Course Structure – BR23 Regulations
For UG - B.Tech: Computer Science and Engineering
III Year Course Structure

Semester–I							
S.No.	**Course Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	PCC	23CS5T07	Data Warehousing and Data Mining	3	0	0	3
2.	PCC	23CS5T08	Computer Networks	3	0	0	3
3.	PCC	23CS5T09	Formal Languages and Automata Theory	3	0	0	3
4.	PEC	23CS5D01 23CS5D02 23CS5D03 23CS5D04	PROFESSIONAL ELECTIVE-I 1. Object Oriented Analysis and Design 2. Artificial Intelligence 3. Microprocessors & Microcontrollers 4. Quantum Computing 5. 12 week MOOC SWAYAM/NPTEL course recommended by the BoS	3	0	0	3
5.	OEC		OPEN ELECTIVE-I	3	0	0	3
6.	PCC	23CS5L06	Data Mining Lab	0	0	3	1.5
7.	PCC	23CS5L07	Computer Networks Lab	0	0	3	1.5
8	SEC	23CS5S06	Full Stack Development – II/ SWAYAM Plus – Data Engineer/ AI Engineer	0	1	2	2
9.	ESC	23ES5L09	Tinkering Lab User Interface Design Using Flutter/SWAYAM Plus-Android Application Development(With Flutter)	0	0	2	1
10	PROJ	23BS5P01	Evaluation of Community Service Project	-	-	-	2
Total				**15**	**1**	**10**	**23**

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Course Structure – BR23 Regulations
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III Year Course Structure

Semester–II							
S.No.	**Course Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	PCC	23CS6T10	Compiler Design	3	0	0	3
2.	PCC	23CS6T11	Cloud Computing	3	0	0	3
3.	PCC	23CS6T12	Cryptography & Network Security	3	0	0	3
4.	PEC	23CS6D05 23IT6D01 23CS6D06 23CS6D07	PROFESSIONAL ELECTIVE-II 1. Software Testing Methodologies 2. Cyber Security 3. DevOps 4. Machine Learning 5. 12 week MOOC SWAYAM/NPTEL course recommended by the BoS	3	0	0	3
5.	PEC	23CS6D08 23CS6D09 23CS6D10 23CS6D11 23CS6D12	PROFESSIONAL ELECTIVE-III 1. Software Project Management 2. Mobile Adhoc Networks 3. Natural Language Processing 4. Big Data Analytics 5. Distributed Operating System 6. 12 week MOOC SWAYAM/NPTEL course recommended by the BoS	3	0	0	3
6.	OEC		OPEN ELECTIVE-II	3	0	0	3
7.	PCC	23CS6L08	Cloud Computing Lab	0	0	3	1.5
8	PCC	23CS6L09	Cryptography & Network Security Lab	0	0	3	1.5
9.	SEC	23HM6S02	Soft Skills/SWAYAM PLUS-21st-Century Employability Skills	0	1	2	2
10	AC	23AC6T03	Technical Paper Writing &IPR	2	0	0	-
Total				**20**	**1**	**8**	**23**
23CS6P01 Mandatory Industry Internship /Mini Project of 08 weeks duration during summer vacation							

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III Year Course Structure

OPEN ELECTIVES OFFERED TO OTHER BRANCHS (NOT FOR CSE AND ALLIED)

S.No.	Course category	Course Code	Subjects	L	T	P	C
OPEN ELECTIVE -I							
1	OEC	23CS5E01	Principles of Operating Systems	3	0	0	3
2		23CS5E02	Computer Organization and Architecture	3	0	0	3
OPEN ELECTIVE -II							
3	OEC	23CS6E03	Principles of Database Management Systems	3	0	0	3

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Minor Engineering Courses offered by CSE Department for Other Branches

(NEED TO ACQUIRE 18 CREDITS)
(Except CSE Branch)

S.No.	Course Code	Subjects	L	T	P	C
1	23CSMT01	Principles of Database Management Systems	3	0	0	3
2	23CSMT02	Principles of Software Engineering	3	0	0	3
3	23CSMT03	Advanced Data Structures & Algorithm Analysis	3	0	0	3
4	23CSMT04	Principles of Operating Systems	3	0	0	3
NOTE: Any of the following 12 week 3 credit NPTEL MOOC Courses						
5	23CSMT05	Artificial Intelligence: Knowledge Representation and Reasoning	3	0	0	3
6	23CSMT06	Computer Networks and Internet Protocol	3	0	0	3
7	23CSMT07	Machine Learning and Deep Learning - Fundamentals and Applications	3	0	0	3
8	23CSMT08	Fundamentals of Object Oriented Programming	3	0	0	3
9	23CSMT09	Discrete Mathematics for CS	3	0	0	3
10	23CSMT10	Software Engineering	3	0	0	3

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Honors Engineering Courses offered CSE Branch students
(Need to Acquire 18 credits)

NOTE: Any of the following 12 week 5 credits NPTEL MOOC courses

S.No.	Course Code	Subjects	L	T	P	C
1	23CSHT01	Social Network Analysis	3	0	0	3
2	23CSHT02	Applied Linear Algebra in AI & ML	3	0	0	3
3	23CSHT03	Design & Implementation of Human-Computer Interfaces	3	0	0	3
4	23CSHT04	Cyber Security	3	0	0	3
5	23CSHT05	Privacy and Security in Online Social Media	3	0	0	3
6	23CSHT06	Deep Learning for Natural Language Processing	3	0	0	3
7	23CSHT07	Computer Vision	3	0	0	3
8	23CSHT08	Applied Time-Series Analysis	3	0	0	3
9	23CSHT09	Parallel Computer Architecture	3	0	0	3
10	23CSHT10	Reinforcement Learning	3	0	0	3
11	23CSHT11	GPU Architecture and Programming	3	0	0	3
12	23CSHT12	Computational Complexity	3	0	0	3
13	23CSHT13	Quantum Algorithms and Cryptography	3	0	0	3
14	23CSHT14	Unmanned Arial Systems & Robotics	3	0	0	3
15	23CSHT15	Prompt Engineering for Generative AI	3	0	0	3

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III Year - I Semester	Code: 23CS5T07	L	T	P	C
		3	0	0	3

DATA WAREHOUSING&DATA MINING

Course Objectives:

The main objectives of the course is to

- Introduce basic concepts and techniques of data warehousing and data mining
- Examine the types of the data to be mined and apply pre-processing methods on raw data Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Explain the fundamental concepts of data warehousing and OLAP architecture.	BL3
CO 2	Integrate data from multiple sources and resolve conflicts and redundancy.	BL4
CO 3	Distinguish appropriate classification techniques for data analysis	BL3
CO 4	Construct frequent pattern and association rule mining techniques for data analysis	BL3
CO 5	Determine appropriate clustering techniques for data analysis	BL6

UNIT I

Data Warehousing and Online Analytical Processing: Basic concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Cloud Data Warehouse, Data Mining and Patten Mining, Technologies, Applications, Major issues, Data Objects & Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity.(TextBook-1)

UNIT II

Data Preprocessing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization. (Text Book- 1

UNIT III

Classification: Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Attribute Selection Measures, Tree Pruning, Scalability and Decision Tree Induction, Visual Mining for Decision Tree Induction, Bayesian Classification Methods: Bayes Theorem, Naïve Bayes Classification, Rule-Based Classification, Model Evaluation and Selection. (Text Book- 2)

UNIT IV

Association Analysis: Problem Definition, Frequent Itemset Generation, Rule Generation: Confident Based Pruning, Rule Generation in Apriori Algorithm, Compact Representation of frequent item sets, FP-Growth Algorithm. (Text Book- 2)

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UNIT IV

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UNIT V

Cluster Analysis: Overview, Basics and Importance of Cluster Analysis, Clustering techniques, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Bi-secting K Means, Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm DBSCAN: Traditional Density Center-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses. (Text Book- 2)

Text Books:

1. Data Mining concepts and Techniques, 3rd edition, Jiawei Han, Michel Kamber, Elsevier, 2011.
2. Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson, 2012.

Reference Books:

1. Data Mining: VikramPudi and P. Radha Krishna, Oxford Publisher.
2. Data Mining Techniques, Arun K Pujari, 3rd edition, Universities Press,2013.
3. (NPTEL course by Prof.PabitraMitra) http://onlinecourses.nptel.ac.in/noc17_mg24/preview
   http://www.saedsayad.com/data_mining_map.htm

Online Learning Resources:

1.https://nptel.ac.in/courses/106/106/106106144

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III Year - I Semester	Code:23CS5T08	L	T	P	C
		3	0	0	3

COMPUTER NETWORKS
(Common to CSE & IT)

Course Objectives:

The main objectives of the course is to

- To provide insight about networks, topologies, and the key concepts.
- To gain comprehensive knowledge about the layered communication architectures (OSI and TCP/IP) and its functionalities.
- To understand the principles, key protocols, design issues, and significance of each layers in ISO and TCP/IP.

To know the basic concepts of network services and various network applications.

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	**To Describe** the OSI and TCP/IP reference models and **identify** the functions of each layer in both models.	BL2
CO 2	**To Analyze** error detection and correction techniques such as CRC, checksum, and one's complement method.	BL4
CO 3	**To Explain** the working principles of Ethernet protocols and **evaluate** their suitability for different wired LAN environments.	BL5
CO 4	**To Describe** the structure and functionality of IPv4 and IPv6 including header formats, addressing schemes (classful, CIDR, subnets), and the transition process from IPv4 to IPv6.	BL2
CO 5	**To Analyze** the working of TCP flow, error, and congestion control, and **compare** it with UDP in terms of reliability and use cases.	BL4

UNIT I **15Hrs**

Introduction: Network Types, LAN, MAN, WAN, Network Topologies Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models, OSI Vs TCP/IP. **Physical Layer** –Introduction to Guided Media- Twisted-pair cable, Coaxial cable and Fiber optic cable and introduction about unguided media.

UNIT II **15Hrs**

Data link layer: Design issues, **Framing**: fixed size framing, variable size framing, flow control, error control, error detection and correction codes, CRC, Checksum: idea, one's complement internet checksum, services provided to Network Layer, **Elementary Data Link Layer protocols**: simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel. **Sliding window protocol:** One bit, Go back N, Selective repeat-Stop and wait protocol, Data link layer in HDLC, Point to point protocol (PPP)

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UNIT III

Media Access Control: Random Access: ALOHA, Carrier sense multiple access (CSMA), CSMA with Collision Detection, CSMA with Collision Avoidance, **Controlled Access:** Reservation, Polling, Token Passing, **Channelization:** frequency division multiple Access(FDMA), time division multiple access(TDMA), code division multiple access(CDMA). **Wired LANs:** Ethernet, Ethernet Protocol, Standard Ethernet, Fast Ethernet(100 Mbps), Gigabit Ethernet, 10 Gigabit Ethernet

UNIT IV

The Network Layer Design Issues – Store and Forward Packet Switching-Services Provided to the Transport layer- Implementation of Connectionless Service-Implementation of Connection Oriented Service- Comparison of Virtual Circuit and Datagram Networks, Routing Algorithms-The Optimality principle-Shortest path, Flooding, Distance vector, Link state, Hierarchical, Congestion Control algorithms-General principles of congestion control, Congestion prevention polices, Approaches to Congestion Control-Traffic Aware Routing- Admission Control-Traffic Throttling-Load Shedding. Traffic Control Algorithm-Leaky bucket & Token bucket. **Internet Working:** How networks differ- How networks can be connected- Tunnelling, internetwork routing-, Fragmentation, network layer in the internet – IP protocols-IP Version 4 protocol-IPV4 Header Format, IP addresses, Class full Addressing, CIDR, Subnets-IP Version 6-The main IPV6 header, Transition from IPV4 to IPV6, Comparison of IPV4 & IPV6

UNIT V

The Transport Layer: Transport layer protocols: Introduction-services- port number-User data gram protocol-User datagram-UDP services-UDP applications-Transmission control protocol: TCP services-TCP features- Segment- A TCP connection- windows in TCP- flow control-Error control, Congestion control in TCP. **Application Layer** — World Wide Web: HTTP, Electronic mail-Architecture- web based mail- email security- TELENET-local versus remote Logging-Domain Name System

Text Books:

1. Computer Networks, Andrew S Tanenbaum, Fifth Edition. Pearson Education/PHI

Data Communications and Networks, Behrouz A. Forouzan, Fifth Edition TMH.

References Books:

1. Data Communications and Networks- Achut S Godbole, AtulKahate

Computer Networks, Mayank Dave, CENGAGE

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III Year - I Semester	Code: 23CS5T09	L	T	P	C
		3	0	0	3

FORMAL LANGUAGES AND AUTOMATA THEORY

Course Objectives:

- To learn fundamentals of Regular and Context Free Grammars and Languages
- To understand the relation between Regular Language and Finite Automata and machines
- To learn how to design Automata's and machines as Acceptors, Verifiers and Translators
- To understand the relation between Contexts free Languages, PDA and TM

To learn how to design PDA as acceptor and TM as Calculators

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	**To Explain** the fundamental concepts and need for automata theory, including finite automata and transition systems.	BL2
CO 2	**To Apply** the pumping lemma to **analyze** the regularity of a given language.	BL3
CO 3	**To Transform** CFGs into Chomsky Normal Form (CNF) and Greibach Normal Form (GNF).	BL3
CO 4	**To Design** Pushdown Automata for simple context-free languages and **demonstrate** their functioning.	BL3
CO 5	**To Classify** problems as decidable or undecidable, and **analyze** examples such as the Halting Problem and Post's Correspondence Problem (PCP and Modified PCP).	BL4

UNIT I

Finite Automata: Need of Automata theory, Central Concepts of Automata Theory, Automation, Finite Automation, Transition Systems, Acceptance of a String, DFA, Design of DFAs, NFA, Design of NFA, Equivalence of DFA and NFA, Conversion of NFA into DFA, Finite Automata with Є-Transitions, Minimization of Finite Automata, Finite Automata with output-Mealy and Moore Machines, Applications and Limitation of Finite Automata.

UNIT II

Regular Expressions, Regular Sets, Identity Rules, Equivalence of two RE, Manipulations of REs, Finite Automata and Regular Expressions, Inter Conversion, Equivalence between FA and RE, Pumping Lemma of Regular Sets, Closure Properties of Regular Sets, Grammars, Classification of Grammars, Chomsky Hierarchy Theorem, Right and Left Linear Regular Grammars, Equivalence between RG and FA, Inter Conversion.

UNIT III

Formal Languages, Context Free Grammar, Leftmost and Rightmost Derivations, Parse Trees,

Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols, Є-Productions and Unit Productions, Normal Forms-Chomsky Normal Form and Greibach Normal Form, Pumping Lemma, Closure Properties, Applications of Context Free Grammars.

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UNIT IV **15Hrs** Pushdown Automata, Definition, Model, Graphical Notation, Instantaneous Description, Language Acceptance of Pushdown Automata, Design of Pushdown Automata, Deterministic and Non – Deterministic Pushdown Automata, Equivalence of Pushdown Automata and Context Free Grammars, Conversion, Two Stack Pushdown Automata, Application of Pushdown Automata.
UNIT V **12Hrs** Turning Machine: Definition, Model, Representation of TMs-Instantaneous Descriptions, Transition Tables and Transition Diagrams, Language of a TM, Design of TMs, Types of TMs, Church's Thesis, Universal and Restricted TM, Decidable and Un-decidable Problems, Halting Problem of TMs, Post's Correspondence Problem, Modified PCP, Classes of P and NP, NP-Hard and NP-Complete Problems
Text Books: 1. Introduction to Automata Theory, Languages and Computation, J. E. Hopcroft, R. Motwani and J. D.Ullman, 3rd Edition, Pearson, 2008 2.Theory of Computer Science-Automata, Languages and Computation, K. L. P. Mishra and N. Chandrasekharan, 3rd Edition, PHI, 2007
Reference Books: 1. Elements of Theory of Computation, Lewis H.P. & Papadimition C.H., Pearson /PHI 2. Theory of Computation, V. Kulkarni, Oxford University Press, 2013 3. Theory of Automata, Languages and Computation, Rajendra kumar, McGraw Hill, 2014
e-Resources: 1) https://nptel.ac.in/courses/106/104/106104028/

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III Year - I Semester	Code: 23CS5D01	L	T	P	C
		3	0	0	3

OBJECT ORIENTED ANALYSIS AND DESIGN
(Common to CSE, CSE-(AI&DS), AIML, IT)

Course Objectives: The main objective of the students to

- Become familiar with all phases of OOAD.
- Master the main features of the UML.
- Master the main concepts of Object Technologies and how to apply them at work and develop the ability to analyze and solve challenging problem in various domains.
- Learn the Object design Principles and understand how to apply them towards Implementation.

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO 1	**To Explain** the fundamental structure and characteristics of complex systems and their significance in software engineering.	BL2
CO 2	**To Identify** and **illustrate** basic structural modeling elements such as classes, relationships, common mechanisms, and structural diagrams.	BL3
CO 3	**Apply** advanced structural modeling techniques to model complex software components and their interactions.	BL3
CO 4	**To Analyze** system behavior using activity diagrams to model sequential and concurrent flows.	BL4
CO 5	**Develop** component and deployment diagrams to represent the physical and runtime architecture of software systems.	BL3

UNIT I **15Hrs**

Introduction: The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems. **Case Study:** System Architecture: Satellite-Based Navigation

UNIT II **15Hrs**

Introduction to UML: Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, and Software Development Life Cycle. **Basic Structural Modeling:** Classes, Relationships, common Mechanisms, and diagrams. **Case Study:** Control System: Traffic Management.

UNIT III **12Hrs**

Class & Object Diagrams: Terms, concepts, modeling techniques for Class & Object Diagrams. **Advanced Structural Modeling:** Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. **Case Study:** AI: Cryptanalysis.

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UNIT IV	**15Hrs**
Basic Behavioural Modelling-I: Interactions, Interaction diagrams Use cases, Use case Diagrams, Activity Diagrams. **Case Study:** Web Application: Vacation Tracking System	
UNIT V	**12Hrs**
Advanced Behavioural Modelling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams. **Architectural Modelling:** Component, Deployment, Component diagrams and Deployment diagrams. **Case Study:** Weather Forecasting	
Text Books: 1. Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, Kellia Houston , "Object- Oriented Analysis and Design with Applications", 3rd edition, 2013, PEARSON. 2. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education.	
Reference Books: 1. Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education. 2. Pascal Roques: Modeling Software Systems Using UML2, WILEY- Dreamtech India Pvt. Ltd. 3. Atul Kahate: Object Oriented Analysis & Design, The McGraw-Hill Companies. 4. Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.	

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III Year - I Semester	Code: 23CS5D02	L	T	P	C
		3	0	0	3

ARTIFICIAL INTELLIGENCE
(Common to CSE, IT)

Course Objectives:

1. The student should be made to study the concepts of Artificial Intelligence.
2. The student should be made to learn the methods of solving problems using Artificial Intelligence.
3. The student should be made to introduce the concepts of Expert Systems.
4. To understand the applications of AI, namely game playing, theorem proving, and machine learning.

To learn different knowledge representation techniques

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO 1	To Describe the historical evolution and foundational concepts of Artificial Intelligence	BL1
CO 2	To Evaluate optimal strategies for decision-making in multi-player games and adversarial search environments	BL5
CO 3	To Apply predicate logic and rule-based systems to represent structured knowledge in AI systems	BL3
CO 4	To Apply logical inference methods to solve knowledge-based problems using first-order logic	BL3
CO 5	To Evaluate the effectiveness of expert systems in decision support and problem-solving contexts	BL5

UNIT I

Introduction: AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

UNIT II

Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A* ,AO* Algorithms, Problem reduction, Game Playing-Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions

UNIT III

Representation of Knowledge: Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rules based deduction systems. Reasoning under uncertainty, review of probability, Bayes' probabilistic interferences and dempstershafer theory

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UNIT IV **Logic concepts:** First order logic. Inference in first order logic, propositional vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution, Learning from observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning.
UNIT V **Expert Systems:** Architecture of expert systems, Roles of expert systems – Knowledge Acquisition Meta knowledge Heuristics. Typical expert systems – MYCIN, DART, XCON: Expert systems shells
Textbooks: 1. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", SecondEdition, Pearson Education. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Mc Graw Hill
Reference Books: 1. David Poole, Alan Mackworth, Randy Goebel,"Computational Intelligence: a logical approach", Oxford University Press. 2. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problemsolving", Fourth Edition, Pearson Education. 3. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers. Artificial Intelligence, SarojKaushik, CENGAGE Learning.
Online Learning Resources: https://ai.google/https://swayam.gov.in/nd1_noc19_me71/preview

N. Ramakrishnaiah					
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University Nominee	Subject Expert	Subject Expert	Industrial Expert	Alumni Expert	Chairman-BOS.

III Year - I Semester	Code: 23CS5D03	L	T	P	C
		3	0	0	3

MICROPROCESSORS & MICROCONTROLLERS
(Common to CSE, IT)

Course Objectives:

- To introduce fundamental architectural concepts of microprocessors and microcontrollers.
- To impart knowledge on addressing modes and instruction set of 8086 and 8051
- To introduce assembly language programming concepts
- To explain memory and I/O interfacing with 8086 and 8051
- To introduce16 bit and 32 bit microcontrollers.

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	To Describe the pin configuration and functions of the 8086 microprocessor.	BL2
CO 2	To Identify and use appropriate addressing modes and instructions for solving simple programming problems.	BL3
CO 3	To Demonstrate interfacing techniques for RAM, ROM, LEDs, switches, seven-segment displays, and stepper motors with microprocessors.	BL 3
CO 4	To Analyze and troubleshoot 8051-based assembly programs using SFRs and I/O interfaces.	BL4
CO 5	To Design and implement real-time embedded applications using appropriate interfacing techniques.	BL6

UNIT I **15Hrs**

8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

UNIT II **15Hrs**

8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools

UNIT III **12Hrs**

8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

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UNIT IV **15Hrs** Microcontroller, Architecture of 8051, Special Function Registers(SFRs), I/O Pins Ports and Circuits, Instruction set, Addressing modes, Assembly language programming
UNIT V **12Hrs** Interfacing Microcontroller, Programming 8051 Timers, Serial Port Programming, Interrupts Programming, LCD & Keyboard Interfacing, ADC, DAC & Sensor Interfacing, External Memory Interface, Stepper Motor and Waveform generation, Comparison of Microprocessor, Microcontroller, PIC and ARM processors
Textbooks: 1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition,1994. 2. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017 3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.
Reference Books: 1. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013. 2. Kenneth J. Ayala, The 8051 Microcontroller, 3rd edition, Cengage Learning, 2004

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University Nominee	Subject Expert	Subject Expert	Industrial Expert	Alumni Expert	Chairman-BOS.

III Year - I Semester	Code: 23CS5D04/23CS6D04	L	T	P	C
		3	0	0	3

QUANTUM COMPUTING
Common to CSE, CSE(AI & DS)

Course Objectives:

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

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO 1	Recall the historical development and interdisciplinary foundations of quantum computing involving mathematics, physics, and biology.	BL1
CO 2	Illustrate the biological foundations of quantum biology through genomics, proteomics, and the central dogma.	BL3
CO 3	Design simple quantum circuits using qubit gates for basic quantum operations.	BL6
CO 4	Demonstrate the application of Shor's algorithm for integer factorization and Grover's algorithm for unstructured search.	BL3
CO 5	Analyze the working and significance of quantum cryptographic protocols and quantum teleportation.	BL4

UNIT I **15Hrs**

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

UNIT II **15Hrs**

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 **12Hrs**

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.

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UNIT IV **15Hrs** 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 **12Hrs** 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
Textbooks: 1. Quantum Computation and Quantum Information, Nielsen M. A.,Cambridge 2. Programming Quantum Computers, Essential Algorithms and Code Samples, Eric R Johnson, Nic Harrigan, Mercedes Ginemo, Segovia, Oreilly Harrigan, Mercedes Ginemo, Segovia, Oreilly
Reference Books: 1. Quantum Computing for Computer Scientists, Noson S. Yanofsk, Mirco A. Mannucci 2. Principles of Quantum Computation and Information,Benenti G., Casati G. and Strini G., Vol.I: Basic Concepts, Vol II 3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithm

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University Nominee	Subject Expert	Subject Expert	Industrial Expert	Alumni Expert	Chairman-BOS.

III Year - I Semester	Code: 23CS5E01	L	T	P	C
		3	0	0	3

PRINCIPLES OF OPERATING SYSTEMS

Course Objectives:

The main objectives of the course is to make student

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- Illustrate different conditions for deadlock and their possible solutions.

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO1	Describe the fundamental concepts of operating systems	BL2
CO2	Apply the concept of a process, including creation, termination and scheduling	BL3
CO3	Analyse the Mutual exclusion, Deadlock detection	BL4
CO4	Apply the various memory management techniques.	BL3
CO5	Illustrate the File system	BL2

UNIT I **12Hrs**

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems System Structures: Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Building and Booting an Operating System, Operating system debugging

UNIT II **12Hrs**

Processes: Process Concept, Process scheduling, Operations on processes, Inter-process communication. Threads and Concurrency: Multithreading models, Thread libraries, Threading issues. CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling.

UNIT III **12Hrs**

Synchronization Tools: The Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization. Deadlocks: system Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.

UNIT IV **12Hrs**

Memory-Management Strategies: Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping. Virtual Memory Management: Introduction, Demand paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing Storage Management: Overview of Mass Storage Structure, HDD Scheduling.

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UNIT V	**13Hrs**
File System: File System Interface: File concept, Access methods, Directory Structure; File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management; File-System Internals: File-System Mounting, Partitions and Mounting, File Sharing. Protection: Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix.	
Text Books: 1. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018. 2. Modern Operating Systems, Tanenbaum A S, 4th Edition, Pearson , 2016	
Reference Books: 1. Operating Systems -Internals and Design Principles, Stallings W, 9th edition, Pearson, 2018 2. Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3rd Edition, McGraw- Hill, 2013	
Online Learning Resources: 1. https://nptel.ac.in/courses/106/106/106106144/ 2. http://peterindia.net/OperatingSystems.html	

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III Year - I Semester	Code: 23CS5E02	L	T	P	C
		3	0	0	3

COMPUTER ORGANIZATION AND ARCHITECTURE

Course Objectives:

The main objectives of the course is to make student

- To understand the basic structure and operational concepts of digital computers.
- To learn the representation of data and instructions in binary and perform basic operations
- To analyse the concepts of instruction set architecture (ISA), addressing modes, and instruction formats.
- To understand the principles of pipelining and performance optimization techniques.
- To introduce concepts of parallel and multiprocessor architectures

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO1	Understand the representation of data, the register transfer language and Micro operations	BL4
CO2	Know the basic computer organization and design, programming the basic computer and design the micro programmer control unit.	BL3
CO3	Know the development of central processing unit and explain various algorithms for computer arithmetic operations.	BL5
CO4	Interface various Peripheral devices and various data transfer operations	BL2
CO5	Study the memory Hierarchy and different types of memories	BL5

UNIT I **12Hrs**

Introduction: Digital Computers, Von Neumann computers, Basic organization of a computer, **Data Representation:** Data types, Complements, Fixed-point representation, Conversion of fractions, Floating-point representation.

Register Transfer and Micro operations: Register transfer language, Register transfer, Bus and Memory transfers, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit

UNIT II **12Hrs**

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference instructions, Input-Output and Interrupt, Complete Computer Description, Design of Basic computer

Programming the Basic Computer: Introduction, Machine Language, Assembly language, The Assembler, Program Loops, Programming Arithmetic and Logic Operations

Micro programmed Control: Control Memory, Address Sequencing, Micro program Example, Design of Control Unit (**Preferably from Reference Book 2**).

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UNIT III **12Hrs**

Central Processing Unit: Introduction, General Register Organization, Stack organization, Instruction Formats, Addressing Modes, Data transfer and Manipulation, Program Control, Reduced Instruction Set Computer

Computer Arithmetic: Introduction, Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating-Point Arithmetic Operations, Decimal Arithmetic Unit, Decimal Arithmetic Operations

UNIT IV **12Hrs**

Input-Output organization : Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA), Input-Output Processor (IOP), Serial Communication.

UNIT– V

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

Text Book

1. M. Morris Mano," Computer System Architecture," Pearson Publishers, Revised Third Edition

Reference Books

1. John P Hayes, "Computer Architecture and Organization,"Mc-Graw Hill Publishers, Third Edition
2. Carl Hamacher, "Computer Organization," Tata Mc-Graw Hill Publishers, Fifth Edition.

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III Year - I Semester	Code: 23CS5L06	L	T	P	C
		0	0	3	1.5

DATA MINING LAB

Course Objectives: The main objective of the course is to

- Inculcate Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment
- Design a data warehouse or data mart to present information needed by management in a form that is usable
- Emphasize hands-on experience working with all real data sets.
- Test real data sets using popular data mining tools such as WEKA, Python Libraries

Develop ability to design various algorithms based on data mining tools

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO 1	Design a data mart or data warehouse for any organization	BL2
CO 2	Extract knowledge using data mining techniques and enlist various algorithms used in information analysis of Data Mining Techniques ,	BL2
CO 3	Demonstrate the working of algorithms for data mining tasks such as association rule mining, classification for realistic data	BL2
CO 4	Students will be able to understand and apply efficient memory systems and memory organization techniques	BL3

List of Experiments:

Experiment 1: Creation of a Data Warehouse.

- Build Data Warehouse/Data Mart (using open source tools like Pentaho Data Integration Tool, Pentaho Business Analytics; or other data warehouse tools like Microsoft-SSIS, Informatica, Business Objects, etc.,)
- Design multi-dimensional data models namely Star, Snowflake and Fact Constellation schemas for any one enterprise (ex. Banking, Insurance, Finance, Healthcare, manufacturing, Automobiles, sales etc).
- Write ETL scripts and implement using data warehouse tools.
- Perform Various OLAP operations such slice, dice, roll up, drill up and pivot

Experiment 2: Explore machine learning tool "WEKA"

- Explore WEKA Data Mining/Machine Learning Toolkit.
- Downloading and/or installation of WEKA data mining toolkit.
- Understand the features of WEKA toolkit such as Explorer, Knowledge Flow interface, Experimenter, command-line interface.

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- Navigate the options available in the WEKA (ex. Select attributes panel, Preprocess panel, Classify panel, Cluster panel, Associate panel and Visualize panel)
- Study the arff file format Explore the available data sets in WEKA. Load a data set (ex. Weather dataset, Iris dataset, etc.)
- Load each dataset and observe the following:
  1. List the attribute names and they types
  2. Number of records in each dataset
  3. Identify the class attribute (if any)
  4. Plot Histogram
  5. Determine the number of records for each class.
  6. Visualize the data in various dimensions

Experiment 3: Perform data preprocessing tasks and Demonstrate performing association rule mining on data sets

- Explore various options available in Weka for preprocessing data and apply Unsupervised filters like Discretization, Resample filter, etc. on each dataset
- Load weather. nominal, Iris, Glass datasets into Weka and run Apriori Algorithm with different support and confidence values.
- Study the rules generated. Apply different discretization filters on numerical attributes and run the Apriori association rule algorithm. Study the rules generated.
- Derive interesting insights and observe the effect of discretization in the rule generation process.

Experiment 4: Demonstrate performing classification on data sets Weka/R

- Load each dataset and run 1d3, J48 classification algorithm. Study the classifier output. Compute entropy values, Kappa statistic.
- Extract if-then rules from the decision tree generated by the classifier, Observe the confusion matrix.
- Load each dataset into Weka/R and perform Naïve-bayes classification and k-Nearest Neighbour classification. Interpret the results obtained.
- Plot RoC Curves

Compare classification results of ID3, J48, Naïve-Bayes and k-NN classifiers for each dataset, and deduce which classifier is performing best and poor for each dataset and justify

Experiment 5: Demonstrate performing clustering of data sets

- Load each dataset into Weka/R and run simple k-means clustering algorithm with different values of k (number of desired clusters).
- Study the clusters formed. Observe the sum of squared errors and centroids, and derive insights.
- Explore other clustering techniques available in Weka/R.

Explore visualization features of Weka/R to visualize the clusters. Derive interesting insights and explain.

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Experiment 6: Demonstrate knowledge flow application on data sets into Weka/R

- Develop a knowledge flow layout for finding strong association rules by using Apriori, FP Growth algorithms
- Set up the knowledge flow to load an ARFF (batch mode) and perform a cross validation using J48 algorithm

Demonstrate plotting multiple ROC curves in the same plot window by using j48 and Random forest tree

Experiment 7: Demonstrate ZeroR technique on Iris dataset (by using necessary preprocessing technique(s)) and share your observations

Experiment 8: Write a java program to prepare a simulated data set with unique instances

Experiment 9: Write a Python program to generate frequent item sets / association rules using Apriori algorithm

Experiment 10: Write a program to calculate chi-square value using Python/R. Report your observation

Experiment 11: Write a program of Naive Bayesian classification using Python/R programming language.

Experiment 12: Implement a Java/R program to perform Apriori algorithm

Experiment 13: Write a R program to cluster your choice of data using simple k-means algorithm using JDK

Experiment 14: Write a program of cluster analysis using simple k-means algorithm Python/R programming language

Experiment 15: Write a program of cluster analysis using simple k-means algorithm Python/R programming language.

Experiment 16: Visualize the datasets using matplotlib in python/R.(Histogram, Box plot, Bar chart, Pie chart etc.,)

Text Books:

1. Data Mining concepts and Techniques, 3rd edition, Jiawei Han, Michel Kamber, Elsevier, 2011.
2. Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson, 2012.

Reference Books:

1. Data Mining: VikramPudi and P. Radha Krishna, Oxford Publisher.
2. Data Mining Techniques, Arun K Pujari, 3rd edition, Universities Press,2013.
3. (NPTEL course by Prof.PabitraMitra) http://onlinecourses.nptel.ac.in/noc17_mg24/preview

http://www.saedsayad.com/data_mining_map.htm

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III Year - I Semester	Code: 23CS5L07	L	T	P	C
		0	0	3	1.5

COMPUTER NETWORKS LAB
(Common to CSE, CSE-(AI&DS), CSE(AI&ML), IT)

Course Objectives:

Learn basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP. A lab provides a practical approach to Ethernet/Internet networking: networks are assembled, and experiments are made to understand the layered architecture and how do some important protocols work

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO1	Identify and set up various network devices and establish Local Area Networks (LANs).	BL3
CO2	Develop programs for error detection and correction using Hamming code and CRC algorithms.	BL4
CO3	Implement and evaluate congestion control mechanisms such as the Leaky Bucket algorithm.	BL5
CO4	Design and apply routing algorithms like Dijkstra's and Distance Vector to determine optimal network paths.	BL4

List of Experiments:

Experiment 1: Study of Network devices in detail and connect the computers in Local Area Network

Experiment 2: Write a Program to implement the data link layer farming methods such as i) Character stuffing ii) bit stuffing.

Experiment 3: Write a Program to implement data link layer farming method checksum.

Experiment 4: Write a program for Hamming Code generation for error detection and correction.

Experiment 5: Write a Program to implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.

Experiment 6: Write a Program to implement Sliding window protocol for Goback N.

Experiment 7: Write a Program to implement Sliding window protocol for Selective repeat.

Experiment 8: Write a Program to implement Stop and Wait Protocol.

Experiment 9: Write a program for congestion control using leaky bucket algorithm

Experiment 10: Write a Program to implement Dijkstra's algorithm to compute the Shortest path through a graph.

Experiment 11: Write a Program to implement Distance vector routing algorithm by obtaining routing table at each node
(Take an example subnet graph with weights indicating delay between nodes).

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Experiment 12: Write a Program to implement Broadcast tree by taking subnet of hosts.
Experiment 13: Wireshark i. Packet Capture Using Wire shark ii. Starting Wire shark iii. Viewing Captured Traffic iv. Analysis and Statistics & Filters
Experiment 14: How to run Nmap scan
Experiment 15: Operating System Detection using Nmap
Experiment 16: Do the following using NS2 Simulator i. NS2 Simulator-Introduction ii. Simulate to Find the Number of Packets Dropped iii. Simulate to Find the Number of Packets Dropped by TCP/UDP iv. Simulate to Find the Number of Packets Dropped due to Congestion v. Simulate to Compare Data Rate& Throughput.

Note: At the end of Lab course students have to complete a Mini Project/Case Study for evaluation of Internal Marks

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III Year - I Semester	Code: 23CS5S06	L	T	P	C
		0	1	2	2

FULL STACK DEVELOPMENT – II
(Common to CSE,CSE-(AI&DS),AIML,CSE(AI&ML))

Course Objectives:

The main objectives of the course are to

- Make use of router, template engine and authentication using sessions to develop application in ExpressJS.
- Build a single page application using RESTful APIs in ExpressJS
- Apply router and hooksin designing ReactJS application
- Make use of MongoDB queries to perform CRUD operations on document database

Experiments covering the Topics:

- ExpressJS – Routing, HTTP Methods, Middleware, Templating, Form Data
- ExpressJS – Cookies, Sessions, Authentication, Database, RESTful APIs
- ReactJS – Render HTML, JSX, Components – function & Class, Props and States, Styles, Respond to Events
- ReactJS – Conditional Rendering, Rendering Lists, React Forms, React Router, Updating the Screen
- ReactJS – Hooks, Sharing data between Components, Applications – To-do list and Quiz
- MongoDB – Installation, Configuration, CRUD operations, Databases, Collections and Records

Course Outcomes:

Students are able to

CO Number	Course Outcome	Blooms Level
CO1	Develop server-side applications using ExpressJS with routing, middleware, and HTTP methods.	BL3
CO2	Implement user session management and authentication using cookies and sessions in ExpressJS.	BL4
CO3	Apply advanced ReactJS concepts such as conditional rendering, list rendering, forms, routing, hooks, and data sharing between components.	BL6
CO4	Design and implement real-world web applications by integrating front-end, back-end, and database technologies.	BL5

List of Experiments:

Experiment 1: ExpressJS – Routing, HTTP Methods, Middleware.

a. Write a program to define a route, Handling Routes, Route Parameters, Query Parameters and. URL building

b. Write a program to accept data, retrieve data and delete a specified resource using http methods.

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c. Write a program to show the working of middleware.
Experiment 2: ExpressJS – Templating, Form Data
a. Write a program using templating engine.
b. Write a program to work with form data.
Experiment 3: ExpressJS – Cookies, Sessions, Authentication
a. Write a program for session management using cookies and sessions.
b. Write a program for user authentication.
Experiment 4: ExpressJS – Database, RESTful APIs
a. Write a program to connect MongoDB database using Mangoose and perform CRUD operations.
b. Write a program to develop a single page application using RESTful APIs
Experiment 5: ReactJS – Render HTML, JSX, Components – function & Class
a. Write a program to render HTML to a web page.
b. Write a program for writing markup with JSX.
c. Write a program for creating and nesting components (function and class).
Experiment 6. ReactJS – Props and States, Styles, Respond to Events
a. Write a program to work with props and states.
b. Write a program to add styles (CSS & Sass Styling) and display data.
c. Write a program for responding to events.
Experiment 7. ReactJS – Conditional Rendering, Rendering Lists, React Forms
a. Write a program for conditional rendering.
b. Write a program for rendering lists.
c. Write a program for working with different form fields using react forms.
Experiment 8. ReactJS – React Router, Updating the Screen
a. Write a program for routing to different pages using react router.
b. Write a program for updating the screen.
Experiment 9. ReactJS – Hooks, Sharing data between Components
a. Write a program to understand the importance of using hooks.
b. Write a program for sharing data between components.
Experiment 10. MongoDB – Installation, Configuration, CRUD operations
a. Install MongoDB and configure ATLAS
b. Write MongoDB queries to perform CRUD operations on document using insert(), find(), update(), remove()
Experiment 11:MongoDB – Databases, Collections and Records
a. Write MongoDB queries to Create and drop databases and collections.
b. Write MongoDB queries to work with records using find(), limit(), sort(), createIndex(),

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aggregate().
Experiment 12. Augmented Programs: (Any 2 must be completed) 1. Design a to-do list application using NodeJS and ExpressJS. 2. Design a Quiz app using ReactJS. 3. Complete the MongoDB certification from MongoDB University website.
Text Books: 1. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, APress, O'Reilly. 2. Node.Js in Action, Mike Cantelon, Mark Harter, T.J. Holowaychuk, Nathan Rajlich,Manning Publications. (Chapters 1-11) 3. React Quickly, AzatMardan,Manning Publications(Chapters 1-8,12-14)
Web Links: 1. ExpressJS - https://www.tutorialspoint.com/expressjs 2. ReactJS - https://www.w3schools.com/REACT (and) https://react.dev/learn# 3. MongoDB - https://learn.mongodb.com/learning-paths/introduction-to-mongodb

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III Year - I Semester	Code: 23ES5L09	L	T	P	C
		0	0	2	1

TINKERING LAB
USER INTERFACE DESIGN USING FLUTTER
(Common to CSE,CSE-(AI&DS),AIML,CSE(AI&ML),IT)

Course Objectives:

The main objectives of the course are to

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

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Install and configure the Flutter and Dart environment, and demonstrate Dart programming basics.	BL2
CO 2	Develop responsive user interfaces adaptable to various screen sizes using media queries and layout management.	BL3
CO 3	Create custom widgets and apply themes and styling to enhance UI consistency and aesthetics.	BL6
CO 4	Integrate animations into UI components to improve user experience using Flutter's animation features.	BL3

List of Experiments:

Students need to implement the following experiments

Experiment 1:

a) Install Flutter and Dart SDK.
b) Write a simple Dart program to understand the language basics

Experiment 2:

a) Explore various Flutter widgets (Text, Image, Container, etc.)
b) Implement different layout structures using Row, Column, and Stack widgets

Experiment 3:

a) Design a responsive UI that adapts to different screen sizes.
b) Implement media queries and breakpoints for responsiveness.

Experiment 4:

a) Set up navigation between different screens using Navigator.
b) Implement navigation with named routes.

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Experiment 5:
a) Learn about stateful and stateless widgets.
b) Implement state management using set State and Provider

Experiment 6:
a) Create custom widgets for specific UI elements.
b) Apply styling using themes and custom styles

Experiment 7:
a) Design a form with various input fields.
b) Implement form validation and error handling

Experiment 8:
a) Add animations to UI elements using Flutter's animation framework.
b) Experiment with different types of animations (fade, slide, etc.).

Experiment 9:
a) Fetch data from a REST API.
b) Display the fetched data in a meaningful way in the UI.

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

Text Books:

1. Marco L. Napoli, Beginning Flutter: A Hands-on Guide to App Development.
2. Rap Payne, Beginning App Development with Flutter: Create Cross-Platform Mobile Apps 1st Edition, Apres
3. Richard Rose, Flutter & Dart Cookbook, Developing Full stack Applications for the Cloud, Oreilly..

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III Year - II Semester	Code:23CS6T10	L	T	P	C
		3	0	0	3

COMPILER DESIGN

Course Objectives:

The main objectives of the course is to

- **To introduce the basic concepts and phases of compiler design** including lexical analysis, syntax analysis, semantic analysis, intermediate code generation, optimization, and code generation.
- **To develop an understanding of the structure and functionality of a compiler** and how high-level programming language code is translated into machine code.
- **To enable students to apply formal grammar and automata theory** in the context of language parsing and syntax-directed translation.
- **To familiarize students with various parsing techniques** such as top-down and bottom-up parsing, including LL and LR parsers.

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO 1	Demonstrate the construction and functioning of finite automata and their relation to regular expressions in token recognition.	BL3
CO 2	Apply shift-reduce parsing and construct SLR, CLR(1), and LALR parsing tables for given grammars.	BL3
CO 3	Construct syntax-directed translation schemes for expressions and control structures.	BL6
CO 4	Analyze structure-preserving transformations and their impact on program behavior and performance.	BL4
CO 5	Evaluate strategies for register allocation and assignment to optimize execution performance	BL5

UNIT I **15Hrs**

Lexical Analysis: Language Processors, Structure of a Compiler, Lexical Analysis, The Role of the Lexical Analyzer, Bootstrapping, Input Buffering, Specification of Tokens, Recognition of Tokens, Lexical Analyzer Generator-LEX, Finite Automata, Regular Expressions and Finite Automata, Design of a Lexical Analyzer Generator. **Syntax Analysis:** The Role of the Parser, Context-Free Grammars, Derivations, Parse Trees, Ambiguity, Left Recursion, Left Factoring.

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UNIT II **15Hrs**

Top Down Parsing: Pre Processing Steps of Top Down Parsing, Backtracking, Recursive Descent Parsing, LL (1) Grammars, Non-recursive Predictive Parsing, Error Recovery in Predictive Parsing.

Bottom Up Parsing: Introduction, Difference between LR and LL Parsers, Types of LR Parsers, Shift Reduce Parsing, SLR Parsers, Construction of SLR Parsing Tables, More Powerful LR Parses, Construction of CLR (1) and LALR Parsing Tables, Dangling Else Ambiguity, Error Recovery in LR Parsing, Handling Ambiguity Grammar with LR Parsers

UNIT III

Syntax Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's. **Intermediate Code Generation:** Variants of Syntax Trees, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Back patching, Intermediate Code for Procedures

UNIT IV

Code Optimization: The Principle Sources of Optimization, Basic Blocks, Optimization of Basic Blocks, Structure Preserving Transformations, Flow Graphs, Loop Optimization, Data-Flow Analysis, Peephole Optimization

UNIT V

Run Time Environments: Storage Organization, Run Time Storage Allocation, Activation Records, Procedure Calls, Displays

Code Generation: Issues in the Design of a Code Generator, Object Code Forms, Code Generation Algorithm, Register Allocation and Assignment.

Text Books:

1. Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman, Pearson, 2007.

References Books:

1. Compiler Construction, Principles and Practice, Kenneth C Louden, Cengage Learning, 2006
2. Modern compiler implementation in C, Andrew W Appel, Revised edition, Cambridge University Press.
3. Optimizing Compilers for Modern Architectures, Randy Allen, Ken Kennedy, Morgan Kauffmann, 2001.
4. Levine, J.R., T. Mason and D. Brown, Lex and Yacc, edition, O'Reilly & Associates, 1990

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ODALAREVU – 533 210, Andhra Pradesh, India

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

III Year - II Semester	Code: 23CS6T11	L	T	P	C
		3	0	0	3

CLOUD COMPUTING
(Common to CSE & IT)

Course Objectives:
The main objectives of the course is to

- To explain the evolving utility computing model called cloud computing.
- To introduce the various levels of services offered by cloud.
- To discuss the fundamentals of cloud enabling technologies such as distributed computing, service-oriented architecture and virtualization.
- To emphasize the security and other challenges in cloud computing.
- To introduce the advanced concepts such as containers, serverless computing and cloud-centric Internet of Things.

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO 1	Define the concept of cloud computing and identify its fundamental components and architecture.	BL1
CO 2	Describe the principles of inter-process communication and technologies enabling distributed computing.	BL2
CO 3	Demonstrate the use of virtualization technologies such as XEN and VMware in virtualized setups.	BL3
CO 4	Analyze cloud security architectures and the shared responsibility model in different cloud deployment models (public, private, hybrid).	BL4
CO 5	Apply cloud-centric IoT frameworks to real-world application scenarios using layered architecture.	BL3

UNIT I
Introduction to Cloud Computing Fundamentals
Cloud computing at a glance, defining a cloud, cloud computing reference model, types of services (IaaS, PaaS, SaaS), cloud deployment models (public, private, hybrid), utility computing, cloud computing characteristics and benefits, cloud service providers (Amazon Web Services, Microsoft Azure, Google App Engine).

UNIT-II: Cloud Enabling Technologies
Ubiquitous Internet, parallel and distributed computing, elements of parallel computing, hardware architectures for parallel computing (SISD, SIMD, MISD, MIMD), elements of distributed computing, Inter-process communication, technologies for distributed computing, remote procedure calls (RPC), service-oriented architecture (SOA), Web services, virtualization.

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UNIT III Virtualization and Containers Characteristics of virtualized environments, taxonomy of virtualization techniques, virtualization and cloud Computing, pros and cons of virtualization, technology examples (XEN, VMware), building blocks of containers, container platforms (LXC, Docker), container orchestration, Docker Swarm and Kubernetes, public cloud VM (e.g. Amazon EC2) and container (e.g. Amazon Elastic Container Service) offerings.
UNIT IV Cloud computing challenges Economics of the cloud, cloud interoperability and standards, scalability and fault tolerance, energy efficiency in clouds, federated clouds, cloud computing security, fundamentals of computer security, cloud security architecture, cloud shared responsibility model, security in cloud deployment models.
UNIT V Advanced concepts in cloud computing Serverless computing, Function-as-a-Service, serverless computing architecture, public cloud (e.g. AWS Lambda) and open-source (e.g. OpenFaaS) serverless platforms, Internet of Things (IoT), applications, cloud-centric IoT and layers, edge and fog computing, DevOps, infrastructure-as-code, quantum cloud computing
Text Books: 1. Mastering Cloud Computing, 2nd edition, Rajkumar Buyya, Christian Vecchiola, Thamarai Selvi, Shivananda Poojara, Satish N. Srirama, Mc Graw Hill, 2024. 2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.
Reference Books: 1. Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018. 2. Essentials of cloud Computing, K. Chandrasekhran, CRC press, 2014. 3. Online documentation and tutorials from cloud service providers (e.g., AWS, Azure, GCP)

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III Year - II Semester	Code: 23CS6T12	L	T	P	C
		3	0	0	3

CRYPTOGRAPHY & NETWORK SECURITY
(Common to CSE, IT)

Course Objectives:

The main objectives of this course are to explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, public key algorithms, design issues and working principles of various authentication protocols and various secure communication standards including Kerberos, IPsec, and SSL/TLS.

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Define the fundamental security goals, cryptographic services, attacks, and mechanisms.	BL1
CO 2	Analyze the security and design aspects of DES, AES, and multiple DES.	BL4
CO 3	Apply asymmetric algorithms to encrypt/decrypt data and assess their security properties.	BL3
CO 4	Analyze the effectiveness of message authentication codes and digital signature schemes in securing communication.	BL4
CO 5	Evaluate security mechanisms deployed across network and system layers for their effectiveness and performance.	BL5

UNIT I

Basic Principles: Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography- integer arithmetic, modular arithmetic, matrices, linear congruence.

UNIT II

Symmetric Encryption: Mathematics of Symmetric Key Cryptography-algebraic structures, GF(2^n) Fields, Introduction to Modern Symmetric Key Ciphers-modern block ciphers, modern stream ciphers, Data Encryption Standard- DES structure, DES analysis, Security of DES, Multiple DES, Advanced Encryption Standard-transformations, key expansions, AES ciphers, Analysis of AES.

UNIT-III

Asymmetric Encryption: Mathematics of Asymmetric Key Cryptography-primes, primality testing, factorization, CRT, Asymmetric Key Cryptography- RSA crypto system, Rabin cryptosystem, Elgamal Crypto system, ECC

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UNIT IV **Data Integrity, Digital Signature Schemes & Key Management :** Message Integrity and Message Authentication-message integrity, Random Oracle model, Message authentication, Cryptographic Hash Functions-whirlpool, SHA-512, Digital Signature- process, services, attacks, schemes, applications, Key Management-symmetric key distribution, Kerberos.
UNIT V **Network Security-I:** Security at application layer: PGP and S/MIME, Security at the Transport Layer: SSL and TLS, **Network Security-II :** Security at the Network Layer: IPSec-two modes, two security protocols, security association, IKE, ISAKMP, System Security-users, trust, trusted systems, buffer overflow, malicious software, worms, viruses, IDS, Firewalls.
Text Books: 1. Cryptography and Network Security, 3rd Edition Behrouz A Forouzan, Deb deep Mukhopadhyay, McGraw Hill,2015 2. Cryptography and Network Security,4th Edition, William Stallings, (6e) Pearson,2006 3. Everyday Cryptography, 1st Edition, Keith M.Martin, Oxford,2016
Reference Books: 1. Network Security and Cryptography, 1st Edition, Bernard Meneges, Cengage Learning,2018

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III Year - II Semester	Code: 23CS6D05	L	T	P	C
		3	0	0	3

SOFTWARE TESTING METHODOLOGIES
(Common to CSE,CSE-(AI&DS),AIML,CSE(AI&ML),IT)

Course Objectives:

The main objectives of the course is to

- To provide knowledge of the concepts in software testing such as testing process, criteria, strategies, and methodologies.

To develop skills in software test automation and management using the latest tools

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Define key concepts of software testing including purpose, dichotomies, testing models, and types of bugs.	BL1
CO 2	Describe the basics of data flow testing and apply strategies to identify anomalies in variable usage.	BL3
CO 3	Illustrate path products, path expressions, and regular expressions for flow anomaly detection in software.	BL2
CO 4	Assess software testability using state models and transitions.	BL5
CO 5	Demonstrate practical knowledge in automated testing tools (e.g., JMeter, Selenium, SoapUI, Catalon) to design and execute test cases	BL3

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 graphs, good & bad state graphs, state testing, Testability tips.

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UNIT V 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. Software Testing techniques - Baris Beizer, Dreamtech, second edition. 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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University Nominee	Subject Expert	Subject Expert	Industrial Expert	Alumni Expert	Chairman-BOS.

III Year – IISemester	Code: 23CS6D06	L	T	P	C
		3	0	0	3

DEVOPS
(Common to CSE, AIML, CSE(AI&ML), IT)

Course Objectives:

The main objectives of this course are to:

- 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: Students are able to

CO Number	Course Outcome	Blooms Level
CO 1	Define the fundamentals of SDLC, Agile methodologies, and the concept of DevOps and its architecture.	BL1
CO 2	Describe the need for version control and apply Git features such as branching, staging, and collaboration	BL3
CO 3	Analyze Jenkins architecture (master-slave, pipeline basics) to automate and optimize build processes	BL4
CO 4	Use Docker commands to build, run, and manage containers, including publishing to Docker Hub	BL3
CO 5	Compare different configuration management tools such as Ansible, Puppet, and Chef.	BL5

UNIT I

Introduction to DevOps: Introduction to SDLC, Agile Model. Introduction to Devops. DevOps Features, DevOps Architecture, DevOps Lifecycle, Understanding Workflow and principles, Introduction to DevOps tools, Build Automation, Delivery Automation, Understanding Code Quality, Automation of CI/ CD. Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples

UNIT II

Source Code Management (GIT): The need for source code control, The history of source code management, Roles and code, source code management system and migrations. What is Version Control and GIT, GIT Installation, GIT features, GIT workflow, working with remote repository, GIT commands, GIT branching, GIT staging and collaboration. UNIT TESTING - CODE COVERAGE: Junit, nUnit & Code Coverage with Sonar Qube, SonarQube - Code Quality Analysis.

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UNIT-III

Build Automation - Continuous Integration (CI): Build Automation, What is CI Why CI is Required, CI tools, Introduction to Jenkins (With Architecture), jenkins workflow, jenkins master slave architecture, Jenkins Pipelines, PIPELINE BASICS - Jenkins Master, Node, Agent, and Executor Freestyle Projects & Pipelines, Jenkins for Continuous Integration, Create and Manage Builds, User Management in Jenkins Schedule Builds, Launch Builds on Slave Nodes.

UNIT IV

Continuous Delivery (CD): Importance of Continuous Delivery, CONTINUOUS DEPLOYMENT CD Flow, Containerization with Docker: Introduction to Docker, Docker installation, Docker commands, Images & Containers, DockerFile, Running containers, Working with containers and publish to Docker Hub.**Testing Tools:** Introduction to Selenium and its features, JavaScript testing.

UNIT V

Configuration Management - ANSIBLE: Introduction to Ansible, Ansible tasks, Roles, Jinja templating, Vaults, Deployments using Ansible.

CONTAINERIZATION USING KUBERNETES(OPENSHIFT): Introduction to Kubernetes Namespace & Resources, CI/CD - On OCP, BC, DC & ConfigMaps, Deploying Apps on Openshift Container Pods. Introduction to Puppet master and Chef.

Text Books:

1. Joyner, Joseph., Devops for Beginners: Devops Software Development Method Guide for Software Developers and It Professionals, 1st Edition Mihails Konoplows, 2015.
2. Alisson Machado de Menezes., Hands-on DevOps with Linux,1st Edition, BPB Publications, India, 2021.

Reference Books:

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10
2. Gene Kim Je Humble, Patrick Debois, John Willis. The DevOps Handbook, 1st Edition, IT Revolution Press, 2016.
3. Verona, Joakim Practical DevOps, 1st Edition, Packt Publishing, 2016.
4. Joakim Verona. Practical Devops, Ingram short title; 2nd edition (2018). ISBN10: 1788392574
5. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

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III Year - II Semester	Code: 23CS6D07	L	T	P	C
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MACHINE LEARNING

Course Objectives:

The objectives of the course is to

- Define machine learning and its different types (supervised and unsupervised) and understand their applications.
- Apply supervised learning algorithms including decision trees and k-nearest neighbours (k-NN).
- Implement unsupervised learning techniques, such as K-means clustering.

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Define fundamental concepts, paradigms, and types of learning in Machine Learning.	BL1
CO 2	Apply K-Nearest Neighbor (KNN) and related algorithms for classification and regression.	BL3
CO 3	Analyze the bias-variance tradeoff and extend learning using ensemble methods like Random Forests.	BL4
CO 4	Apply linear models including perceptron, SVM, and logistic regression for classification tasks	BL3
CO 5	Analyze the suitability of hierarchical and spectral clustering techniques for various types of datasets.	BL4

UNIT I

Introduction to Machine Learning: Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets

UNIT II

Nearest Neighbor-Based Models: Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures ,K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.

UNIT-III:

Models Based on Decision Trees: Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification

Dr. N Ramakrishnaiah, Professor and HOD-CSE UCEK, JNTUK Kakinada.	Dr. U.S.N. Raju, Assoc.Professor, Dept. of CSE, NIT, Warangal	Dr.V.Venkata Krishna, Dean of Computer Science, JBIET, Hyderabad	Mr. B. Jnaneswara Rao, Senior Machine Learning Expert HC Robotics Pvt. Ltd., Hyderabad	Dr. S.Rao Chintalapudi, Professor and HOD-CSE (AIML),CMR Technical campus, Hyderabad	Dr. Sheik Meera Sharif, Professor and Head of CSE
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and Regression. The Bayes Classifier: Introduction to the Bayes Classifier, Bayes' Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification, Class Conditional Independence and Naive Bayes Classifier (NBC)
UNIT IV **Linear Discriminants for Machine Learning:** Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptrons (MLPs), Backpropagation for Training an MLP.
UNIT V **Clustering :** Introduction to Clustering, Partitioning of Data, Matrix Factorization, Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering.
Text Books: 1. "Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana, Universities Press (India), 2024
Reference Books: 1. "Machine Learning", Tom M. Mitchell, McGraw-Hill Publication, 2017 2. "Machine Learning in Action",Peter Harrington, DreamTech 3. "Introduction to Data Mining", Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th Edition, 2019.

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III Year - II Semester	Code: 23CS6D08	L	T	P	C
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SOFTWARE PROJECT MANAGEMENT
(Common to CSE,CSE-(AI&DS),CSE(AI&ML),IT)

Course Objectives:

At the end of the course, the student shall be able to:

- To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
- To compare and differentiate organization structures and project structures

To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Describe the waterfall model and limitations of conventional software management.	BL2
CO 2	Explain various process artifacts – management, engineering, and programmatic – and their significance.	BL2
CO 3	Analyze the checkpoints (milestones and assessments) used in iterative development for effective monitoring.	BL4
CO 4	Describe types of project organizations and their evolution in software project management	BL2
CO 5	Analyze DevOps adoption in real-world projects with respect to technology, tools, people, and processes.	BL4

UNIT-I:

Conventional Software Management: The waterfall model, conventional software Management performance. **Evolution of Software Economics**: Software Economics, pragmatic software cost estimation. **Improving Software Economics:** Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.**The old way and the new:** The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

UNIT-II:Life cycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases. **Artifacts of the process:** The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts

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UNIT- III:

Model based software architectures: A Management perspective and technical perspective.

Work Flows of the process: Software process workflows, Iteration workflows.

Checkpoints of the process: Major mile stones, Minor Milestones, Periodic status assessments.

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

UNIT-IV:

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations. **Process Automation:** Automation Building blocks, The Project Environment.**Project Control and Process instrumentation:** The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation

UNIT-V:

Agile Methodology, ADAPTing to Scrum, Patterns for Adopting Scrum, Iterating towards Agility.

Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system. DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

Text Books:

1. Software Project Management, Walker Royce, PEA, 2005.
2. Succeeding with Agile: Software Development Using Scrum, Mike Cohn, Addison Wesley.
3. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim , John Willis , Patrick Debois , Jez Humb,1st Edition, O'Reilly publications, 2016

Reference Books:

1. Software Project Management, Bob Hughes,3/e, Mike Cotterell, TMH
2. Software Project Management, Joel Henry, PEA
3. Software Project Management in practice, Pankaj Jalote, PEA, 2005,
4. Effective Software Project Management, Robert K.Wysocki, Wiley,2006.

Project Management in IT, Kathy Schwalbe, Cengage

Dr. N Ramakrishnaiah, Professor and HOD-CSE UCEK, JNTUK Kakinada.	Dr. U.S.N. Raju, Assoc.Professor, Dept. of CSE, NIT, Warangal	Dr.V.Venkata Krishna, Dean of Computer Science, JBIET, Hyderabad	Mr. B. Jnaneswara Rao, Senior Machine Learning Expert HC Robotics Pvt. Ltd., Hyderabad	Dr. S.Rao Chintalapudi, Professor and HOD-CSE (AIML),CMR Technical campus, Hyderabad	Dr. Sheik Meera Sharif, Professor and Head of CSE
University Nominee	Subject Expert	Subject Expert	Industrial Expert	Alumni Expert	Chairman-BOS.

III Year– II Semester	Code: 23CS6D09	L	T	P	C
		3	0	0	3

MOBILE ADHOC NETWORKS
(Common to CSE, CSE(AI&ML), IT)

Course Objectives:

From the course the student will learn

- Architect sensor networks for various application setups.
- Devise appropriate data dissemination protocols and model links cost.
- Understanding of the fundamental concepts of wireless sensor networks and has a basic knowledge of the various protocols at various layers.
  Evaluate the performance of sensor networks and identify bottlenecks.

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO 1	Classify and describe MAC protocols for ad hoc wireless networks and their design goals.	BL2
CO 2	Evaluate various solutions for TCP performance improvement and other transport protocols in ad hoc environments.	BL5
CO 3	Analyze different security protocols and mechanisms like cooperation enforcement and intrusion detection systems.	BL4
CO 4	Analyze data retrieval techniques and sensor deployment strategies in real-world applications of WSNs.	,BL4
CO 5	Compare programming languages and simulation tools (nesC, TinyGALS, NS-2, TOSSIM) for WSN development.	BL5

UNIT I

Introduction to Ad Hoc Wireless Networks- Cellular and Ad Hoc Wireless Networks, Characteristics of MANETs, Applications of MANETs, Issues and Challenges of MANETs, Ad Hoc Wireless Internet, MAC protocols for Ad hoc Wireless Networks-Issues, Design Goals and Classifications of the MAC Protocols.

UNIT II

Routing Protocols for Ad Hoc Wireless Networks- Issues in Designing a Routing Protocol, Classifications of Routing Protocols, Topology-based versus Position-based Approaches, Issues and design goals of a Transport layer protocol, Classification of Transport layer solutions, TCP over Ad hoc Wireless Networks, Solutions for TCP over Ad Hoc Wireless Networks, Other Transport layer protocols.

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University Nominee	Subject Expert	Subject Expert	Industrial Expert	Alumni Expert	Chairman-BOS.

UNIT III

Security protocols for Ad hoc Wireless Networks- Security in Ad hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad hoc Wireless Networks, Cooperation in MANETs, Intrusion Detection Systems.

UNIT IV

Basics of Wireless Sensors and Applications- The Mica Mote, Sensing and Communication Range, Design Issues, Energy Consumption, Clustering of Sensors, Applications, Data Retrieval in Sensor Networks-Classification of WSNs, MAC layer, Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.

UNIT V

Security in WSNs- Security in WSNs, Key Management in WSNs, Secure Data Aggregation in WSNs, Sensor Network Hardware-Components of Sensor Mote, Sensor Network Operating Systems–TinyOS, LA-TinyOS, SOS, RETOS, Imperative Language-nesC, **Dataflow Style Language**-TinyGALS, Node-Level Simulators, NS-2 and its sensor network extension, TOSSIM.

Text Books:

1. Ad Hoc Wireless Networks – Architectures and Protocols, 1st edition, C. Siva Ram Murthy, B. S. Murthy, Pearson Education, 2004
2. Ad Hoc and Sensor Networks – Theory and Applications, 2nd edition *Carlos Corderio Dharma P.Aggarwal,* World Scientific Publications / Cambridge University Press, March 2006

References Books:

1. Wireless Sensor Networks: An Information Processing Approach, 1st edition, *Feng Zhao, Leonidas Guibas*, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, rp2009
2. Wireless Ad hoc Mobile Wireless Networks – Principles, Protocols and Applications, 1st edition, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008
3. Ad hoc Networking, 1st edition, *Charles E.Perkins*, Pearson Education, 2001
4. Wireless Ad hoc Networking, 1st edition, *Shih-Lin Wu, Yu-Chee Tseng,* Auerbach Publications, Taylor & Francis Group, 2007
5. Wireless Sensor Networks – Principles and Practice, 1st edition, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group, 2010

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University Nominee	Subject Expert	Subject Expert	Industrial Expert	Alumni Expert	Chairman-BOS.

III Year– II Semester	Code: 23CS6D10	L	T	P	C
		3	0	0	3

NATURAL LANGUAGE PROCESSING
(Common to CSE, IT)

Course Objectives:

This course introduces the fundamental concepts and techniques of natural language processing (NLP).

- Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
- The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.

Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO 1	Describe the origins, goals, and challenges of Natural Language Processing (NLP).	BL1
CO 2	Analyze Hidden Markov Models (HMMs) and Maximum Entropy models for sequence tagging.	BL4
CO 3	Apply dynamic programming methods like CYK for parsing and resolve ambiguity in syntax.	BL3
CO 4	Evaluate word similarity using distributional methods and thesaurus-based techniques.	BL5
CO 5	Apply algorithms such as Hobbs and Centering Theory for anaphora resolution.	BL3

UNIT I

INTRODUCTION: Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

UNIT II

WORD LEVEL ANALYSIS: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part- of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNIT III

SYNTACTIC ANALYSIS: Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures

UNIT IV

SEMANTICS AND PRAGMATICS: Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between

Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNIT V

DISCOURSE ANALYSIS AND LEXICAL RESOURCES: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

Text Books:

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 2nd Edition, Daniel Jurafsky, James H. Martin -Pearson Publication,2014.
2. Natural Language Processing with Python, First Edition, Steven Bird, Ewan Klein and Edward Loper, OReilly Media,2009.

References Books:

1. Language Processing with Java and Ling Pipe Cookbook, 1st Edition, Breck Baldwin, Atlantic Publisher, 2015.
2. Natural Language Processing with Java, 2nd Edition, Richard M Reese, OReilly Media,2015.
3. Handbook of Natural Language Processing, Second, NitinIndurkhya and Fred J. Damerau, Chapman and Hall/CRC Press, 2010.Edition
4. Natural Language Processing and Information Retrieval, 3rd Edition, TanveerSiddiqui, U.S. Tiwary, Oxford University Press,2008.

III Year - II Semester	Code: 23CS6D11	L	T	P	C
		3	0	0	3

BIG DATA ANALYTICS

Course Objectives:

This course is aimed at enabling the students to

- To provide an overview of an exciting growing field of big data analytics.
- To introduce the tools required to manage and analyze big data like Hadoop, NoSQL, Map Reduce, HIVE, Cassandra, Spark.
- To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
- To optimize business decisions and create competitive advantage with Big Data analytics

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Define big data and describe its characteristics, convergence of trends, and industry applications.	BL1
CO 2	Apply sharding and replication concepts in NoSQL systems, including master-slave and peer-to-peer models.	BL3
CO 3	Analyze the working of MapReduce programming model and data flow.	BL4
CO 4	Apply transformations and actions on RDDs and DataFrames for large-scale data processing.	BL3
CO 5	Evaluate Spark performance tuning strategies for optimized data processing.	BL5

UNIT I

big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

UNIT II

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer- peer replication, shardingand replication, consistency, relaxing consistency, version stamps, Working with Cassandra ,Table creation, loading and reading data.

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UNIT III: Data formats, analyzing data with Hadoop, scaling out, Architecture of Hadoop distributed file system (HDFS), fault tolerance ,with data replication, High availability, Data locality , Map Reduce Architecture, Process flow, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization. Introduction to Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, Logical joins, Window functions, Optimization, Table partitioning, Bucketing, Indexing, Join strategies.

UNIT IV: Apache spark- Advantages over Hadoop, lazy evaluation, In memory processing, DAG, Spark context, Spark Session, RDD, Transformations- Narrow and Wide, Actions, Data frames ,RDD to Data frames, Catalyst optimizer, Data Frame Transformations, Working with Dates and Timestamps, Working with Nulls in Data, Working with Complex Types, Working with JSON, Grouping, Window Functions, Joins, Data Sources, Broadcast Variables, Accumulators, Deploying Spark- On-Premises Cluster Deployments, Cluster Managers- Standalone Mode, Spark on YARN , Spark Logs, The Spark UI- Spark UI History Server, Debugging and Spark First Aid

UNIT V: Spark-Performance Tuning, Stream Processing Fundamentals, Event-Time and State full Processing - Event Time, State full Processing, Windows on Event Time- Tumbling Windows, Handling Late Data with Watermarks, Dropping Duplicates in a Stream, Structured Streaming Basics - Core Concepts, Structured Streaming in Action, Transformations on Streams, Input and Output.

Text Books:

1. Big Data, Big Analytics: Emerging, Michael Minnelli, Michelle Chambers, and AmbigaDhiraj, 1st edition ,2013
2. SPARK: The Definitive Guide, Bill Chambers &MateiZaharia, O'Reilley, 2018-first Edition.
3. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, First edition-2013.
4. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World Polyglot Persistence", Addison-Wesley Professional, 2012
5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012

Reference Books:

1. "Hadoop Operations", O'Reilley, Eric Sammer, First Edition -2012.
2. "Programming Hive", O'Reilley, E. Capriolo, D. Wampler, and J. Rutherglen, 2012.
3. "HBase: The Definitive Guide", O'Reilley, Lars George, September 2011: First Edition..
4. "Cassandra: The Definitive Guide", O'Reilley, Eben Hewitt, 2010.

"Programming Pig", O'Reilley, Alan Gates, October 2011: First Edition

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BONAM VENKATA CHALAMAYYA ENGINERING COLLEGE
ODALAREVU – 533 210, Andhra Pradesh, India

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

III Year - II Semester	Code: 23CS6D12	L	T	P	C
		3	0	0	3

DISTRIBUTED OPERATING SYSTEM
Common to CSE & IT

Course Objectives:

The main objective of the course is to introduce design issues and different message passing techniques in DOS, distributed systems, RPC implementation and its performance in DOS, distributed shared memory and resource management, distributed file systems and evaluate the performance in terms of fault tolerance, file replication as major factors

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO 1	Define distributed computing systems and explain their models, evolution, and design challenges.	BL1
CO 2	Describe the RPC model and its transparency, implementation, and message handling mechanisms.	BL2
CO 3	Analyze synchronization mechanisms like clock synchronization, mutual exclusion, and election	BL4
CO 4	Describe global scheduling algorithms, load balancing, and task assignment strategies in distributed systems.	BL2
CO 5	Evaluate design principles of distributed file systems using consistency and atomic transactions.	BL5

Unit I:Fundamentals:

What is Distributed Computing Systems? Evolution of Distributed Computing System; Distributed Computing System Models; What is Distributed Operating System? Issues in Designing a Distributed Operating System; Introduction to Distributed Computing Environment(DCE).

Message Passing:

Introduction, Desirable features of a Good Message Passing System, Issues in PC by Message Passing, Synchronization, Buffering, Multi-datagram Messages, Encoding and Decoding of Message Data, Process Addressing, Failure Handling, Group Communication, Case Study: 4.3 BSD UNIX IPC Mechanism.

Unit II: Remote Procedure Calls:

Introduction, The RPC Model, Transparency of RPC, Implementing RPC Mechanism, Stub Generation, RPC Messages, Marshaling Arguments and Results, Server Management, Parameter-Passing Semantics, Call Semantics, Communication Protocols for RPCs, Complicated RPCs, Client-Server Binding, Exception Handling, Security, Some Special Types of RPCs, RPC in Heterogeneous Environments, Lightweight RPC, Optimization for Better Performance, Case Studies: Sun RPC

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UNIT III: Unit III: Distributed Shared Memory: Introduction, General Architecture of DSM systems, Design and Implementation Issues of DSM, Granularity, Structure of Shared Memory Space, Consistency Models, Replacement Strategy, Thrashing, Other approaches to DSM, Heterogeneous DSM, Advantages of DSM. Synchronization: Introduction, Clock Synchronization, Event Ordering, Mutual Exclusion, Dead Lock, Election Algorithms
Unit IV:Resource Management: Introduction, Desirable Features of a Good Global Scheduling Algorithm, Task Assignment Approach, Load – Balancing Approach, Load – Sharing Approach Process Management: Introduction, Process Migration, Threads.
Unit V: Distributed File Systems: Introduction, Desirable Features of a Good Distributed File System, File models, File–Accessing Models, File – Sharing Semantics, File – Caching Schemes, File Replication, Fault Tolerance, Atomic Transactions and Design Principles.
Text books 1. Pradeep. K. Sinha: Distributed Operating Systems: Concepts and Design, PHI, 2007.
Reference Books: 1. Andrew S. Tanenbaum: Distributed Operating Systems, Pearson Education, 2013. 2. Ajay D. Kshemkalyani and Mukesh Singhal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press, 2008 3. SunitaMahajan, Seema Shan, " Distributed Computing", Oxford University Press,2015

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III Year - II Semester	Code: 23CS6E03	L	T	P	C
		3	0	0	3

Principles of Database Management Systems

Course Objectives:

The main objectives of the course is to

- Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra
- Introduce the concepts of basic SQL as a universal Database language
- Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO1	Explain the fundamental concepts of database systems and their characteristics, distinguishing them from file systems.	BL 1
CO2	Apply basic DML operations such as insert, delete, and update on tables in SQL.	BL 3
CO3	Create tables with relationships and implement primary key, foreign key, and integrity constraints.	BL 3
CO4	Analyze and apply the concepts of lossless join and dependency preserving decomposition during normalization.	BL 4
CO5	Implement operations on B+ Trees, including insertion, deletion, and search.	BL 3

UNIT I **10Hrs**

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database. Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

UNIT II **8Hrs**

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

UNIT III **8Hrs**

SQL:Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL

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functions(Date and Time, Numeric, String conversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set operations.
UNITIV Schema Refinement (Normalization):Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form(BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).
UNITV Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm. Introduction to Indexing Techniques: B+ Trees, operations on B+ Trees, Hash Based Indexing/
Text Books: 1) Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4) 2) Database System Concepts,5th edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 3) Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning. 4) Database Management Systems,Battacharya, Pritimoy 5) Database Management Systems, POST,Gerald V 6) Database Management System, Pujari,Arun k.
Reference Books: 1) Introduction to Database Systems, 8thedition, C J Date, Pearson. 2) Database Management System, 6th edition, Ramez Elmasri, Shamkant B. Navathe, Pearson 3) Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.
Online Learning Resources: 1) https://nptel.ac.in/courses/106/105/106105175/ 2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012758066672820 22456_shared/overview

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III Year – II Semester	Code: 23CS6L08	L	T	P	C
		0	0	3	1.5

CLOUD COMPUTING LAB
(Common to CSE & IT)

Course Objectives:

- To introduce the various levels of services offered by cloud.
- To give practical knowledge about working with virtualization and containers.

  To introduce the advanced concepts such as serverless computing and cloud simulation

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Demonstrate various service types, delivery models and technologies of a cloud computing environment.	BL2
CO 2	Distinguish the services based on virtual machines and containers in the cloud offerings	BL3
CO 3	Distinguish the services based on virtual machines and containers in the cloud offerings.	BL4
CO 4	Discuss advanced cloud concepts such as serverless computing and cloud simulation	BL6
CO5	Examine various programming paradigms suitable to solve real world and scientific problems using cloud services	BL3

List of Experiments:

Experiment 1

Lab on web services

Experiment 2:

Lab on IPC, messaging, publish/subscribe

Experiment 3:

Install VirtualBox/VMware Workstation with different flavours of Linux or windows OS on top of windows8 or above.

Experiment 4:

Install a C compiler in the virtual machine created using VirtualBox and execute Simple Programs.

Experiment 5:

Create an Amazon EC2 instance and set up a web-server on the instance and associate an IP address with the instance. In the process, create a security group allowing access to port 80 on the instance.

Experiment 6:

Do the same with OpenStack

Experiment 7:

Install Google App Engine. Create a hello world app and other simple web applications using python/java.

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Experiment 8:
Start a Docker container and set up a web-server (e.g. apache2 or Python based Flask micro web framework) on the instance. Map the host directory as a data volume for the container.

Experiment 9:
Find a procedure to transfer the files from one virtual machine to another virtual machine. Similarly, from one container to another container

Experiment 10:
Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)

Experiment 11:
Install Hadoop single node cluster and run simple applications like word count

Experiment 12: Utilize OpenFaaS – Serverless computing framework and demonstrate basic event driven function invocation.

Experiment 13: Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

Text Books:

1. Mastering Cloud Computing, 2nd edition, Rajkumar Buyya, Christian Vecchiola, Thamarai Selvi, Shivananda Poojara, Satish N. Srirama, McGraw Hill, 2024.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.

Reference books:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018.
2. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
3. Online documentation and tutorials from cloud service providers (e.g. AWS, Google App Engine)
4. Docker, Reference documentation, https://docs.docker.com/reference/
5. OpenFaaS, Serverless Functions Made Simple, https://docs.openfaas.com/

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III Year - II Semester	Code: 23CS6L09	L	T	P	C
		0	0	3	1.5

CRYPTOGRAPHY & NETWORK SECURITY LAB

Course Objectives:

- To learn basic understanding of cryptography, how it has evolved, and some key encryption techniques used today.
- To understand and implement encryption and decryption using Ceaser Cipher, Substitution Cipher, Hill Cipher.

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO 1	Apply basic bitwise operations (XOR, AND) to manipulate strings in C and understand low-level data security fundamentals.	BL3
CO 2	Develop programs to simulate symmetric encryption algorithms like DES, Blowfish, and Rijndael using C or Java.	BL4
CO 3	Implement public-key encryption techniques such as RSA and secure key exchange mechanisms like Diffie-Hellman using Java and JavaScript.	BL6
CO 4	Generate and verify message digests using cryptographic hash functions like SHA-1 in Java.	BL5
CO 5	Demonstrate the use of Java Cryptography Architecture (JCA) to perform encryption and key generation for secure communication.	BL4

List of Experiments:

Experiment 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 displays the result.

Experiment 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

Experiment 3: Write a Java program to perform encryption and decryption using the following algorithms:

a) Ceaser Cipher
b) Substitution Cipher
c)Hill Cipher

Experiment 4: Write a Java program to implement the DES algorithm logic

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Experiment 5: Write a C/JAVA program to implement the BlowFish algorithm logic
Experiment 6: *Write a C/JAVA program to implement the Rijndael algorithm logic*
Experiment 7: Using Java Cryptography, encrypt the text "Hello world" using BlowFish. Create your own key using Java key tool.
Experiment 8: Write a Java program to implement RSA Algorithm
Experiment 9: Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).
Experiment 10: Calculate the message digest of a text using the SHA-1 algorithm in JAVA.

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III Year - II Semester	Code: 23HM6S02	L	T	P	C
		0	1	2	2

SOFT SKILLS
(Common to CSE,CSE-(AI&DS),AIML,CSE(AI&ML),IT)

Course Objectives:

- To equip the students with the skills to effectively communicate in English
- To train the students in interview skills, group discussions and presentation skills
- To motivate the students to develop confidence
- To enhance the students' interpersonal skills
- To improve the students' writing skills

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Demonstrate analytical thinking and effective listening skills, and apply verbal and non-verbal communication techniques in personal and professional settings.	BL2
CO 2	Develop self-management competencies such as stress, time, and anger management, and exhibit team building, leadership, and professional etiquette.	BL4
CO 3	Participate effectively in job-related scenarios such as group discussions and interviews, and prepare resumes tailored for employment opportunities	BL6
CO 4	Understand the dynamics of interpersonal relationships, their significance in a workplace, and apply strategies to manage different relationship styles effectively.	BL3
CO 5	Use correct grammar, sentence structure, and formats for professional written communication, including note-making, minutes writing, and email drafting.	BL5

UNIT – I

Analytical Thinking & Listening Skills: Self-Introduction, Shaping Young Minds - A Talk by Azim Premji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception.

Communication Skills: Verbal Communication; Non Verbal Communication (Body Language)

UNIT – II

Self-Management Skills: Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities

Etiquette: Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette

UNIT – III

Standard Operation Methods : Basic Grammars, Tenses, Prepositions, Pronunciation, Letter Writing; Note Making, Note Taking, Minutes Preparation, Email & Letter Writing

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UNIT-IV **Job-Oriented Skills:** Group Discussion, Mock Group Discussions, Resume Preparation, Interview Skills, Mock Interviews
UNIT-V **Interpersonal relationships**: Introduction, Importance, Types, Uses, Factors affecting interpersonal relationships, Accommodating different styles, Consequences of interpersonal relationships
Text books: 1. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011. 2. S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.
Reference books: 1. R.S.Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand& Company Ltd., 2018.

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III Year - II Semester	Code: 23AC6T03	L	T	P	C
		2	0	0	-

TECHNICAL PAPER WRITING & IPR

(Common to CSE, CSE-(AI&DS), AIML, CSE(AI&ML), IT)

Course Objective: The course will explain the basic related to writing the technical reports and understanding the concepts related to formatting and structuring the report. This will help students to comprehend the concept of proofreading, proposals and practice

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Understand the structure and language of technical reports, and demonstrate the ability to plan and organize report content effectively.	BL2
CO 2	Use advanced features of word processors for technical documentation, including formatting, tracking changes, citations, bibliographies, and document protection techniques	BL3
CO 3	Understand the fundamentals of intellectual property rights including patents, copyrights, trademarks, and the international framework for protection and innovation.	BL4
CO 4	Draft clear, concise, and well-structured technical reports using appropriate visuals and adhere to principles of good grammar, spelling, and readability.	BL5
CO 5	Proofread documents for clarity and correctness, summarize content effectively, and develop oral and written presentation skills for technical proposals and reports.	BL6

Unit I:

Introduction: An introduction to writing technical reports, technical sentences formation, using transitions to join sentences, Using tenses for technical writing.

Planning and Structuring: Planning the report, identifying reader(s), Voice, Formatting and structuring the report, Sections of a technical report, Minutes of meeting writing

Unit II:

Drafting report and design issues: The use of drafts, Illustrations and graphics.

Final edits: Grammar, spelling, readability and writing in plain English: Writing in plain English, Jargon and final layout issues, Spelling, punctuation and Grammar, Padding, Paragraphs, Ambiguity.

Unit III:

Proofreading and summaries: Proofreading, summaries, Activities on summaries. **Presenting final reports:** Printed presentation, Verbal presentation skills, Introduction to proposals and practice.

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Unit IV: Using word processor: Adding a Table of Contents, Updating the Table of Contents, Deleting the Table of Contents, Adding an Index, Creating an Outline, Adding Comments, Tracking Changes, Viewing Changes, Additions, and Comments, Accepting and Rejecting Changes , Working with Footnotes and Endnotes, Inserting citations and Bibliography, Comparing Documents, Combining Documents, Mark documents final and make them read only., Password protect Microsoft Word documents., Using Macros,
Unit V: **Nature of Intellectual Property:** Patents, Designs, Trade and Copyright. Process of **Patenting and Development:** technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property
Text Books: 1. Kompal Bansal & Parshit Bansal, "Fundamentals of IPR for Beginner's", 1st Ed., BS Publications, 2016. 2. William S. Pfeiffer and Kaye A. Adkins, "Technical Communication: A Practical Approach", Pearson. 3. Ramappa,T., "Intellectual Property Rights Under WTO", 2nd Ed., S Chand, 2015.
Reference Books: 1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011. 2. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press(2006)
E-resources: 1. https://www.udemy.com/course/reportwriting/ 2. https://www.udemy.com/course/professional-business-english-and-technical-report-writing/ 3. https://www.udemy.com/course/betterbusinesswriting/

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