PE: GRAPH THEORY
(Professional Elective - IV)

Pre-requisites: An understanding of Mathematics in general is sufficient.

Course Objectives:

- Understanding graphs, trees, connected paths, applications of trees and graphs

Course Outcomes:

- Know some important classes of graph theoretic problems;
- Able to formulate and prove central theorems about trees, matching, connectivity, coloring and planar graphs;
- Able to describe and apply some basic algorithms for graphs;
- Able to use graph theory as a modelling tool.

UNIT - I

Introduction-Discovery of graphs, Definitions, Subgraphs, Isomorphic graphs, Matrix representations of graphs, Degree of a vertex, Directed walks, paths and cycles, Connectivity in digraphs, Eulerian and Hamilton digraphs, Eulerian digraphs, Hamilton digraphs, Special graphs, Complements, Larger graphs from smaller graphs, Union, Sum, Cartesian Product, Composition, Graphic sequences, Graph theoretic model of the LAN problem, Havel-Hakimi criterion, Realization of a graphic sequence.

UNIT - II

Connected graphs and shortest paths - Walks, trails, paths, cycles, Connected graphs, Distance, Cut-vertices and cut-edges, Blocks, Connectivity, Weighted graphs and shortest paths, Weighted graphs, Dijkstra's shortest path algorithm, Floyd-Warshall shortest path algorithm.

UNIT - III

Trees- Definitions and characterizations, Number of trees, Cayley's formula, Kirchoff's matrix- tree theorem, Minimum spanning trees, Kruskal's algorithm, Prim's algorithm, Special classes of graphs, Bipartite Graphs, Line Graphs, Chordal Graphs, Eulerian Graphs, Fleury's algorithm, Chinese Postman problem, Hamilton Graphs, Introduction, Necessary conditions and sufficient conditions.

UNIT - IV

Independent sets coverings and matchings– Introduction, Independent sets and coverings: basic equations, Matchings in bipartite graphs, Hall's Theorem, König's Theorem, Perfect matchings in graphs, Greedy and approximation algorithms.

UNIT - V

Vertex Colorings- Basic definitions, Cliques and chromatic number, Mycielski's theorem, Greedy coloring algorithm, Coloring of chordal graphs, Brooks theorem, Edge Colorings, Introduction and Basics, Gupta-Vizing theorem, Class-1 and Class-2 graphs, Edge-coloring of bipartite graphs, Class-2 graphs, Hajos union and Class-2 graphs, A scheduling problem and equitable edge-coloring.

TEXT BOOKS:

1. J. A. Bondy and U. S. R. Murty. Graph Theory, volume 244 of Graduate Texts in Mathematics. Springer, 1st edition, 2008.
2. J. A. Bondy and U. S. R. Murty. Graph Theory with Applications.

REFERENCE BOOKS:

1. Lecture Videos: <http://nptel.ac.in/courses/111106050/13>
2. Introduction to Graph Theory, Douglas B. West, Pearson.
3. Schaum's Outlines Graph Theory, Balakrishnan, TMH
4. Introduction to Graph Theory, Wilson Robin j, PHI
5. Graph Theory with Applications to Engineering and Computer Science, NarsingDeo, PHI
6. Graphs - An Introductory Approach, Wilson, and Watkins

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B.Tech. VII Semester

**CS742PE: Advanced Operating Systems
(Professional Elective - IV)**

Course Objectives:

- To study, learn, and understand the main concepts of advanced operating systems (parallel processing systems, distributed systems, real time systems, network operating systems, and open-source operating systems), Hardware and software features that support these systems.

Course Outcomes:

- Understand the design approaches of advanced operating systems
- Analyze the design issues of distributed operating systems.
- Evaluate design issues of multi-processor operating systems.
- Identify the requirements Distributed File System and Distributed Shared Memory.
- Formulate the solutions to schedule the real time applications.

Unit-1: Architectures of Distributed Systems

System Architecture Types, Distributed Operating Systems, Issues in Distributed Operating Systems, Communication Primitives.

Theoretical Foundations: Inherent Limitations of a Distributed System, Lamport's Logical Clocks, Vector Clocks, Causal Ordering of Messages, Termination Detection.

Unit-2: Distributed Mutual Exclusion

The Classification of Mutual Exclusion Algorithms, Non-Token – Based Algorithms: Lamport's Algorithm, The Ricart-Agrawala Algorithm, Maekawa's Algorithm, Token-Based Algorithms: Suzuki-Kasami's Broadcast Algorithm, Singhal's Heuristic Algorithm, Raymond's Heuristic Algorithm.

Unit-3: Distributed Deadlock Detection

Preliminaries, Deadlock Handling Strategies in Distributed Systems, Issues in Deadlock Detection and Resolution, Control Organizations for Distributed Deadlock Detection, Centralized- Deadlock – Detection Algorithms, Distributed Deadlock Detection Algorithms, Hierarchical Deadlock Detection Algorithms

Unit-4: Multiprocessor System Architectures

Introduction, Motivation for multiprocessor Systems, Basic Multiprocessor System Architectures Multi Processor Operating Systems: Introduction, Structures of Multiprocessor Operating Systems, Operating Design Issues, Threads, Process Synchronization, Processor Scheduling.

Distributed File Systems: Architecture, Mechanisms for Building Distributed File Systems, Design Issues

Unit-5: Distributed Scheduling

Issues in Load Distributing, Components of a Load Distributed Algorithm, Stability, Load Distributing Algorithms, Requirements for Load Distributing, Task Migration, Issues in task Migration

Distributed Shared Memory: Architecture and Motivation, Algorithms for Implementing DSM, Memory Coherence, Coherence Protocols, Design Issues

TEXT BOOK:

1. Advanced Concepts in Operating Systems, Mukesh Singhal, Niranjana G. Shivaratri, Tata McGraw-Hill Edition 2001

REFERENCES:

1. Distributed Systems: Andrew S. Tanenbaum, Maarten Van Steen, Pearson Prentice Hall, Edition – 2, 2007

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B.Tech. VII Semester

CS743PE: Soft Computing (Professional Elective - IV)

Course Objectives:

- Familiarize with soft computing concepts
- Introduce and use the idea of fuzzy logic and use of heuristics based on human experience
- Familiarize the Neuro-Fuzzy modeling using Classification and Clustering techniques
- Learn the concepts of Genetic algorithm and its applications
- Acquire the knowledge of Rough Sets.

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

- Identify the difference between Conventional Artificial Intelligence to Computational Intelligence.
- Understand fuzzy logic and reasoning to handle and solve engineering problems
- Apply the Classification and clustering techniques on various applications.
- Understand the advanced neural networks and its applications
- Perform various operations of genetic algorithms, Rough Sets.
- Comprehend various techniques to build model for various applications

UNIT - I

Introduction to Soft Computing: Evolutionary Computing, "Soft" computing versus "Hard" computing, Soft Computing Methods, Recent Trends in Soft Computing, Characteristics of Soft computing, Applications of Soft Computing Techniques.

UNIT-II

Fuzzy Systems: Fuzzy Sets, Fuzzy Relations, Fuzzy Logic, Fuzzy Rule-Based Systems

UNIT-III

Fuzzy Decision Making, Particle Swarm Optimization

UNIT-IV

Genetic Algorithms: Basic Concepts, Basic Operators for Genetic Algorithms, Crossover and Mutation Properties, Genetic Algorithm Cycle, Fitness Function, Applications of Genetic Algorithm.

UNIT-V

Rough Sets, Rule Induction, and Discernibility Matrix, Integration of Soft Computing Techniques

TEXT BOOKS:

1. Soft Computing – Advances and Applications - Jan 2015 by B.K. Tripathy and J. Anuradha – Cengage Learning

REFERENCE BOOKS:

1. S. N. Sivanandam & S. N. Deepa, "Principles of Soft Computing", 2nd edition, Wiley India, 2008.
2. David E. Goldberg, "Genetic Algorithms-In Search, optimization and Machine learning", Pearson Education.
3. J. S. R. Jang, C.T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", Pearson Education, 2004.
4. G.J. Klir& B. Yuan, "Fuzzy Sets & Fuzzy Logic", PHI, 1995.
5. Melanie Mitchell, "An Introduction to Genetic Algorithm," PHI, 1998.
6. Timothy J. Ross, "Fuzzy Logic with Engineering Applications," McGraw- Hill International editions, 1995

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B.Tech. VII Semester

**CS744PE: Cloud Computing
(Professional Elective - IV)**

Pre-requisites:

Knowledge on Computer Networks, Operating Systems and Distributed Systems.

Course Objectives:

- To know the basics of cloud computing and its advantages.
- To analyze the components of cloud computing and its business perspective.
- To understand various cloud service/deployment models.
- To evaluate the various cloud development tools
- To study various cloud service provider services.

Course Outcomes:

- Ability to understand the fundamentals of cloud computing.
- Understand the architecture of cloud computing model.
- Ability to understand various service and deployment models of cloud.
- Understand the concept of virtualization and its types.
- Understanding cloud service providers and cloud based applications.

Unit – I:

Cloud Computing Fundamentals: Motivation for Cloud Computing, Basic Principles of Cloud computing. Five Essential Characteristics, Four Cloud Deployment Models, Three service Offering Models, Requirements for Cloud Services - Cloud Ecosystem, Cloud Application - Virtualization- approaches and types

Unit – II:

Cloud Computing Architecture and Management: Cloud architecture Layers, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Networking Technologies, Applications on the Cloud, Managing the Cloud application, Migrating Application to Cloud- Phases of Cloud Migration - Approaches for Cloud Migration

Unit – III:

Cloud Deployment Models: Private Cloud, Public cloud, Community Cloud and Hybrid Cloud – Characteristics, Suitability, Issues, Advantages and Disadvantages.

Cloud Service Models: Infrastructure as a Service, Platform as a Service, Software as a Service - Characteristics, Suitability, Pros and Cons and Summary.

UNIT – IV

Virtualization technology

Virtual Machine Technology - Types of virtualizations - System virtual machines- Virtual machines and elastic computing, Virtual machine migration - Virtualization Applications In Enterprises- Security through virtualization, Desktop virtualization, Server consolidation, Automating infrastructure management, Pitfalls Of Virtualization.

Unit – V

Cloud Service Providers and Applications: Amazon Web Services, Amazon Elastic Compute Cloud, Google Cloud Platform, Google App Engine, Microsoft Azure, Windows Azure, IBM Cloud Models – Cloud Security issues – Case studies in Cloud Computing and its applications.

TEXT BOOKS:

1. Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2014.
2. “Enterprise Cloud Computing Technology Architecture Applications”, GautamShroff, Cambridge University Press; 1 edition, [ISBN: 978-0521137355], 2010.

REFERENCE BOOKS:

1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.
3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, SubraKumaraswamy, Shahed Latif, O’Reilly, SPD, rp 2011.

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B.Tech. VII Semester

CS745PE: Adhoc and Sensor Networks
(Professional Elective - IV)
(Common to CSE, IT)

Prerequisites:

- A course on “Computer Networks
- A course on “Mobile Computing”

Course Objectives:

- | |
|--|
| <ul style="list-style-type: none"> • To understand the concepts of sensor networks • To understand the MAC and transport protocols for ad hoc networks • To understand the security of sensor networks • To understand the applications of adhoc and sensor networks |
|--|

Course Outcomes:

- | |
|---|
| <ul style="list-style-type: none"> • Ability to understand the state-of-the-art research in the emerging subject of AdHoc and Wireless Sensor Networks • Ability to solve the issues in real-time application development based on ASN. • Ability to conduct further research in the domain of ASN |
|---|

Unit – I :

Introduction to AdHoc Networks - Characteristics of MANETs, Applications of MANETs and Challenges of MANETs. Routing in MANETs - Criteria for classification, Taxonomy of MANET routing algorithms, Topology- based routing algorithms-Proactive: DSDV; Reactive: DSR, AODV; Hybrid: ZRP; Position-based routing algorithms-Location Services-DREAM, Quorum-based; Forwarding Strategies: Greedy Packet, Restricted Directional Flooding-DREAM, LAR.

Unit – II :

Data Transmission - Broadcast Storm Problem, Rebroadcasting Schemes-Simple-flooding, Probability-based Methods, Area-based Methods, Neighbor Knowledge-based: SBA, Multipoint Relaying, AHBP. Multicasting: Tree-based: AMRIS, MAODV; Mesh-based: ODMRP, CAMP; Hybrid: AMRoute, MCEDAR.

Unit – III :

Geocaching: Data-transmission Oriented-LBM; Route Creation Oriented-GeoTORA, MGR. TCP over Ad Hoc TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc.

Unit – IV :

Basics of Wireless, Sensors and Lower Layer Issues: Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer, Routing Layer.

Unit – V :

Upper Layer Issues of WSN: Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs, Sensor Networks and mobile robots.

TEXT BOOKS:

1. AdHoc and Sensor Networks – Theory and Applications, Carlos Corderio Dharma P. Aggarwal, World Scientific Publications, March 2006, ISBN – 981–256–681–3.
2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science, ISBN – 978-1-55860-914-3 (Morgan Kaufman).

REFERENCE BOOKS:

1. Ad-Hoc Wireless Sensor Networks- C. Siva Ram Murthy, B. S. Manoj, Pearson
2. Principles of Wireless Networks – KavehPahLaven and P. Krishna Murthy, 2002, PE
3. Mobile Cellular Communication – Gottapu Sasibhushana Rao, Pearson Education,

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B.Tech. VII Semester

**CS751PE: Advanced Algorithms
(Professional Elective - V)**

Pre-Requisites: Algorithm Design and Analysis Course

Objectives:

- To familiarize advanced methods on analysis of algorithms.
- To familiarize with graphs and algorithms related shortest path
- To understand matrix computations and modulo representations
- To introduce randomized, approximation algorithms and computational complexity topics

Course Outcomes:

- Familiarize with advanced methods on analysis of algorithms
- Familiarize with the graphs, graph matching and shortest path algorithms
- Understand matrix computations and modulo representations
- Understand randomized, approximation algorithms and computational complexity topics

UNIT – I

Introduction to Algorithms, Classification of Algorithms, Asymptotic Analysis, Introduction to Recurrence equations - Linear recurrences, Non-linear recurrences, Formulation of recurrence equations, techniques for solving recurrence equations, solving recurrence equations using polynomial reduction, Master's theorem

Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge- weighted case (Dijkstra's), depth-first search and computation of strongly connected components, Multistage Graph, topological sorting

UNIT – II

Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path, Bipartite matching problem

Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set, Optimal tree problems- optimal merge, Huffman coding, tree vertex splitting problem. Shortest Path in Graphs: Floyd-Warshall algorithm, Travelling Sales Person Problem, and introduction to dynamic programming paradigm. Optimal Graph Problems - Minimum Spanning Tree, Single source shortest path.

UNIT - III

Flow-Networks: Maxflow - mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm.

Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, Chain Matrix Multiplication, Matrix operations – Gaussian Elimination method, LUP- decomposition, Crout's method of decomposition, inverse of a triangular matrix,

UNIT - IV

Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation, interpolation problem. Multiplication of long integers by using Divide and Conquer paradigm, Schonhage-Strassen's Integer Multiplication algorithm.

String Algorithms: Naïve String, Rabin Karp, KMP, Boyer Moore, Harspool algorithms

UNIT - V

Basics of Computational Complexity: Introduction to computational complexity, complexity classes, Satisfiability problem and Cook's theorem, Examples of NP- Complete problems Randomized algorithms: Introduction, Types of Randomized algorithms, Example of Randomized algorithms.

Approximation algorithms: Introduction, Types of Approximation algorithms, Examples of Approximation algorithms

TEXT BOOK:

1. Design and Analysis of Algorithms, S. Sridhar, Oxford University Press.

REFERENCE BOOKS:

1. Introduction to Algorithms, Cormen, Leiserson, Rivest, Stein.
2. The Design and Analysis of Computer Algorithms, Aho, Hopcroft, Ullman.
3. Algorithm Design, Kleinberg and Tardos.

B.Tech. VII Semester

L	T	P	C
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CS752PE- Agile Methodology (Professional Elective - V)

Course Objectives:

- Knowledge on concepts of Agile development, releasing, planning and developing

Course Outcomes:

- Understand basic concepts of agile methods and extreme programming.
- Analyze real customer involvement and ubiquitous language.
- Discuss risk management and iteration planning.
- Summarize incremental requirements, refactoring, incremental design and architecture.

UNIT - I

Introduction Extreme Programming (XP) - Agile Development: Why Agile - Understanding Success, Beyond Deadlines, Importance of Organizational Success, Introduction to Agility How to Be Agile - Agile methods, Don't make your own method, Road to mastery Understanding XP (Extreme Programming) - XP life cycle, XP team, XP Concepts Adopting XP - Knowing whether XP is suitable, Implementing XP, assessing Agility Practicing XP - Thinking - Pair Programming, Energized work, Informative Workspace, Root cause Analysis, Retrospectives.
(5 Chapters from Text book 1)

UNIT - II

Collaborating: Trust, Sit together, Real customer involvement, Ubiquitous language, meetings, coding standards, Iteration demo, Reporting. (6th chapter)

UNIT - III

Releasing: Bugfree Release, Version Control, fast build, continuous integration, Collective ownership, Documentation. (7th chapter)

UNIT - IV

Planning: Version, Release Plan, Risk Management, Iteration Planning, Slack, Stories, Estimating. (8th chapter)

UNIT - V

Developing: Incremental requirements, Customer tests, Test driven development, Refactoring, Incremental design and architecture, spike solutions, Performance optimization, Exploratory testing. (9th chapter)

TEXT BOOK:

1. The art of Agile Development, James Shore and Shane Warden, 11th Indian Reprint, O'Reilly, 2018.

REFERENCE BOOKS:

1. Learning Agile, Andrew Stellman and Jennifer Greene, O'Reilly, 4th Indian Reprint, 2018.
2. Practices of an Agile Developer, Venkat Subramaniam and Andy Hunt, SPD, 5th Indian Reprint, 2015.
3. Agile Project Management - Jim Highsmith, Pearson Low price Edition 2004.

B.Tech. VII Semester

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**CS753PE: Robotic Process Automation
(Professional Elective –V)**

Pre-requisites: Basic Programming Concepts

Course objectives:

- Describe RPA, where it can be applied and how it's implemented.
- Describe the different types of variables, Control Flow and data manipulation techniques.
- Identify and understand Image, Text and Data Tables Automation.
- Describe how to handle the User Events and various types of Exceptions and strategies.
- Understand the Deployment of the Robot and to maintain the connection.

Course Outcomes:

- Ability to understand the Fundamental and basic principles of Robotics Process Automation, Applications in various Industries/business.
- Design, build and deploy an RPA robot.
- Develop RPA solutions for simple work processes.
- Identify areas within their own business or organization that could benefit from RPA
- Create a provision robot

UNIT-I

Introduction & Fundamentals

Scope and techniques of automation, Robotic process automation - What can RPA do? Benefits of RPA, Components of RPA, RPA platforms, The future of automation.

History of Automation - What is RPA - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - What Processes can be Automated - Types of Bots - Workloads which can be automated - RPA Advanced Concepts - Standardization of processes - RPA Development methodologies - Difference from SDLC - Robotic control flow architecture - RPA business case - RPA Team - Process Design Document/Solution Design Document - Industries best suited for RPA - Risks & Challenges with RPA - RPA and emerging ecosystem.

UNIT-II

Introduction Of RPA Tools

The User Interface - Variables - Managing Variables - Naming Best Practices - The Variables Panel - Generic Value Variables - Text Variables - True or False Variables - Number Variables - Array Variables - Date and Time Variables - Data Table Variables - Managing Arguments - Naming Best Practices - The Arguments Panel - Using Arguments - About Imported Namespaces - Importing New Namespaces- Control Flow - Control Flow Introduction - If Else Statements - Loops - Advanced Control Flow - Sequences – Flowcharts - About Control Flow - Control Flow Activities - The Assign Activity - The Delay Activity - The Do While Activity - The If Activity - The Switch Activity - The While Activity - The For Each Activity - The Break Activity - Data Manipulation - Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation - Data Manipulation - Gathering and Assembling Data

UNIT – III**Advanced Automation Concepts & Techniques**

Recording Introduction - Basic and Desktop Recording - Web Recording - Input/output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text & Advanced Citrix Automation - Introduction to Image & Text Automation - Image based automation - Keyboard based automation - Information Retrieval - Advanced Citrix Automation challenges - Best Practices - Using tab for Images - Starting Apps - Excel Data Tables & PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel – Extracting Data from PDF - Extracting a single piece of data - Anchors - Using anchors in PDF.

UNIT – IV**Handling user events & assistant bots, exception handling:**

What are assistant bots? - Monitoring system event triggers - Hotkey trigger - Mouse trigger - System trigger - Monitoring image and element triggers - An example of monitoring email - Example of monitoring a copying event and blocking it - Launching an assistant bot on a keyboard event. Debugging and Exception Handling - Debugging Tools - Strategies for solving issues - Catching errors.

UNIT – V**Deploying And Maintaining the Bot**

Publishing using publish utility - Creation of Server - Using Server to control the bots - Creating a provision Robot from the Server - Connecting a Robot to Server - Deploy the Robot to Server - Publishing and managing updates - Managing packages - Uploading packages - Deleting packages

TEXT BOOKS:

1. Alok Mani Tripathi, “Learning Robotic Process Automation,” Packet Publishing, 2018.
2. Nikku, S.B., Introduction to Robotics, Prentice Hall of India Private Limited (2002).
3. Schilling. R. J., Fundamentals of Robotics: Analysis and Control, Prentice Hall of India Private Limited (2006).

REFERENCES:

1. Frank Casale, Rebecca Dilla, Heidi Jaynes, Lauren Livingston, “Introduction to Robotic Process Automation: A Primer,” Institute of Robotic Process Automation, 1st Edition 2015.
2. Richard Murdoch, Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant,” Independently Published, 1st Edition 2018.
3. Srikanth Merianda, ”Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation”, Consulting Opportunity Holdings LLC, 1st Edition 2018.
4. Lim Mei Ying, “Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots and automate business processes”, Packt Publishing, 1st Edition 2018.
5. Criag, J., Fundamentals of Robotics: Analysis and Control, PrenticeHall of India Private Limited (2006).
6. Gonzalex, R. C. and Fu, K. S., Robotics Control Sensing, Vision and Intelligence, McGrawHill (2004). Koren, Y., Robotics for Engineers, McGrawHill (1985).

Web references:

1. <https://www.uipath.com/rpa/robotic-process-automation>
2. <https://www.academy.uipath.com>

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B.Tech. VII Semester

CS754PE: Blockchain Technology**(Professional Elective – V)***(Common to CSE, IT, CSBS)***Prerequisites:**

- Knowledge in security and applied cryptography
- Knowledge in distributed databases

Course Objectives:

- To Introduce blockchain technology and Cryptocurrency

Course Outcomes:

- Learn about research advances related to one of the most popular technological areas today.

UNIT- I

Introduction: Blockchain or distributed trust, Protocol, Currency, Cryptocurrency, How a Cryptocurrency works, Crowdfunding

UNIT- II

Extensibility of Blockchain concepts, Digital Identity verification, Block chain Neutrality, Digital art, Block chain Environment

UNIT- III

Blockchain Science: Grid coin, Folding coin, Blockchain Genomics, Bit coin MOOCs

UNIT - IV

Currency, Token, Tokenizing, Campus coin, Coin drop as a strategy for Public adoption, Currency Multiplicity, Demurrage currency

UNIT - V

Technical challenges, Businessmodel challenges, Scandals and Public perception, Government Regulations

TEXTBOOK:

1. Blockchain Blue print for Economy by Melanie Swan

REFERENCE:

1. Blockchain Basics: A Non-Technical Introduction in 25 Steps 1st Edition, by Daniel Drescher

B.Tech. VII Semester

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CS755PE: Software Process & Project Management
(Professional Elective – V)
(Common to CSE, IT)

Prerequisites:

- A Course on “Objected Oriented Programming through Java”
- A course on “Web Technologies”

Course Objectives:

- To acquire knowledge on software process management
- To acquire managerial skills for software project development
- To understand software economics

Course Outcomes:

- Gain knowledge of software economics, phases in the life cycle of software development, project organization, project control and process instrumentation
- Analyze the major and minor milestones, artifacts and metrics from management and technical perspective
- Design and develop software product using conventional and modern principles of software project management

UNIT – I: Software Process Maturity:

Software maturity Framework, Principles of Software Process Change, Software Process Assessment, The Initial Process, The Repeatable Process, The Defined Process, The Managed Process, The Optimizing Process. Process Reference Models, Capability Maturity Model (CMM), CMMI, PCMM, PSP, TSP).

UNIT – II: Software Project Management Renaissance:

Conventional Software Management, Evolution of Software Economics, Improving Software Economics, The old way and the new way.

Life-Cycle Phases and Process artifacts

Engineering and Production stages, inception phase, elaboration phase, construction phase, transition phase, artifact sets, management artifacts, engineering artifacts and pragmatic artifacts, model-based software architectures.

UNIT – III: Workflows and Checkpoints of process

Software process workflows, Iteration workflows, Major milestones, minor milestones, periodic status assessments.

Process Planning: Work breakdown structures, Planning guidelines, cost and schedule estimating process, iteration planning process, Pragmatic planning.

UNIT – IV: Project Organizations

Line-of- business organizations, project organizations, evolution of organizations, process automation.

Project Control and process instrumentation

The seven-core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic software metrics, metrics automation.

UNIT – V:

CCPDS-R Case Study and Future Software Project Management Practices

Modern Project Profiles, Next-Generation software Economics, Modern Process Transitions.

TEXT BOOKS:

1. Managing the Software Process, Watts S. Humphrey, Pearson Education
2. Software Project Management, Walker Royce, Pearson Education

REFERENCE BOOKS:

1. An Introduction to the Team Software Process, Watts S. Humphrey, Pearson Education, 2000 Process Improvement essentials, James R. Persse, O'Reilly, 2006
2. Software Project Management, Bob Hughes & Mike Cotterell, fourth edition, TMH, 2006
3. Applied Software Project Management, Andrew Stellman & Jennifer Greene, O'Reilly, 2006.
4. Head First PMP, Jennifer Greene & Andrew Stellman, O'Reilly, 2007
5. Software Engineering Project Management, Richard H. Thayer & Edward Yourdon, 2nd edition, Wiley India, 2004.
6. Agile Project Management, Jim Highsmith, Pearson education, 2004.

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B.Tech. VII Semester

CS721OE: Operating Systems (Open Elective –II)

Prerequisites:

- A course on “Computer Programming and Data Structures”.
- A course on “Computer Organization and Architecture”

Course Objectives

To Learn

- Introduce operating system concepts (i.e., processes, threads, scheduling, synchronization, deadlocks, memory management, file and I/O subsystems and protection)
- Introduce the issues to be considered in the design and development of operating system
- Introduce basic Unix commands, system call interface for process management, interprocess communication and I/O in Unix

Course Outcomes

Student will be able to:

- Will be able to control access to a computer and the files that may be shared
- Demonstrate the knowledge of the components of computers and their respective roles in computing.
- Ability to recognize and resolve user problems with standard operating environments.
- Gain practical knowledge of how programming languages, operating systems, and architectures interact and how to use each effectively.

Unit I:

Operating System - Introduction: Simple Batch, Multiprogrammed, Time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System components, Operating System services, System Calls

Process - Process concepts and scheduling, Operations on processes, Cooperating Processes, Threads.

Unit II:

CPU Scheduling: Scheduling Criteria, Scheduling Algorithms, Multiple -Processor Scheduling. System call interface for process management-fork, exit, wait, waitpid, exec

Deadlocks - System Model, Deadlocks Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock.

Unit III:

Process Management and Synchronization: The Critical Section Problem, Synchronization Hardware, Semaphores, and Classical Problems of Synchronization, Critical Regions, Monitors

Interprocess Communication Mechanisms: IPC between processes on a single computer system, IPC between processes on different systems, using pipes, FIFOs, message queues, shared memory.

Unit IV:

Memory Management and Virtual Memory: Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging, Demand Paging, Page Replacement, Page Replacement Algorithms.

Unit V:

File System Interface and Operations: Access methods, Directory Structure, Protection, File System Structure, Allocation methods, Free-space Management. Usage of open, create, read, write, close, lseek, stat, ioctl system calls

Text Books:

1. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley.
2. Advanced programming in the UNIX environment, W.R. Stevens, Pearson education.

Reference Books:

1. Operating Systems- Internals and Design Principles, William Stallings, Fifth Edition–2005, Pearson Education/PHI
2. Operating System A Design Approach- Crowley, TMH.
3. Modern Operating Systems, Andrew S. Tanenbaum 2nd edition, Pearson/PHI

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B.Tech. VII Semester

CS722OE: Software Engineering (Open Elective –II)

Course Objectives:**To Learn**

- The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.
- Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams

Course Outcomes:

Student will be able to:

- Ability to translate end-user requirements into system and software requirements, using e.g. UML, and structure the requirements in a Software Requirements Document (SRD).
- Identify and apply appropriate software architectures and patterns to carry out high level design of a system and be able to critically compare alternative choices.
- Will have experience and/or awareness of testing problems and will be able to develop a simple testing report

Unit I:

Introduction to Software Engineering: The evolving role of software, changing nature of software, software myths. A Generic view of process: Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI). Process models: The waterfall model, Spiral model and Agile methodology

Unit II:

Software Requirements: Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document.

Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management.

Unit III:

Design Engineering: Design process and design quality, design concepts, the design model. Creating an architectural design: software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.

Unit IV:

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.

Metrics for Process and Products: Software measurement, metrics for software quality.

Unit V:

Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM. Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

Text Books:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, McGraw Hill International Edition.
2. Software Engineering- Sommerville, 7th edition, Pearson Education.

Reference Books:

1. The unified modeling language user guide Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education.
2. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiley.
3. Fundamentals of object-oriented design using UML Meiler page-Jones: Pearson Education.

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B.Tech. VII Semester**CS751PC: Cryptography and Network Security Lab****Course Objectives:**

- Explain the objectives of information security
- Explain the importance and application of each of confidentiality, integrity, authentication and availability
- Understand various cryptographic algorithms.

Course Outcomes:

- Understand basic cryptographic algorithms, message and web authentication and security issues.
- Identify information system requirements for both of them such as client and server.
- Understand the current legal issues towards information security.

List of Experiments:

1. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should XOR each character in this string with 0 and display the result.
2. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should AND or and XOR each character in this string with 127 and display the result.
3. Write a Java program to perform encryption and decryption using the following algorithms
 - a) Substitution cipher
 - b). Hill Cipher
 - c). Poly Alphabetic Cipher
4. Write a C/JAVA program to implement the DES algorithm logic.
5. Write a C/JAVA program to implement the Blowfish algorithm logic.
6. Write a C/JAVA program to implement the Rijndael algorithm logic.
7. Write the RC4 logic in Java Using Java cryptography; encrypt the text "Hello world" using Blowfish. Create your own key using Java key tool.
8. Write a Java program to implement the RSA algorithm.
9. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.
10. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
11. Calculate the message digest of a text using the MD5 algorithm in JAVA

TEXT BOOKS:

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition
2. Cryptography and Network Security: Atul Kahate, McGraw Hill, 3rd Edition

REFERENCE BOOKS:

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
2. Cryptography and Network Security: Forouzan Mukhopadhyay, McGraw Hill, 3rd Edition
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning
6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning

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B.Tech. VII Semester

CS752PC: Compiler Design Lab**Course Objectives:**

- To understand the various phases in the design of a compiler.
- To understand the design of top-down and bottom-up parsers.
- To understand syntax directed translation schemes.
- To introduce lex and yacc tools.

Course Outcomes:

- Ability to design, develop, and implement a compiler for any language.
- Able to use lex and yacc tools for developing a scanner and a parser.
- Able to design and implement LL and LR parsers.

List of Experiments

1. Develop a lexical analyzer to recognize a few patterns inc (ex. Identifiers, constants, comments, operators etc.)
2. Implementation of lexical analyzer using lex tool.
3. Generate yacc specification for a few syntactic categories.
 - a. Program to recognize a valid arithmetic expression that uses operator +, -, * and /.
 - b. Program to recognize a valid variable which starts with a letter followed by any number of letter or digits.
 - c. Implementation of calculator using lex and yacc.
4. Convert the bnf rules into yacc form and write code to generate abstract syntax tree.
5. Implement type checking
6. Implement any one storage allocation strategies (heap, stack, static)
7. Write a lex program to count the number of words and number of lines in a given file or program.
8. Write a 'C' program to implement lexical analyzer using c program.
9. write recursive descent parser for the grammar $E \rightarrow E+T \quad E \rightarrow T \quad T \rightarrow T * F \quad T \rightarrow FF \rightarrow (E)/id$.
10. write recursive descent parser for the grammar $S \rightarrow (L) \quad S \rightarrow a \quad L \rightarrow L, S \quad L \rightarrow S$
11. Write a C program to calculate first function for the grammar $E \rightarrow E+T \quad E \rightarrow T \quad T \rightarrow T * F \quad T \rightarrow F \quad F \rightarrow (E)/id$
12. Write a YACC program to implement a top down parser for the given grammar.

TEXT BOOK:

1. Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman

REFERENCE BOOKS:

1. Lex & Yacc – John R. Levine, Tony Mason, Doug Brown, O'reilly
2. Compiler Construction, Loudon, Thomson.

MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)

B.Tech. in Computer Science & Engineering

Scheme of Instruction and Examination

(Choice Based Credit System)

Applicable from the Academic Year 2022-23

VIII Semester

S. No.	Course Code	Course Title	Instructions			Examination			Credits
			Hours Per Week			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE		
1	MS801HS	Organizational Behaviour	3	0	0	40	60	3	3
2	CS86XPE	Professional Elective – VI	3	0	0	40	60	3	3
3	CS82XOE	Open Elective – III	3	0	0	40	60	3	3
4	CS851PC	Project Stage – II including Seminar	0	0	22	40	60	-	11
Total Hours/Marks/Credits			9	0	22	160	240	-	20

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Professional Elective – VI

CS861PE	Computational Complexity
CS862PE	Distributed Systems
CS863PE	Deep Learning
CS864PE	Human Computer Interaction
CS865PE	Cyber Forensics

Open Elective-III

CS821OE	Algorithms Design and Analysis
CS822OE	Introduction to Computer Networks

B.Tech. VIII Semester

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MS801HS: ORGANIZATIONAL BEHAVIOUR
(Common to CSE, IT & CSE (Data Science))

Course Objective: The objectives of the course are:

1. To understand the perception and attribution concepts in organizational and external environmental Context.
2. To discuss the concepts and theories of personality, attitudes and Motivation.
3. To understand the decision making and communication process in interpersonal and their intrapersonal context.
4. To familiarize the students with the basic understanding of individual behavior and explore issues of power and empowerment.
5. To discuss the concepts of High performance, Learning and Leadership.

Course Outcomes: Upon the completion of the subject, the student will be able to

1. Analyze the concepts of perception and attribution of individuals and groups in organizations in terms of the key factors that influence organizational behavior.
2. Acquire knowledge of personality and attitudes of individuals in applying motivational theories to resolve problems of employees.
3. Apply group dynamics and skills required for working in groups and identify the processes used in developing communication and decision making to overcome stress and conflicts.
4. Analyze organizational behavioral issues in the context of, power, and empowerment issues.
5. Acquire the knowledge of learning concepts and leadership styles to achieve high performance levels.

UNIT I: INTRODUCTION, PERCEPTION AND ATTRIBUTION

Introduction to OB - Definition, Nature and Scope – Environmental and organizational context – Impact of IT, globalization, Diversity, Ethics, culture, reward systems and organizational design on Organisational Behaviour.

Cognitive Process I: Perception and Attribution: Meaning of Perception, Nature, and importance of Perception — Sensation versus Perception - Perceptual selectivity and organization – Social perception.

Attribution: Meaning - Attribution Theories – Fritz heider’s theory of attribution; Jones & Davis correspondent inference theory; Kelley’s Covariation Model; and Weiner’s Three-Dimensional Model - Locus of control –Attribution Errors – Impression Management – Types - Strategies of Impression Management.

UNIT II: PERSONALITY, ATTITUDES AND MOTIVATION

Cognitive Process II: Personality and Attitudes - Personality as a continuum –Meaning of personality, Personality Traits - Johari Window and Transactional Analysis. Attitudes: Nature and Dimension of Attitudes - Job satisfaction and organizational commitment.

Motivation: Motivational needs and processes- Theories of Motivation– the content theories of motivation: Maslow’s hierarchy of needs; Herzberg’s two factor theory of motivation; Alderfer’s ERG theory – The process theories of work motivation: Vroom’s expectancy theory of motivation; the Porter-Lawler’s model.

UNIT III: COMMUNICATION, DECISION-MAKING, STRESS AND CONFLICT

Dynamics of OB - I: Communication: Meaning and types - interactive communication in organizations – barriers to communication and strategies to improve the flow of communication. Decision Making: Participative decision-making techniques – creativity and group decision making.

Dynamics of OB – II: Stress and Conflict: Meaning and types of stress –Meaning and types of conflict - Effect of stress and intra-individual conflict -strategies to cope with stress and conflict.

UNIT IV: POWER AND EMPOWERMENT

Dynamics of OB - III Power: Meaning - Types of power – Legitimate power, Coercive power, Expert power, Informal power and Referent power.

Empowerment – Benefits, Process, Determinants, Techniques of Empowerment; Groups vs. Teams –Nature of groups – dynamics of informal groups – Dysfunctions of groups and teams – Teams in modern work place.

UNIT V: HIGH PERFORMANCE, LEARNING AND LEADERSHIP

Leading High performance: Job design and Goal setting for High Performance - Quality of Work Life - Socio technical Design and High-performance work practices - Behavioural performance management.

Learning: Reinforcement and Punishment as principles of Learning – Process of Behavioural modification.

Leadership: Definition of leadership – Traits of effective leaders - Leadership behaviour Vs Traits – Leadership skills – Leadership theories: Trait theories; Behavioural theories; Contingency approaches to leadership, Leadership Styles: Autocratic Leadership style, Democratic Leadership style, Free rein Leadership style.

TEXT BOOKS:

1. Luthans, Fred, Organizational Behavior, McGraw-Hill, 10th Edition, 2009.
2. Robbins, P. Stephen, Timothy A. Judge, Organizational Behavior, PHI/Pearson, 18th Edition, 2022.
3. Pareek Udai, Behavioral Process at Work: Oxford & IBH, New Delhi, 2009.

REFERENCE BOOKS:

1. Schermerhorn, Organizational Behavior Wiley, 9th Edition, 2008.
2. Michael A Hitt, Organizational Behavior, Wiley, 2008.
3. Aswathappa, Organizational Behavior, Himalaya, 2009.

B.Tech. VIII Semester

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**CS861PE: Computational Complexity
(Professional Elective - VI)**

Prerequisites:

- A course on “Computer Programming and Data Structures”
- A course on “Discrete Structures and Graph Theory”

Course Objectives:

- Introduces to theory of computational complexity classes
- Discuss about algorithmic techniques and application of these techniques to problems.
- Introduce to randomized algorithms and discuss how effective they are in reducing time and space complexity.
- Discuss about Graph based algorithms and approximation algorithms
- Discuss about search trees

Course Outcomes:

- Ability to classify decision problems into appropriate complexity classes
- Ability to specify what it means to reduce one problem to another, and construct reductions for simple examples.
- Ability to classify optimization problems into appropriate approximation complexity classes
- Ability to choose appropriate data structure for the given problem
- Ability to choose and apply appropriate design method for the given problem

Unit - I

Computational Complexity: Polynomial time and its justification, Nontrivial examples of polynomial-time algorithms, the concept of reduction (reducibility), Class P Class NP and NP- Completeness, The P versus NP problem and why it's hard

Unit - II

Algorithmic paradigms: Dynamic Programming – Longest common subsequence, matrix chain multiplication, knapsack problem, Greedy – 0-1 knapsack, fractional knapsack, scheduling problem, Huffman coding, MST, Branch-and-bound – travelling sales person problem, 0/1 knapsack problem, Divide and Conquer – Merge sort, binary search, quick sort.

Unit - III

Randomized Algorithms: Finger Printing, Pattern Matching, Graph Problems, Algebraic Methods, Probabilistic Primality Testing, De-Randomization Advanced Algorithms.

Unit - IV

Graph Algorithms: Shortest paths, Flow networks, Spanning Trees; Approximation algorithms, Randomized algorithms.
Approximation algorithms: Polynomial Time Approximation Schemes.

Unit - V

Advanced Data Structures and applications: Decision Trees and Circuits, B-Trees, AVL Trees, Red and Black trees, Dictionaries and tries, Maps, Binomial Heaps, Fibonacci Heaps, Disjoint sets, Union by Rank and Path Compression

TEXT BOOKS:

1. T. Cormen, C. Leiserson, R. Rivest and C. Stein, Introduction to Algorithms, Third Edition, McGraw-Hill, 2009.
2. R. Motwani and P. Raghavan, Randomized Algorithms, Cambridge University Press, 1995.

B.Tech. VIII Semester

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CS862PE: Distributed Systems
(Professional Elective - VI)
(Common to CSE, IT)

Course Objectives:

- To learn the fundamentals of distributed systems, IPC mechanism in Distributed systems.
- To provide an insight on Remote Procedure Calls, Distributed Shared Memory.
- To examine state-of-the-art distributed systems, such as Google File System.

Course Outcomes:

On successful completion of the course, the student should be able to:

- Identify the core concepts of distributed systems, characteristics, and models.
- Understand how IPC works in distributed systems.
- Analyze remote communication in a distributed environment.
- Examine Distributed File System structure.
- Know about Concurrency control mechanism and Distributed Shared Memory.

UNIT-I:

Characterization of Distributed Systems: Introduction, Examples of Distributed Systems, Resource Sharing and the Web Challenges.

System Models: Introduction, Architectural Models- Software Layers, System Architecture, Variations, Interface and Objects, Design Requirements for Distributed Architectures, Fundamental Models- Interaction Model, Failure Model, Security Model.

UNIT-II:

Inter process Communication: Introduction, The API for the Internet Protocols- The Characteristics of Inter process communication, Sockets, UDP Datagram Communication, TCP Stream Communication; External Data Representation and Marshalling; Client Server Communication; Group Communication- IP Multicast- an implementation of group communication, Case Study: IPC in UNIX.

UNIT-III

Distributed Objects and Remote Invocation: Introduction, Communication between Distributed Objects- Object Model, Distributed Object Model, Design Issues for RMI, Implementation of RMI, Distributed Garbage Collection; Remote Procedure Call, Events and Notifications, Case Study: JAVA RMI

UNIT-IV

Distributed File Systems: Introduction, File Service Architecture; Peer-to-Peer Systems: Introduction, Napster and its Legacy, Peer-to-Peer Middleware, Routing Overlays. Case Study: Google FS (GFS)/ Hadoop Distributed FS (HDFS), Bigtable / HBase Map Reduce

UNIT-V:

Transactions & Replications: Introduction, System Model and Group Communication, Concurrency Control in Distributed Transactions, Distributed Dead Locks, Transaction Recovery; Replication-Introduction, Passive (Primary) Replication, Active Replication.

Distributed Shared Memory: Design and Implementation issues, Consistency models.

TEXT BOOKS:

1. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems- Concepts and Design", Fourth Edition, Pearson Publication
2. Distributed Systems – Principles and Paradigms, A.S. Tanenbaum and M.V. Steen, Pearson Education.

REFERENCE BOOKS:

1. Distributed Computing, Principles, Algorithms and Systems, Ajay D. Kshema kalyani and Mukesh Singhal, Cambridge, rp 2010.
2. Distributed Computing, Fundamentals, Simulations and Advanced topics, 2nd Edition, Hagit Attiya and Jennifer Welch, Wiley India
3. Distributed Systems, S.Ghosh, Chapman & Hall/CRC, Taylor & Francis Group, 2010.
4. Ajay D Kshemkalyani, Mukesh Sigal, "Distributed Computing, Principles, Algorithms and Systems", Cambridge

B.Tech. VIII Semester

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CS863PE: Deep Learning
(Professional Elective - VI)
(Common to CSE, IT, CSBS)

Course Objectives:

- To introduce the foundations of Artificial Neural Networks
- To acquire the knowledge on Deep Learning Concepts
- To learn various types of Artificial Neural Networks
- To gain knowledge to apply optimization strategies

Course Outcomes:

- Ability to understand the concepts of Neural Networks
- Ability to select the Learning Networks in modeling real world systems
- Ability to use an efficient algorithm for Deep Models
- Ability to apply optimization strategies for large scale applications

UNIT-I

Artificial Neural Networks Introduction, Basic models of ANN, important terminologies, Supervised Learning Networks, Perceptron Networks, Adaptive Linear Neuron, Back-propagation Network. Associative Memory Networks. Training Algorithms for pattern association, BAM and Hopfield Networks.

UNIT-II

Unsupervised Learning Network- Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks. Special Networks- Introduction to various networks.

UNIT - III

Introduction to Deep Learning, Historical Trends in Deep learning, Deep Feedforward networks, Gradient-based learning, Hidden Units, Architecture Design, Back-Propagation, and Other Differentiation Algorithms

UNIT - IV

Regularization for Deep Learning: Parameter norm Penalties, Norm Penalties as Constrained Optimization, Regularization, and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised learning, multi-task learning, Early Stopping, Parameter Typing and Parameter Sharing, Sparse Representations, Bagging and other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, tangent Prop and Manifold, Tangent Classifier

UNIT - V

Optimization for Train Deep Models: Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Optimization Strategies and Meta-algorithms.

Applications: Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing

TEXTBOOKS:

1. Deep Learning: An MIT Press Book By Ian Goodfellow and Yoshua Bengio and Aaron Courville
2. Neural Networks and Learning Machines, Simon Haykin, 3rd Edition, Pearson Prentice Hall

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B.Tech. VIII Semester

CS864PE: Human Computer Interaction
(Professional Elective - VI)

Course Objectives:

- To gain an overview of Human-Computer Interaction (HCI), with an understanding of user interface design in general, and alternatives to traditional "keyboard and mouse" computing; become familiar with the vocabulary associated with sensory and cognitive systems as relevant to task performance by humans.
- Be able to apply models from cognitive psychology to predicting user performance in various human-computer interaction tasks and recognize the limits of human performance as they apply to computer operation.
- Appreciate the importance of a design and evaluation methodology that begins with and maintains a focus on the user.
- Be familiar with a variety of both conventional and non-traditional user interface paradigms, the latter including virtual and augmented reality, mobile and wearable computing, and ubiquitous computing.
- Understand the social implications of technology and their ethical responsibilities as engineers in the design of technological systems.
- Finally, working in small groups on a product design from start to finish will provide you with invaluable team-work experience.

Course Outcomes:

- Describe the user interface and graphical user interface.
- Demonstrate the design process and screen designing
- Ability to apply windows and components to interaction design.
- Ability to design HCI in the software process
- Ability to design certain tools for blind or PH people.

Unit - I

Introduction: Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design.

The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.

Unit - II

Design process – Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, and understanding business junctions.

Screen Designing: Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.

Unit- III

Windows – New and Navigation schemes selection of window, selection of devices based and screen- based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors.

Unit- IV

HCI in the software process, The software life cycle Usability engineering Iterative design and prototyping Design Focus: Prototyping in practice Design rationale Design rules Principles to support usability Standards Golden rules and heuristics HCI patterns Evaluation techniques, Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method. Universal design, Universal design principles Multi-modal interaction

Unit- V

Cognitive models Goal and task hierarchies Design Focus: GOMS saves money Linguistic models The challenge of display-based systems Physical and device models Cognitive architectures Ubiquitous computing and augmented realities Ubiquitous computing applications research Design Focus: Ambient Wood – augmenting the physical Virtual and augmented reality Design Focus: Shared experience Design Focus: Applications of augmented reality Information and data visualization Design Focus: Getting the size right.

TEXT BOOKS:

1. The essential guide to user interface design, Wilbert O Galitz, Wiley Dream Tech. Units 1, 2, 3
2. Human – Computer Interaction. Alan Dix, Janet Finckay, Gre Goryd, Abowd, Russell Bealg, Pearson Education Units 4,5

REFERENCE BOOKS:

1. Designing the user interface. 3rd Edition Ben Shneidermann, Pearson Education Asia.
2. Interaction Design Prece, Rogers, Sharps. Wiley Dreamtech.
3. User Interface Design, Soren Lauesen, Pearson Education.
4. Human –Computer Interaction, D. R. Olsen, Cengage Learning.
5. Human –Computer Interaction, Smith - Atakan, Cengage Learning.

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B.Tech. VIII Semester

CS865PE: Cyber Forensics (Professional Elective-VI)

Prerequisites: Network Security

Course Objectives:

- A brief explanation of the objective is to provide digital evidences which are obtained from digital media.
- In order to understand the objectives of computer forensics, first fall, people have to recognize the different roles computer plays in a certain crime.
- According to a snippet from the United States Security Service, the functions computer has in different kinds of crimes.

Course Outcomes:

- Students will understand the usage of computers in forensic, and how to use various forensic tools for a wide variety of investigations.
- It gives an opportunity to students to continue their zeal in research in computer forensics

Unit-I

Introduction of Cybercrime: Types, The Internet spawns crime, Worms versus viruses, Computers' roles in crimes, Introduction to digital forensics, Introduction to Incident - Incident Response Methodology – Steps - Activities in Initial Response, Phase after detection of an incident

Unit-II

Initial Response and forensic duplication, Initial Response & Volatile Data Collection from Windows system- Initial Response & Volatile Data Collection from Unix system–Forensic Duplication: Forensic duplication: Forensic Duplicates as Admissible Evidence, Forensic Duplication Tool Requirements, Creating a Forensic Duplicate/Qualified Forensic Duplicate of a Hard Drive

Unit-III

Forensics analysis and validation: Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions
Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honey net project.

Unit-IV

Current Forensic tools: evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software
E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools.
Cell phone and mobile device forensics: Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.

Unit-V

Working with Windows and DOS Systems: understanding file systems, exploring Microsoft File Structures, Examining NTFS disks, Understanding whole disk encryption, windows registry, Microsoft startup tasks, MS-DOS startup tasks, virtual machines.

TEXTBOOKS:

1. Kevin Mandia, Chris Prosise, "Incident Response and computer forensics," TataMcGrawHill, 2006.
2. Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media, New Delhi.
3. Computer Forensics and Investigations by Nelson, PhillipsEnfinger, Steuart, CENGAGE Learning

REFERENCE BOOKS:

1. Real Digital Forensics by Keith J. Jones, Richard Bejtich, Curtis W. Rose, Addison- Wesley Pearson Education
2. Forensic Compiling, A Tractitioneris Guide by Tony Sammes and Brian Jenkinson, Springer International edition.

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B.Tech. VIII Semester

CS821OE: Algorithm Design and Analysis

Prerequisites:

- A course on “Computer Programming and Data Structures”
- A course on “Advanced Data Structures”

Course Objectives:

- Introduces the notations for analysis of the performance of algorithms. Introduces the data structure disjoint sets.
- Describes major algorithmic techniques (divide-and-conquer, greedy, Dynamic Programming, backtracking and branch and bound methods) and mention problems for which each technique is appropriate
- Describes how to evaluate and compare different algorithms using worst-, average-, and best-case analysis.

Course Outcomes:

Student will be able to:

- Acquire the knowledge of algorithm analysis and its notations that are applied on the problems.
- Understand and apply the concept of Divide and Conquer
- Use greedy approach to solve an appropriate problem for optimal solution.
- Apply dynamic programming approach to solve suitable problems
- Apply the concept of Backtracking, branch and bound paradigm for real time problems.

Unit I:

Introduction: Algorithm, Pseudo code for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Asymptotic Notation- Big oh notation, Omega notation, Theta notation and Little oh notation.

Sets and Disjoint Set Unions: Introduction, Union and Find Operations with algorithms.

Unit II:

Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort, Stassen’s matrix multiplication.

Unit III:

Greedy method: General method, applications- knapsack problem, Minimum cost spanning trees- Prim and Kruskal’s Algorithm, Single source shortest path problem.

Unit IV:

Dynamic Programming: General method, applications- Optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, The Traveling sales person problem

Unit V:

Backtracking: General method, applications- n-Queen problem, sum of subsets problem, graph coloring , Hamiltonian cycles.

Branch and Bound: General method, applications - 0/1 knapsack problem- LC Branch and Bound solution, FIFO Branch and Bound solution, Travelling sales person problem

TEXT BOOKS:

1. Ellis Horowitz, Satraj Sahni and Sanguthevar Rajasekharam, Fundamentals of Computer Algorithms, Galgotia publications Pvt. Ltd, Second Edition.
2. Aho, Ullman and Hopcroft, Design and Analysis of algorithms, Pearson education, Reprint 2002.

REFERENCE BOOKS:

1. R.C.T.Lee, S.S.Tseng, R.C.Chang and T.T Sai, Introduction to Design and Analysis of Algorithms A strategic approach, Mc Graw Hill,2005.
2. Algorithm Design: Foundations, Analysis and Internet Examples, M.T. Goodrich and R.Tamassia, John Wiley and sons.
3. Introduction to Algorithms, 3rd Ed, T. H. Cormen, C.E. Leiserson, R. L. Rivest, and Clifford Stein, PHI Pvt. Ltd., Pearson Education.

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B.Tech. VIII Semester

CS822OE: Introduction to Computer Networks

Course Objectives:

- The objective of the course is to equip the students with a general overview of the concepts and fundamentals of computer networks.
- Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers.

Course Outcomes:

- Gain the knowledge of the basic computer network technology.
- Gain the knowledge of the functions of each layer in the OSI and TCP/IP reference model.
- Identify and analyze various routing algorithms, congestion control algorithms.
- Outline the transport layer protocols like TCP and UDP.
- List and examine the applications of HTTP, WWW, DNS, Email, FTP, and the underlying protocols.

UNIT - I

Network Hardware: Local Area Networks, Metropolitan Area Networks, Wide Area Networks, Internetwork.

Network software: Protocol Hierarchies, Design Issues for the Layers, Connection-Oriented and Connectionless Services.

Reference Models: OSI, TCP/IP Reference models, Comparison of OSI and TCP/IP Models Example Networks: ARPANET, Internet.

Physical Layer: Guided Transmission media, Unguided Transmission Media

UNIT - II

Data link layer: Design issues, Framing, Error Detection and Correction: Block Codes, Simple Parity Check, Hamming Distance, Checksum, Hamming Code, CRC

Elementary data link protocols: simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channel.

Sliding Window protocols: Piggybacking, A one-bit sliding window protocol, A protocol using Go-Back-N, A protocol using Selective Repeat,

Medium Access sub layer: The channel allocation problem, Multiple access protocols: ALOHA, Carrier sense multiple access protocols, collision free protocols

UNIT - III

Network Layer: Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing, Link State Routing, Congestion Control Algorithms: Approaches to Congestion Control, Admission Control, Load shedding.

Quality of Service: Traffic Shaping, Packet scheduling, Admission Control, Integrated services, Differentiated Services, Internetworking,

Network layer in the Internet: IPv4 protocol, IP Addresses, IPv6 protocol, Internet Control Protocols: ICMP, ARP, RARP, BOOTP, DHCP

UNIT - IV

Transport Layer: Transport Services: Services provided to Upper layer, Transport service primitives

Elements of Transport protocols: Addressing, Error and Flow Control, Multiplexing, Crash Recovery, Connection management.

Internet Transport Protocols: TCP: Service Model, TCP Protocol, Segment header, TCP Connection establishment and Release, TCP Connection management, TCP Sliding Window, Timer management, TCP Congestion Control.

UDP: Protocol, UDP Header

UNIT - V

Application Layer: Domain name system- DNS Name Space, Resource records, Name Servers. SNMP, Electronic Mail: Architecture and Services, User Agent, Message Formats, Message Transfer, Final Delivery.SMTP, POP3, ICMP.File transfer: FTP, Telnet.

TEXT BOOKS:

1. Computer Networks -- Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson Education/PHI, 2011.
2. Data Communications and Networking – Behrouz A. Forouzan. Fifth Edition TMH, 2017.

REFERENCE BOOKS:

1. An Engineering Approach to Computer Networks-S. Keshav, 2nd Edition, Pearson Education
2. “Data and Computer Communications” by William Stallings 9 th Edition, Pearson Education 2010.TCP/IP Illustrated” by W. Richard Stevens, Addison-Wesley Professional 2nd edition 2011.