SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE
(AUTONOMOUS)

(Approved by AICTE, New Delhi, Affiliated to JNTUK, Kakinada)
Accredited by NAAC with 'A+' Grade.
Recognised as Scientific and Industrial Research Organisation
SRKR MARG, CHINA AMIRAM, BHIMAVARAM – 534204 W.G.Dt., A.P., INDIA

Regulation: R23	**III / IV - B.Tech. I - Semester**

COMPUTER SCIENCE & ENGINEERING

COURSE STRUCTURE
(With effect from 2023-24 admitted Batch onwards)

Course Code	Course Name	Category	L	T	P	Cr	C.I.E.	S.E.E	Total Marks
B23CS3101	Data Warehousing and Data Mining	PC	3	0	0	3	30	70	100
B23CS3102	Computer Networks	PC	3	0	0	3	30	70	100
B23CS3103	Formal Languages and Automata Theory	PC	3	0	0	3	30	70	100
#PE-I	Professional Elective-I	PE	3	0	0	3	30	70	100
#OE-I	Open Elective-I	OE	3	0	0	3	30	70	100
B23CS3109	Data Mining Lab	PC	0	0	3	1.5	30	70	100
B23CS3110	Computer Networks Lab	PC	0	0	3	1.5	30	70	100
B23CS3111	Full Stack Development -	SEC	0	1	2	2	30	70	100
B23CS3112	Tinkering Lab (User Interface Design using Flutter) / SWAYAM Plus - Android Application Development (with Flutter)	ES	0	0	2	1	30	70	100
B23CS3113	Evaluation of Community Service Internship	PR	--	--	--	2	--	50	50
B23MC3101	Employability Skills	MC	2	--	--	--	30	--	30
		TOTAL	**15**	**1**	**10**	**23**	**300**	**680**	**980**

	Course Code	Course
#PE-I	B23CS3104	Object Oriented Analysis and Design
	B23CS3105	Artificial Intelligence
	B23CS3106	Microprocessors & Microcontrollers
	B23CS3107	Software Testing Methodologies
	B23CS3108	MOOCS-I
#OE-I	Student has to study one Open Elective offered by CE or ECE or EEE or ME or S&H from the list enclosed.	

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3101	**PC**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

DATA WAREHOUSING AND DATA MINING

(For CSE)

Course Objectives: Students are expected to

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

Course Outcomes: At the end of the course, Students will be able to

S.No.	Outcome	Knowledge Level
1.	**Explain** data warehousing and OLAP concepts.	K2
2.	**Utilize** data preprocessing techniques to transform raw data into a suitable format.	K3
3.	**Apply** classification techniques for data analysis.	K3
4.	**Apply** association rule mining techniques for data analysis.	K3
5.	**Use** partitioning, hierarchical, density-based and grid-based clustering algorithms for cluster analysis.	K3

SYLLABUS

UNIT-I (10Hrs)	**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 Pattern Mining, Technologies, Applications, Major issues.
UNIT-II (10 Hrs)	**Getting to know your Data:** Data Objects & Attribute Types, Basic Statistical Descriptions of Data, Measuring Data Similarity and Dissimilarity. **Data Preprocessing:** An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.
UNIT-III (10 Hrs)	**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.
UNIT-IV (10 Hrs)	**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.

UNIT-V (10 Hrs)	**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.

Textbooks:	
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.
e-Resources	
1.	http://onlinecourses.nptel.ac.in/noc17_mg24/preview
2.	http://www.saedsayad.com/data_mining_map.htm

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3102	PC	3	--	--	3	30	70	3 Hrs.

COMPUTER NETWORKS

(For CSE)

Course Objectives: Students are expected

1.	To understand the different types of networks.
2.	To study data link layer concepts, design issues, and protocols.
3.	To study MAC layer Random Access Protocols, LAN.
4.	To gain knowledge on Network layer and Routing Algorithms.
5.	To explain the transport layer protocols and application layer protocols

Course Outcomes: At the end of the Course, Students will be able to

S.No.	Outcome	Knowledge Level
1.	**Illustrate** the OSI reference model, TCP/IP, and Digital transmission techniques	K2
2.	**Apply** error detection and correction, flow control with respect to data link layer	K3
3.	**Understand** MAC layer protocols and LAN technologies	K2
4.	**Summarize** various network layer services and Routing algorithms	K3
5.	**Explain** Transport layer and application layer protocols	K2

SYLLABUS

UNIT-I (10 Hrs)	**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 (10 Hrs)	**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)
UNIT-III (10 Hrs)	**Media Access Control (MAC):** 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. **Wireless LANS**-IEEE802.11 Architecture, MAC Sublayer.
UNIT-IV (10 Hrs)	**The Network Layer Design Issues** – Store and Forward Packet Switching- 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- Tunneling, 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 (10 Hrs)	**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.

Textbooks:	
1.	Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, McGraw Hill Publication, 2017.
2.	Andrew Tanenbaum, Feamster Wetherall, Computer Networks, 6th Edition, Global Edition
Reference Books:	
1.	Data and Computer Communications, William Stallings, Pearson, 10th Edition, 2013.
2.	Computer Networks, Andrew S. Tanenbaum, David J. Wetherall, Pearson Education India; 5 th edition, 2013.
3.	Computer Networks: A Systems Approach, LL Peterson,BS Davie, Morgan-Kauffman, 5th Edition, 2011.
4.	Computer Networking: A Top-Down Approach JF Kurose, KW Ross, Addison-Wesley, 5th Edition, 2009.
e-Resources	
1.	https://www.coursera.org/learn/computer-networking
2.	https://www.youtube.com/playlist?list=PLBlnK6fEyqRiw-GZRqfnlVIBz9dxrqHJS

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3103	PC	3	--	--	3	30	70	3 Hrs.

FORMAL LANGUAGES AND AUTOMATA THEORY

(For CSE)

Course Objectives: Students are expected to

1.	Learn fundamentals of Regular and Context Free Grammars and Languages
2.	Understand the relation between Regular Language and Finite Automata and machines
3.	Learn how to design Automata's and machines as Acceptors, Verifiers and Translators
4.	Understand the relation between Contexts free Languages, PDA and TM
5.	Learn how to design PDA as acceptor and TM as Calculators

Course Outcomes: At the end of the Course, Students will be able to

S.No.	Outcome	Knowledge Level
1.	**Apply** the fundamental concepts of Deterministic and Non-Deterministic Finite Automata to design and optimize finite automata for string acceptance.	K3
2.	**Construct** and transform Regular Expressions and Finite Automata, and apply Pumping Lemma to test language regularity.	K3
3.	**Construct** Context-Free Grammars for language constructs, simplify grammars, and convert to normal forms for parser development.	K3
4.	**Construct** pushdown Automata for context-free languages and demonstrate their equivalence with context-free grammars.	K3
5.	**Construct** Turing Machines for language recognition and classify computational problems based on decidability and complexity classes.	K3

SYLLABUS

UNIT-I (10 Hrs)	**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 (10 Hrs)	**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 (10 Hrs)	**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.
UNIT-IV (10 Hrs)	**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 (10 Hrs)	**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.

Textbooks:	
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/

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3104	PE	3	--	--	3	30	70	3 Hrs.

OBJECT ORIENTED ANALYSIS AND DESIGN

(For CSE)

Course Objectives: Students are expected to

1.	Demonstrate all phases of OOAD and basic features of UML
2.	Demonstrate Structural modeling
3.	Design software using UML
4.	Demonstrate behavioral modeling
5.	Apply advanced behavioral modeling to real time systems

Course Outcomes: At the end of the course, Students will be able to

S.No.	Outcome	Knowledge Level
1.	**Demonstrate** basics of modeling for object-oriented analysis and design using UML	K3
2.	**Apply** structural modeling for Software applications	K3
3.	**Apply** advanced structural modeling for Software applications	K3
4.	**Demonstrate** basic behavior of a software system with Use Case, Interaction and Activity Diagrams	K3
5.	**Apply** UML for modeling advanced behavioral aspects and Runtime environment of Software Systems	K3

SYLLABUS

UNIT-I (10Hrs)	**Structure of Complex systems**: Complexity of Software systems, Software development life cycle, Analysis and design process. Introduction to UML: Importance of modeling, principles of modeling, Object Oriented modeling, conceptual model of the UML, Architecture of UML. Case study: Simple Hello World Application
UNIT-II (10 Hrs)	**Basic Structural Modeling:** Classes, Relationships, Common Mechanisms and diagrams, Class Diagrams: Terms, concepts and modeling techniques. Case study: Student information system
UNIT-III (10 Hrs)	**Advanced Structural Modeling:** Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages, instances and Object diagrams. Case study: Human Resource management system
UNIT-IV (10 Hrs)	**Basic Behavioral Modeling-I:** Interactions, Interaction diagrams, Use cases, Use case Diagrams, Activity Diagrams. Case study: Order Management System

UNIT-V (10 Hrs)	**Advanced Behavioral Modeling:** Events and signals, state machines, processes and Threads, time and space, state chart diagrams, Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams. Case study: Web Application: Vacation Tracking System

Textbooks:	
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", 2nd edition, 2005, Addison Wesley.
Reference Books:	
1.	Ali Bahrami, "Object oriented systems development using the unified modeling language", 6th edition, 2019, TMH.
2.	Meilir Page-Jones, "Fundamentals of Object Oriented Design in UML",1st Edition, 1999, Addison-Wesley.
3.	Pascal Roques, "UML in Practice: The Art of Modeling Software Systems Demonstrated through Worked Examples and Solutions", 1st Edition, 2004, Wiley.
4.	Atul Kahate, "Object Oriented Analysis & Design", 2004, McGraw-Hill Education (India) Pvt Limited.
5.	Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", 3rd Edition, 2004, PHI.
e-Resources	
1.	OOAD, NPTEL course, https://onlinecourses.nptel.ac.in/noc22_cs99/preview
2.	UML standards, https://www.omg.org/spec/UML/2.5.1/About-UML/

Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3105	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

ARTIFICIAL INTELLIGENCE

(For CSE)

Course Objectives: Students are expected to

1.	To understand AI applications and problems
2.	To understand the basic Searching and knowledge representation
3.	To have a basic understanding of Expert systems and NLP

Course Outcomes: At the end of the course, Students will be able to

S. No	Outcome	Knowledge Level
1.	**Use** state space representation for solving AI problems.	K3
2.	**Apply** Heuristic search techniques to solve AI problems	K3
3.	**Apply** complex knowledge representation methods including predicate logic, semantic networks, frames and inheritance, conceptual dependency, scripts, constraint propagation to the knowledge in different domains.	K3
4.	**Apply** various inference techniques on the given facts.	K3
5.	**Apply** principles and techniques from machine learning and expert systems to solve real-world problems.	K3

SYLLABUS

UNIT-I (10 Hrs)	Introduction: Introduction to AI, Foundation of AI and history of AI, Domains of AI, State Space Representation of AI Problems (Water Jug Problem, 8 Puzzle Problem, TSP), Problem characteristics of AI, intelligent agents: Agents and Environments, structure of agents, problem solving agents.
UNIT-II (10 Hrs)	Searching: Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A*, AO* Algorithms, applications of Hill climbing and A* algorithms to solve AI Problems.
UNIT-III (10 Hrs)	Representation of Knowledge: Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, Conceptual dependency and Scripts, constraint propagation, representing knowledge using rules, rules based deduction systems. Reasoning under uncertainty
UNIT-IV (10 Hrs)	Logic concepts: First order Predicate logic. Inference in first order logic, propositional vs. first order inference, Conversion of WFF to Clause form, Unification Algorithm, forward chaining, Backward chaining, Resolution Algorithm. Game Playing: Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning.

UNIT-V (10 Hrs)	Introduction to Machine learning: learning from observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning. Expert Systems: Introduction to Expert Systems, Advantages and disadvantages and applications of Expert systems, Architecture of expert systems, Roles of expert systems – Knowledge Acquisition, Meta knowledge Heuristics.

Textbooks:	
1	S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education (2005)
2	Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Third Edition, Mc GrawHill (2016)
3	Artificial Intelligence- Saroj Kaushik, CENGAGE Learning.
Reference Books:	
1.	Introduction To Artificial Intelligence & Expert Systems, Patterson, PHI publications, First Edition, Year-2015
2.	Artificial Intelligence, George FLuger, Pearson Education Publications, 5th Edition, Year-2008
3.	Artificial Intelligence: A modern Approach, Russell and Norvig, Printice Hall, 3rd Edition, Year2015
4.	Artificial Intelligence, Robert Schalkoff, McGraw-Hill Publications, 3rdEdition, Year-2002
e-Resources	
1.	https://www.geeksforgeeks.org/artificial-intelligence/
2.	https://www.tutorialspoint.com/artificial_intelligence/index.htm

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3106	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

MICROPROCESSORS & MICROCONTROLLERS

(For CSE)

Course Objectives: Students are expected to

1.	To understand the basics of microprocessors and microcontrollers architectures and its functionalities.
2.	To create an exposure to basic peripherals, its programming and interfacing techniques.
3.	To understand the concepts of ARM processor.

Course Outcomes: At the end of the course, Students will be able to

S. No.	Outcome	Knowledge Level
1.	**Understand** the Architecture, Instruction set and Internal organization of 8086 microprocessors.	K2
2.	**Develop** the assembly language programming techniques regarding 8086 Microprocessor.	K3
3.	**Identify** the different I/O Peripherals (8255 and 8279) which are interfaced with 8086 Microprocessor.	K2
4.	**Analyze** the architecture and functional units of 8051 microcontroller.	K3
5.	**Develop** the assembly language programming techniques regarding 8051 and basic fundamentals of ARM processor.	K3

SYLLABUS

UNIT-I (10 Hrs)	**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 (10 Hrs)	**8086 Programming:** Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.
UNIT-III (12 Hrs)	**8086 Interfacing:** Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor Interfacing, A/D and D/A converters, Need for 8259 programmable interrupt controllers.
UNIT-IV (10 Hrs)	**Microcontroller:** Architecture of 8051, Special Function Registers (SFRs), I/O Pins Ports and Circuits, Instruction set, Addressing modes, Assembly language programming.

UNIT-V (08 Hrs)	**Interfacing Microcontroller:** Programming 8051 Timers, Serial Port Programming, Interrupts Programming, LCD & Keyboard Interfacing, External Memory Interface, Stepper Motor and Waveform generation, Comparison of Microprocessor, Microcontroller. **Advanced Topics:** Introduction to PIC and ARM processors.
Textbooks:	
1.	Advanced Microprocessors and Peripherals, A K RAY & K M Bhurchandi , 2nd Edition, The McGraw-Hill companies.
2.	The 8051Microcontrollers, Architecture and Programming and Applications -K.Uma Rao, Andhe Pallavi, Pearson, 2009.
3.	ARM System Developer's Guide: Designing and Optimizing System Software- Andrew N. Sloss, Dominic Symes, Chris Wright, Elsevier Inc., 2007.
Reference Books:	
1.	The 80X86 Family, Design, Programming and Interfacing, John E. Uffenbeck, 3rd Edition, Pearson Education Inc., 2002.
2.	Walter A. tribal and Avatar Singh. The 8088 and 8086 Microprocessors, Programming interfacing, software, hardware and Applications, 4th Edition Pearson education Inc., 2003
3.	Microprocessors and Interfacing. Programming and hardware, 2nd Edition, Douglass V. Hall. MH Edition, 1999.
4.	Kenneth. J. Ayala, The 8051 Microcontroller, 3rd Ed., Cengage Learning.
5.	The 8051 Microcontroller and Embedded systems using assembly and Cm Pearson 2nd edition 2006.
e-Resources	
1.	https://onlinecourses.nptel.ac.in/noc25_ee49/preview
2.	https://onlinecourses.nptel.ac.in/noc22_ee12/preview

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3107	PE	3	--	--	3	30	70	3 Hrs.

SOFTWARE TESTING METHODOLOGIES

(For CSE)

Course Objectives: Students are expected to

1.	To provide knowledge of the concepts in software testing such as testing process, criteria, strategies, and methodologies
2.	To develop skills in software test automation and management using the latest tools.

Course Outcomes: At the end of the course, Students will be able to

S.No.	Outcome	Knowledge Level
1.	**Implement** the Purpose of testing and Apply Path testing strategies	K3
2.	**Apply** Transaction Flow Testing, Data Flow testing and Domain Testing techniques to assess software functionality and reliability.	K3
3.	**Analyze** Path products and Regular expressions, Logic Based Testing to enhance testing effectiveness	K4
4.	**Apply** State, State Graphs and Transition testing strategies to improve software quality.	K3
5.	**Implement** Graph Matrices and Applications using appropriate tools	K3

SYLLABUS

UNIT-I (10Hrs)	**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 (10 Hrs)	**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 (10 Hrs)	**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 (10 Hrs)	State, State Graphs and Transition testing: state graphs, good & bad state graphs, state testing, Testability tips.

UNIT-V (10 Hrs)	**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).
Textbooks:	
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.
e-Resources	
1.	NOC: Software Testing, ST: (Video) https://nptel.ac.in/courses/106/101/106101163/

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3109	**PC**	**--**	**--**	**3**	**1.5**	**30**	**70**	**3 Hrs.**

DATA MINING LAB

(For CSE)

Course Objectives: Students are expected to

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

Course Outcomes: At the end of the course, Students will be able to

S.No.	Outcome	Knowledge Level
1	**Use** the Weka tool to design a robust Data Mart to facilitate efficient data analysis and decision-making.	K3
2	**Apply** appropriate data preprocessing techniques using the WEKA tool to prepare real-world datasets for mining tasks	K3
3	**Analyze** data mining algorithms like classification, prediction, clustering and association rule mining to solve real-world problems using Weka and Python	K4
4	**Use** data visualization tools to interpret and communicate data mining results effectively.	K3

SYLLABUS

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

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. • 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
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.
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
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.

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
7	Demonstrate ZeroR technique on Iris dataset (by using necessary preprocessing technique(s)) and share your observations
8	Generate a Python program to generate frequent item sets / association rules using the Apriori algorithm
9	Develop a Python program to calculate the chi-square value and report your observations.
10	Develop a Python program for Naive Bayes classification.
11	Develop a Python program for cluster analysis using the simple K-Means algorithm.
12	Visualize the datasets using matplotlib in python. (Histogram, Box plot, Bar chart, Pie chart etc.,)
Reference Books:	
1	Data Mining: Practical Machine Learning Tools and Techniques by Ian H. Witten, Eibe Frank, Mark A. Hall, and Christopher J. Pal. 5th edition,2023) Morgan Kaufmann Publishers.
2	Machine Learning for Data Streams: with Practical Examples in MOA by Albert Bifet, Ricard Gavaldà, Geoffrey Holmes, Bernhard Pfahringer,2018, The MIT Press.

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3110	**PC**	**--**	**--**	**3**	**1.5**	**30**	**70**	**3 Hrs.**

COMPUTER NETWORKS LAB

(For CSE)

Course Objectives: Students are expected to

1	Learn basic concepts of computer networking and acquire practical notions of protocols
2	To understand the layered architecture and how do some important protocols work

Course Outcomes: At the end of the course, Students will be able to

S.No.	Outcome	Knowledge Level
1	**Demonstrate** practical knowledge of LAN setup, data link layer framing, error detection and correction.	K2
2	**Experiment** sliding window protocols for efficient data transmission	K3
3	**Develop** skills in traffic analysis using Wireshark, network scanning, and operating system detection using Nmap.	K3
4	**Apply** NS2 Simulator to study packet drops, congestion, throughput, and data rate comparison for TCP/UDP protocols.	K3

SYLLABUS

1	Study of Network devices in detail and connect the computers in Local Area Network.
2	Write a Program to implement the data link layer farming methods such as i)Character stuffing ii) bit stuffing
3	Write a program for Hamming Code generation for error detection and correction.
4	Write a Program to implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.
5	Write a Program to implement Sliding window protocol for Goback N.
6	Write a Program to implement Sliding window protocol for Selective repeat.
7	Write a Program to implement Stop and Wait Protocol.
8	Write a program for congestion control using leaky bucket algorithm
9	Write a Program to implement Dijkstra‘s algorithm to compute the Shortest path through a graph.
10	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).
11	Write a Program to implement Broadcast tree by taking subnet of hosts.

12	Wireshark i. Packet Capture Using Wire shark ii. Starting Wire shark iii. Viewing Captured Traffic iv. Analysis and Statistics & Filters.
13	How to run Nmap scan
14	Operating System Detection using Nmap
15	Do the following using NS2 Simulator 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.
References:	
1	https://www.cisco.com/c/en/us/solutions/small-business/resourcecenter/networking/networking-basics.html
2	https://www.geeksforgeeks.org/computer-network-tutorials/
3	https://www.isi.edu/websites/nsnam/ns/

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3111	SEC	-	1	2	2	30	70	3 Hrs.

FULL STACK DEVELOPMENT – 2

(For CSE)

Course Objectives: Students are expected to

1	Make use of router, template engine, and authentication using sessions to develop applications in ExpressJS.
2	Build a single-page application using RESTful APIs in ExpressJS.
3	Apply routers and hooks in designing ReactJS applications.
4	Make use of MongoDB queries to perform CRUD operations on document databases.

Course Outcomes: At the end of the Course, Students will be able to

S.No.	Outcome	Knowledge Level
1	**Organize** responsive web interfaces using ReactJS.	K4
2	**Create** web applications using MongoDB for document-based storage.	K6
3	**Analyze** RESTful web services using ExpressJS and middleware techniques.	K4

SYLLABUS

1	**Node.js** a. Write a program to show the workflow of JavaScript code executable by creating a web server in Node.js. b. Write a program to Transfer data over http Protocol using http module. c. Create a text file src.txt and add the following content to it. (HTML, CSS, JavaScript, Typescript, MongoDB, ExpressJS, ReactJS, NodeJS) d. Write a program to parse an URL using URL module. e. Write a program to create a user-defined module and show the workflow of Modularization of application using Node.js
2	**Typescript** a. Write a program to understand simple and special types. b. Write a program to understand function parameter and return types. c. Write a program to show the importance with Arrow function. Use optional, default and REST parameters. d. Write a program to understand the working of Typescript with class, constructor, properties, methods and access specifiers. e. Write a program to understand the working of namespaces and modules. f. Write a program to understand generics with variables, functions and constraints.
3	**Augmented Programs:** (Any 2 must be completed) a. Write a CSS program, to apply 2D and 3D transformations in a web page. b. Design a web page with new features of HTML5 and CSS3. c. Design a to-do list application using JavaScript.

4.	**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. c. Write a program to show the working of middleware.
5	**ExpressJS – Templating, Form Data** a. Write a program using templating engine. b. Write a program to work with form data.
6	**ExpressJS – Cookies, Sessions, Authentication** a. Write a program for session management using cookies and sessions. b. Write a program for user authentication.
7	**ExpressJS – Database, RESTful APIs** a. Write a program to connect MongoDB database using Mongoose and perform CRUD operations. b. Write a program to develop a single page application using RESTful APIs.
8	**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).
9	**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.
10	**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.
11	**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.
12	**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.
13	**ReactJS Applications – To-do list and Quiz** Design a to-do list application.
14	**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()
15	**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(), aggregate().

16	**Augmented Programs: (Any 2 must be completed)** a. Design a to-do list application using NodeJS and ExpressJS. b. Design a Quiz app using ReactJS. c. Complete the MongoDB certification from MongoDB University website.
Reference 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, Azat Mardan,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

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3112	**ES**	**--**	**--**	**2**	**1**	**30**	**70**	**3 Hrs.**

TINKERING LAB (USER INTERFACE DESIGN USING FLUTTER)

(For CSE)

Course Objectives: Students are expected to

1.	To understand and apply the fundamentals of Dart programming and Flutter framework setup.
2.	To explore and implement core Flutter widgets, layouts, and responsive UI design techniques.
3.	To develop interactive mobile applications using navigation, state management, and custom widgets.
4.	To integrate animations, form handling, REST API communication, and testing in Flutter applications.

Course Outcomes: At the end of the Course, Students will be able to

S.No.	Outcome	Knowledge Level
1.	**Explain** the basics of Dart language and Flutter tools to design apps that work on multiple platforms with organized screens and visual elements.	K2
2.	**Use** Flutter features like buttons, layouts, page switching, and data handling to build user-friendly and dynamic interfaces.	K3
3.	**Build** real-time apps by connecting to web services, managing forms, adding motion effects and personalized elements, and checking and fixing issues in Flutter apps.	K6

SYLLABUS

1.	**Week 1: Setup and Dart Basics** **a)** Install Flutter SDK and Dart environment. **b)** Write simple Dart programs to understand variables, control structures, and functions.
2.	**Week 2: Exploring Flutter Widgets** **a)** Explore basic Flutter widgets like *Text, Image, Container, Icon*, etc. **b)** Create simple UI layouts using *Row, Column*, and *Stack*.
3.	**Week 3: Layouts and UI Design** **a)** Implement advanced layout strategies with *Expanded, Flexible*, and nested widgets. **b)** Design a clean UI screen using composition and layout principles.
4.	**Week 4: Responsive Design** **a)** Create responsive UI that adapts to screen sizes using *Media Query* and *Layout Builder*. **b)** Implement breakpoints and scalable layouts for tablets and phones.
5.	**Week 5: Navigation and Routing** **a)** Set up navigation between multiple screens using *Navigator* and *Navigator. push.* **b)** Use named routes and pass data between screens.
6.	**Week 6: State Management & Theming** **a)** Compare and implement *Stateless Widget* and *Stateful Widget*. **b)** Use *Provider* for simple state management.

	c) Apply app-wide theming with *Theme Data* and custom styles.
7.	**Week 7: Forms and API Integration** **a)** Design a form with input fields (Text Field, Dropdown, Switch). **b)** Validate input and handle errors. **c)** Fetch and display data from a REST API.
8.	**Week 8: Animations and Testing** **a)** Add basic animations using *AnimatedContainer*, *AnimatedOpacity*, etc. **b)** Write unit tests for widgets and use Flutter DevTools for debugging.
9.	**Week 9: Mini Project** **Objective:** Build a fully functional Flutter app that includes: • Multiple screens with navigation • State management using Provider • REST API integration (e.g., Weather, News, or User Data) • Form with validation • Basic animation and theming **Examples:** To-do app, Weather app, Movie list app, Student form with database.

Textbooks:	
1.	Beginning Flutter: A Hands-On Guide to App Development – Marco L. Napoli, Wiley, 2020.
2.	Flutter for Beginners: An introductory guide to building cross-platform mobile applications with Flutter and Dart 2 – Alessandro Biessek, Packt Publishing, 2020.
Reference Books:	
1.	Flutter Recipes: Mobile Development Solutions for iOS and Android – Fu Cheng, Apress, 2019.
2.	Flutter in Action – Eric Windmill, Manning Publications, 2020.
3.	Flutter & Dart Cookbook: Developing Full-Stack Applications for the Cloud – Richard Rose, O'Reilly Media, 2021.
e-Resources	
1.	https://www.udemy.com/course/flutter-bootcamp-with-dart/?couponCode=LEARNNOWPLANS
2.	https://www.coursera.org/learn/flutter-and-dart-developing-ios-android-mobile-apps

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23MC3101	MC	--	--	--	2		50	

EMPLOYABILITY SKILLS

(For AIML, CSBS, CSE, IT and MECH)

Course Objectives:

1.	To introduce concepts required in framing grammatically correct sentences and identifying errors while using standard English.
2.	To acquaint the learner of making a coherent and cohesive sentences and paragraphs for composing a written discourse.
3.	To inculcate logical thinking in order to frame and use data as per the requirement.

Course Outcomes

S.No	Outcome	Knowledge Level
1.	Match various vocabulary items that appear in competitive examinations with their contextual meanings accurately.	K1
2.	Identify grammatical and ungrammatical usage of English language in all the grammar related questions asked in various competitive examinations like CAT, GRE, IBPS.	K3
3.	Infer meaning from complex texts that are set as questions in different competitive examinations held for higher education or employment	K2
4.	Find solutions to complex arithmetic problems set as questions in the competitive examinations held for employment or higher education	K1
5.	Apply logical thinking abilities in solving the problems of reasoning that appear in the examinations like CAT, GRE, GATE, IBPS.	K3

SYLLABUS

UNIT-I (10Hrs)	Synonyms, Antonyms, Frequently Confused Words, Foreign Phrases, Idioms and Phrasal Verbs, Collocations. Spotting Errors, Sentence Improvement
UNIT-II (10 Hrs)	Time and work, Pipes and Cisterns. Time and Distance Problems, Problems on boats and streams. Percentages, Profit and loss, Simple interest and Compound interest. Discount Problems.
UNIT-III (10 Hrs)	Analogies, Odd One Out. (Verbal ability) Number Series, Letter Series, Analogy, Alpha Numeric Series, Order and Ranking, Directions, Data sufficiency, Syllogisms.
UNIT-IV (10 Hrs)	Sentence Completion, Sentence Equivalence, Close Test Reading Comprehension , Para Jumbles

UNIT-V (10 Hrs)	Number System: Divisibility tests, finding remainders in various cases, Problems related to numbers, Methods to find LCM, Methods to find HCF.
Textbooks:	
1.	*How to Prepare for Verbal Ability and Reading Comprehension for CAT* (10th edition) by Arun Sharma and Meenakshi Upadhyay, McGraw Hill Education, 2022.
2.	*How to Prepare for Quantitative Aptitude for CAT (10th edition) by* by Arun Sharma , McGraw Hill Education, 2022.
Reference Books:	
1.	*English Collocation in Use*- Intermediate (2nd edition) by Michael McCarthy& Felicity O'Dell, CUP, 2017.
2.	*Magical Book On Quicker Maths* (5th Edition) By M.Tyra, BSC Publishing Co Pvt. Ltd, 2018.
e-Resources	
1.	www.Indiabix.com
2.	www.800score.com

Regulation: R23	**III / IV - B.Tech. II - Semester**

COMPUTER SCIENCE & ENGINEERING

COURSE STRUCTURE
(With effect from 2023-24 admitted Batch onwards)

Course Code	Course Name	Category	L	T	P	Cr	C.I.E.	S.E.E.	Total Marks
B23CS3201	Compiler Design	PC	3	0	0	3	30	70	100
B23CS3202	Cloud Computing	PC	3	0	0	3	30	70	100
B23CS3203	Cryptography & Network Security	PC	3	0	0	3	30	70	100
#PE-II	Professional Elective-II	PE	3	0	0	3	30	70	100
#PE-III	Professional Elective-III	PE	3	0	0	3	30	70	100
#OE-II	Open Elective – II	OE	3	0	0	3	30	70	100
B23CS3215	Cloud Computing Lab	PC	0	0	3	1.5	30	70	100
B23CS3216	Cryptography & Network Security Lab	PC	0	0	3	1.5	30	70	100
B23BS3201	Soft skills	SEC	0	1	2	2	30	70	100
B23AC3201	Technical Paper Writing & IPR	AC	2	--	--	--	30	--	30
	TOTAL		**20**	**1**	**8**	**23**	**300**	**630**	**930**

	Course Code	Course
#PE-II	B23CS3204	Quantum Computing
	B23CS3205	Mobile Adhoc Networks
	B23CS3206	DevOps
	B23CS3207	Machine Learning
	B23CS3208	MOOCS-II
#PE-III	**Course Code**	**Course**
	B23CS3209	Software Project Management
	B23CS3210	Cyber Security
	B23CS3211	Natural Language Processing
	B23CS3212	Big Data Analytics
	B23CS3213	Distributed Operating System
	B23CS3214	MOOCS-III
#OE-II	Student has to study one Open Elective offered by CE or ECE or EEE or ME or S&H from the list enclosed.	
*Mandatory Industry Internship /Mini Project of 08 weeks duration during summer vacation		

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3201	PC	3	--	--	3	30	70	3 Hrs.

COMPILER DESIGN

(For CSE)

Course Objectives: Students are expected to

1.	Understand the fundamental phases of a compiler and their roles in translating source code to target code.
2.	Construct different types of parsers for context-free grammars.
3.	Utilize compiler construction tools like LEX and YACC to implement lexical and syntax analyzers.
4.	Explore code optimization techniques and code generation strategies in runtime environments.

Course Outcomes: At the end of the course, Students will be able to

S.No.	Outcome	Knowledge Level
1.	**Apply** the concepts of compiler phases and perform lexical analysis using regular expressions, finite automata, and LEX.	K3
2.	**Construct** top-down and bottom-up parsers including LL (1), SLR, CLR, and LALR for context-free grammars.	K3
3.	**Apply** syntax-directed translation schemes to generate intermediate code using three-address code and perform type checking.	K3
4.	**Apply** code optimization techniques such as basic block optimization, loop optimization, and data-flow analysis to generate the optimized code.	K3
5.	**Apply** code generation techniques considering runtime environment, storage management, and register allocation.	K3

SYLLABUS

UNIT-I (10Hrs)	**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.
UNIT-II (10 Hrs)	**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 (10 Hrs)	**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 (10 Hrs)	**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 (10 Hrs)	**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.
Textbooks:	
1.	Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman, Pearson, Pearson Education India; 2nd edition, 2013
2.	Compiler Construction-Principles and Practice, Kenneth C Louden, Cengage Learning, 2nd Edition, 1 January 2011.
Reference 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
5.	Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman, Pearson, 2007.
e-Resources	
1.	https://nptel.ac.in/courses/106/104/106104123
2.	https://www.geeksforgeeks.org/introduction-of-compiler-design/

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3202	PC	3	--	--	3	30	70	3 Hrs.

CLOUD COMPUTING

(For CSE)

Course Objectives: Students are expected to

1.	Understanding cloud computing models, architectures, and core services along with their deployment strategies.
2.	Exposure to enabling technologies such as distributed computing, virtualization, and containers in cloud environments.
3.	Familiarity with technical challenges and security considerations in cloud adoption.
4.	Awareness of advanced trends in cloud computing including serverless, edge, and fog computing.

Course Outcomes: At the end of the course, Students will be able to

S.No.	Outcome	Knowledge Level
1.	**Apply** cloud architecture, service models, and deployment models to practical computing scenarios.	K3
2.	**Analyze** the role of distributed and parallel architectures in cloud computing.	K4
3.	**Demonstrate** the use of virtualization and containers in cloud resource provisioning.	K3
4.	**Analyze** technical challenges in cloud computing such as security, scalability, and interoperability.	K4
5.	**Use** serverless and edge/fog computing concepts to optimize performance and cost-efficiency in cloud-based systems.	K3

SYLLABUS

UNIT-I (10 Hrs)	**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 AppEngine).
UNIT-II (10 Hrs)	**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.

UNIT-III (10 Hrs)	**Virtualization and Containers** Characteristics of virtualized environments, taxonomy of virtualization techniques, virtualization and cloud Computing, pros and cons of virtualization, technology examples (XEN, VMware), (e.g. Amazon EC2) and container (e.g. Amazon Elastic Container Service) offerings.
UNIT-IV (10 Hrs)	**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, security in cloud deployment models.
UNIT-V (10 Hrs)	**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, edge and fog computing.

Textbooks:	
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)
4.	Docker, Reference documentation, https://docs.docker.com/reference/
5.	OpenFaaS, Serverless Functions Made Simple, https://docs.openfaas.com/
e-Resources	
1.	https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2.	https://onlinecourses.nptel.ac.in/noc24_cs17/preview

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3203	PC	3	--	--	3	30	70	3 Hrs.

CRYPTOGRAPHY & NETWORK SECURITY

(For CSE)

Course Objectives: Students are expected to

1.	Overview of computer security and working principles and utilities of various cryptographic algorithms, including symmetric key cryptography and public key cryptography algorithms.
2.	Design issues and working principles of hashing, message digest algorithms, and various Authentication protocols.
3.	Various secure communication protocol standards.
4.	Concepts of various security threats and measures.

Course Outcomes: At the end of the course, Students will be able to

S.No.	Outcome	Knowledge Level
1.	**Analyze** mathematical concepts to solve problems related to cryptographic algorithms.	K4
2.	**Apply** the mathematical foundations of symmetric key cryptography to evaluate modern symmetric encryption algorithms.	K4
3.	**Apply** the mathematical foundations to evaluate and implement asymmetric encryption algorithms	K3
4.	**Analyze** cryptographic techniques to ensure data integrity, authentication by using different algorithms and key management for key exchange.	K4
5.	**Apply** security mechanisms and measures across various layers of network communication and system-level security.	K3

SYLLABUS

UNIT-I (10Hrs)	**Basic Principles**: Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography—integer arithmetic, modular arithmetic, matrices and linear congruence.
UNIT-II (10 Hrs)	**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 (10 Hrs)	**Asymmetric Encryption:** Mathematics of Asymmetric Key Cryptography-primes, primality testing, factorization, CRT, Asymmetric Key Cryptography- RSA crypto system, Rabin cryptosystem, Elgamal Crypto system, ECC

UNIT-IV (10 Hrs)	**Data Integrity, Digital Signature Schemes & Key Management:** Message Integrity and Message Authentication- message integrity, Random Oracle model, Message authentication, Cryptographic Hash Functions- MD5, SHA-512, Digital Signature-process, services, attacks, schemes, applications, Key Management-symmetric key distribution – Deffie- Hellman, Kerberos.
UNIT-V (10 Hrs)	**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.
Textbooks:	
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
Reference Books:	
1.	Everyday Cryptography, 1st Edition, Keith M.Martin, Oxford,2016
2.	Network Security and Cryptography, 1st Edition, Bernard Meneges, Cengage Learning,2018
e-Resources	
1.	https://www.geeksforgeeks.org/cryptography-and-network-security-principles/

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3204	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

QUANTUM COMPUTING

(For CSE)

Course Objectives: Students are expected to

1.	To introduce the mathematical tools and theoretical foundations required for understanding quantum computation
2.	To develop the ability to model and implement quantum systems using qubits, quantum gates, circuits, and algorithms.
3.	To provide knowledge of quantum error correction methods and familiarize students with quantum programming tools and libraries

Course Outcomes: At the end of the course, Students will be able to

S. No.	Outcome	Knowledge Level
1.	**Explain** the foundational principles of quantum computing including quantum mechanics, vector spaces, and quantum operators	K2
2.	**Describe** qubit representation, measurement, and entanglement	K2
3.	**Construct** basic quantum circuits using quantum gates	K3
4.	**Illustrate** different quantum hardware technologies and their features	K2
5.	**Analyze** quantum errors, apply basic error correction codes, and explore programming libraries for quantum simulation	K4

SYLLABUS

UNIT-I (12 Hrs)	**Foundations of Quantum computer** **Introduction:** Moore's law-A Brief History of Quantum Computing **Mathematical Tools for Quantum Computing:** Complex Numbers, Vector Space, and **Dirac Notation:** Complex Numbers, Conjugation, Vector Space, Basis Set, Dirac Notation, Inner Product, linearly Dependent and Independent Vectors, Dual Vector Space, Computational Basis, Outer Product **Basics of Quantum Mechanics:** limitations of Classical Physics: Blackbody Radiation, Plank's Constant, Photoelectric Effect, Classical Electromagnetic Theory, Rutherford's Model of the Atom, Bohr's Model of Atoms, Particle and Wave Nature of Light, Wave Function, Postulates of Quantum Mechanics. **Matrices and Operators:** Matrices, Square Matrices, Diagonal (or Triangular), Matrix, Operators· Linear Operator, Commutator, Matrix Representation of a Linear Operator, Symmetric Matrix, Transpose Operation, Orthogonal Matrices, Identity Operator, Adjoint Operator, Joint Operator, Hermitian Operator, Unitary Operators, Projection Operator
UNIT-II (10 Hrs)	**Qubits, Operators and Measurement** **Qubits** - Representation of Qubits, Quantum Operators - Representing Superposition of

	States. Unary Operators - Binary Operators - The Qubit as a Hilbert Space. - The Measurement Postulate. Density operators, generalized measurements, no-cloning theorem. **Superposition** Polarization of light, Single qubit notation, Measurement of Qubit **Entanglement:** Entangled States, Testing for Entangled States, Bell Pair and Bell States, EPR Paradox & Bell Theorem/Conditional Instructions, Quantum Teleportation, No-Cloning Theorem, Superdense Coding
UNIT-III (10 Hrs)	**Quantum gates and Quantum circuits** General quantum operations, quantum circuit model, quantum gates, Comparison with Classical Gates, universal sets of quantum gates, quantum circuits Model of computation (movement on Bloch Sphere), X, Y, Z, H gates, CNOT, Toffoli, Fredkin, SWAP gate, Controlled-U Gate, Reversible Gates, Simple circuits, Quantum Adder, Reversible circuits. Analyzing Pauli gates, Analyzing Cascade of gates, Analyzing Two-qubit gates, Tensor Product (example)
UNIT-IV (10 Hrs)	**Quantum Hardware, Quantum Algorithms:** Assessing a Quantum Computer, Neutral Atom, NMR, Photonics, Semiconductor quantum transistor, Spin Qubits, Superconducting Qubits, Trapped Ion Quantum Algorithms: Deutsch, Deutsch-Jozsa, Grover Algorithm, Shor's Algorithm, QFT (Basics)
UNIT-V (8 Hrs)	**Error Correction and Programming Libraries:** Error Correction: Unique challenges in QEC, Shor's bit-flip code, Shor's phase-flip code, Shor 9-qubit code, Steane code, Concatenation code, Threshold theorem Libraries: Quantum computers and QC Simulators, Cirq, Qiskit, Forest, Quantum Development Kit

Textbooks:	
1.	Nielsen, M. A., & Chuang, I. L. (2010). *Quantum Computation and Quantum Information* (10th Anniversary ed.). Cambridge University Press.
2.	Rieffel, E. G., & Polak, W. H. (2011). *Quantum Computing: A Gentle Introduction*. MIT Press
3.	Hidary, J. D. (2021). *Quantum Computing: An Applied Approach* (2nd ed.). Springer. https://doi.org/10.1007/978-3-030-61601-4
Reference Books:	
1.	McMahon, D. (2008). *Quantum computing explained*. John Wiley & Sons.
2.	de Wolf, R. (2019). *Quantum Computing: Lecture Notes*. CWI Amsterdam and University of Amsterdam. Retrieved from https://homepages.cwi.nl/~rdewolf/qcnotes.pdf
e-Resources	
GitHub - hywong2/Intro_to_Quantum_Computing: Class Slides for Introduction to Quantum Computing	

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3205	PE	3	--	--	3	30	70	3 Hrs.

MOBILE ADHOC NETWORKS

(For CSE)

Course Objectives: Students are expected to

1.	Understanding of the fundamental concepts of wireless sensor networks and has a basic knowledge of the various protocols at various layers.
2.	Understand the security requirements and challenges in ad hoc wireless networks and explore secure routing, key management, and intrusion detection techniques to safeguard MANETs.
3.	Evaluate the performance of sensor networks and identify bottlenecks.

Course Outcomes: At the end of the course, Students will be able to

S.No.	Outcome	Knowledge Level
1.	**Explain** the fundamental concepts of Ad Hoc wireless networks and describe the design considerations and classifications of MAC protocols for Ad Hoc Wireless Networks.	K2
2.	**Apply** the design goals and challenges of Routing and Transport layer protocols to configure reliable communication over Ad Hoc Wireless Networks.	K3
3.	**Apply** appropriate security mechanisms to meet network-security requirements and mitigate potential network security threats and attacks in Ad Hoc networks.	K3
4.	**Demonstrate** the use of wireless sensor network principles to address challenges in dynamic WSN environments.	K3
5.	**Use** suitable sensor hardware, operating systems, and programming models to create simulation environments in wireless sensor networks.	K3

SYLLABUS

UNIT-I (10 Hrs)	**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 (10 Hrs)	**Routing Protocols for Ad Hoc Wireless Networks-** Issues in Designing a Routing Protocol, Classifications of Routing Protocols, Topology-based versus Position-based Approaches. **Transport layer Protocols for Ad Hoc Wireless Networks**-Issues and design goals of a Transport layer protocol, Classification of Transport layer solutions, TCP over Ad hoc Wireless Networks, Other Transport layer protocols.

UNIT-III (10 Hrs)	**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 (10 Hrs)	**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 (10 Hrs)	**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.

Textbooks:	
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
Reference 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 Sensor Networks, 1st edition, Ian F. Akyildiz and Mehmet Can Vuran, Wiley Publications, 2010.
3.	Wireless Ad hoc Mobile Wireless Networks – Principles, Protocols and Applications, 1st edition, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008
4.	Ad hoc Networking, 1stedition, *CharlesE.Perkins*, Pearson Education, 2001
5.	Wireless Ad hoc Networking, 1st edition, *Shih-Lin Wu, Yu-Chee Tseng*, Auerbach Publications, Taylor & Francis Group, 2007
6.	Wireless Sensor Networks – Principles and Practice, 1st edition, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group, 2010
e-Resources	
1.	https://en.wikipedia.org/wiki/Wireless_ad_hoc_network
2.	https://www.geeksforgeeks.org/introduction-of-mobile-ad-hoc-network-manet/

Code	Category	L	T	P	C	I.M	E.M	Exam
B23CS3206	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

DEVOPS

(For CSE)

Pre-requisites: Software Engineering

Course Objectives: Students are expected to

1	Understand the core concepts of DevOps and its role in bridging development and operations.
2	Learn to use DevOps tools for version control, build automation, and continuous integration.
3	Explore continuous delivery and containerization using tools like Jenkins, Docker, and Kubernetes.
4	Implement infrastructure automation using configuration management tools such as Ansible.
5	Gain practical experience in setting up CI/CD pipelines and automating software deployment.

Course Outcomes: At the end of the course students will be able to

S. No.	Outcome	Knowledge Level
1	**Demonstrate** an understanding of the DevOps lifecycle and apply its principles to optimize software development and delivery processes.	K3
2	**Apply** version control methods and automated testing techniques to manage source code effectively and ensure software quality.	K3
3	**Infer** the significance of Jenkins in automating build and deployment pipelines within the DevOps lifecycle.	K4
4	**Categorize** the components and functionalities of containerization and orchestration tools in the context of application deployment	K4
5	**Analyze** various configuration management and orchestration tools to understand their roles in infrastructure automation and deployment processes.	K4

SYLLABUS

UNIT-I (10 Hrs)	**Introduction to DevOps and Agile Development:** Software Development Lifecycle (SDLC), Agile Methodology: Scrum & Kanban, DevOps Principles, Practices, and Benefits, DevOps Architecture and Lifecycle, Workflow, Value Stream Mapping, Bottlenecks, Introduction to CI/CD, Toolchains, Introduction to DevOps Tools: Jenkins, Git, Docker, Ansible, Kubernetes.
UNIT-II (10 Hrs)	**Version Control with Git and Automated Testing:** Source Code Management Concepts, Introduction to Version Control Systems (VCS), Git Features, Installation, and Workflow, Git Branching, Merging, Staging, and Collaboration, Unit Testing: JUnit, NUnit, Code Quality Analysis using SonarQube, Test Automation: Basics of Selenium, JavaScript testing frameworks.

UNIT-III (10 Hrs)	**Continuous Integration using Jenkins:** Introduction to Build Automation, Continuous Integration: Concepts & Importance, Jenkins Architecture and Installation, Jenkins Master-Slave Setup, Pipelines: Declarative vs Scripted, Build Triggers, User Management, Build Monitoring, Integration with Git, Test Tools, and Docker.
UNIT-IV (10 Hrs)	**Continuous Delivery & Containerization:** Difference between CI and CD, Continuous Delivery and Deployment Concepts, Docker Essentials: Installation, Images, Containers, Volumes, DockerFile, Docker Compose, DockerHub & Container Registry, Running and Publishing Containers, Container Testing and Monitoring
UNIT-V (10 Hrs)	**Configuration Management & Orchestration:** Infrastructure as Code (IaC), Ansible: Installation, Playbooks, Roles, Vaults, Deployment Automation using Ansible, Kubernetes Fundamentals: Pods, Services, ReplicaSets, Namespaces, Introduction to OpenShift (OCP): CI/CD on OpenShift, Deployments, Overview of Puppet & Chef (for comparative study)

TEXTBOOK:	
1.	**Joseph Joyner**, *DevOps for Beginners: DevOps Software Development Method Guide*, Mihails Konoplows, 2015.
2.	**Alisson Machado de Menezes**, *Hands-on DevOps with Linux*, 1st Edition, BPB Publications, India, 2021.
References:	
1.	Gene Kim, Jez Humble, Patrick Debois, John Willis, *The DevOps Handbook*, IT Revolution Press, 2016.
2.	Len Bass, Ingo Weber, Liming Zhu, *DevOps: A Software Architect's Perspective*, Addison-Wesley.
3.	Joakim Verona, *Practical DevOps*, Packt Publishing, 1st & 2nd Editions.
4.	Deepak Gaikwad, Viral Thakkar, *DevOps Tools from Practitioner's Viewpoint*, Wiley Publications.
e-Resources	
1.	https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_013382690411003904735_shared/overview [Software Engineering and Agile software development]
2.	https://infyspringboard.onwingspan.com/en/viewer/html/lex_auth_013501578194976768104 67 [Development & Testing with Agile: Extreme Programming]
3.	https://infyspringboard.onwingspan.com/en/viewer/html/lex_auth_0135389891719249922 6_shared [DevOps CICD]

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3207	PE	3	--	--	3	30	70	3 Hrs.

MACHINE LEARNING

(For CSE)

Course Objectives: Students are expected to

1.	Introduce the basic concepts and techniques of Machine Learning
2.	Demonstrate regression, classification and clustering methods.
3.	Introduce the concepts of dimensionality reduction, Regularization
4.	Illustrate the concepts of artificial neural networks and reinforcement learning

Course Outcomes: At the end of the course students will be able to

S.No.	Outcome	Knowledge Level
1.	**Use** the concepts of Machine Learning and Feature Engineering	K3
2.	**Apply** Classification models on real world datasets	K3
3.	**Apply** Regression models and ensemble models	K3
4.	**Demonstrate** the concepts of Clustering, dimensionality reduction and regularization techniques.	K3
5.	**Apply** the concepts of artificial neural networks, reinforcement learning	K3

SYLLABUS

UNIT-I (10Hrs)	**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 (10 Hrs)	**Supervised Learning:** Introduction to Proximity Measures, Distance Measures, and Non-Metric Similarity Functions, Proximity Between Binary Patterns. **Classification:** Different Classification Algorithms Based on the Distance Measures, Nearest Neighbors, Decision Trees, Naive Bayes, Binary Class classification and Multi Class classification, Logistic Regression.
UNIT-III (10 Hrs)	**Regression Models:** Linear Regression, SVM, Linear SVM, Kernel Trick. **Ensemble Learning:** Introduction, Voting Classifiers, Bagging, Random Forests, Boosting, AdaBoost, Gradient Boosting. XGBoost, Stacking.
UNIT-IV (10 Hrs)	**Unsupervised Learning Techniques:** Clustering, Types of Clustering, K-means clustering, and Hierarchical Clustering- Agglomerative Clustering, Divisive clustering, and Fuzzy C-Means Clustering. **Dimensionality Reduction & Regularization:** The Curse of Dimensionality, PCA, LDA, Lasso, Ridge.

UNIT-V (10 Hrs)	**Neurons, NNs, Linear Discriminants:** The Neuron, Neural Networks, The perceptron, **Multilayer perceptrons:** Going forwards, Going backwards, Backpropagation of error, Multilayer perceptron in practice, Examples of using MLP. **Reinforcement Learning:** Overview, Example, Markov Decision Process, Values, Q-Learning Algorithm, Uses of Reinforcement Learning.

Textbooks:	
1.	"Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana, Universities Press (India), 2024
2.	Introduction to Machine Learning, Alpaydin E, MIT Press (2014) 3rdEdition
3.	Machine Learning: The art and science of algorithms that make sense of data, Peter Flach, Cambridge, 2012
Reference Books:	
1.	Machine Learning: An algorithmic perspective, Stephen Marsland, 2nd edition, CRC press, 2014.
2.	The elements of statistical learning, Data Mining, Inference and Prediction, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Second edition , Springer, 2009.
3.	Machine Learning in Action, Peter Harington, 2012, Cengage.
4.	Python Machine Learning Cookbook-Practical Solutions from Preprocessing to Deep Learning, Chris Albon, Oreilly, 2018.
5.	Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, Tensorflow, Sebastian Raschka, Vahid Mirjalili, Second edition, 2020
e-Resources	
1.	"Machine Learning" course by Andrew Ng on Coursera
2.	"Introduction to Machine Learning (IITKGP)" by Prof. Sudeshna Sarkar, on Swayam
3.	"Principal Component Analysis versus Linear Discriminant Analysis", https://medium.com/analytics-vidhya/illustrative-example-of-principalcomponent-analysis pcavs-linear-discriminant-analysis-lda-is-105c431e8907
4.	"Regularization in Machine Learning", https://towardsdatascience.com/regularization inmachine-learning76441ddcf99a
5.	Grid search for model tuning", https://medium.com/analyticsvidhya/illustrative-example ofprincipal-component-analysis-pca-vs-lineardiscriminant-analysis-lda-is-105c431e8907

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3209	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

SOFTWARE PROJECT MANAGEMENT

(For CSE)

Course Objectives:

1.	To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
2.	To compare and differentiate organization structures and project structures
3.	To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

Course Outcomes: At the end of the course, Students will be able to

S.No.	Outcome	Knowledge Level
1.	**Apply** the process to be followed in the software development life-cycle models	K3
2.	**Apply** the concepts of project management & planning	K3
3.	**Implement** the project plans through managing people, communications and change	K3
4.	**Explain** the activities necessary to successfully complete and close the Software projects	K2
5.	**Implement** communication, modeling, and construction & deployment practices in software development	K3

SYLLABUS

UNIT-I (10Hrs)	**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 (10 Hrs)	**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.
UNIT-III (10 Hrs)	**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 (10 Hrs)	**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 (10 Hrs)	**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

Textbooks:	
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
5.	Project Management in IT, Kathy Schwalbe, Cengage
e-Resources	
1.	https://www.geeksforgeeks.org/software-engineering-software-project-management-spm/
2.	https://www.tutorialspoint.com/software_engineering/software_project_management.htm

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3210	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

CYBER SECURITY

(For CSE)

Course Objectives: Students are expected to

1.	To understand the foundational principles of cybersecurity, cryptography, and risk management to recognize and mitigate information security threats.
2.	To apply security mechanisms, protocols, and best practices in protecting data, devices, networks, and applications from various forms of cyberattacks.
3.	To evaluate cybersecurity threats and implement appropriate defenses in mobile, wireless, and organizational contexts including policy, privacy, and legal considerations.

Course Outcomes: At the end of the course students will be able to

S.No.	Outcome	Knowledge Level
1.	**Apply** fundamental cyber security concepts and models to identify cyber threats, attacks.	K3
2.	**Apply** knowledge of cyber offense techniques to prevent social engineering, cyberstalking.	K3
3.	**Apply** appropriate authentication and security measures to protect mobile and wireless devices from common threats	K3
4.	**Apply** countermeasures for various cyberattacks such as phishing, malware, DoS/DDoS, and SQL injection using standard tools	K3
5.	**Use** cybercrime legal perspectives to address privacy concerns.	K3

SYLLABUS

UNIT-I (10Hrs)	**Introduction to Cyber Security:** Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy
UNIT-II (10 Hrs)	**Cyber Offenses:** How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber Cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.
UNIT-III (10 Hrs)	**Cybercrime:** Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for

	Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones**,** **Mobile Devices:** Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops**.**
UNIT-IV (10 Hrs)	**Tools and Methods:** Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Identity Theft.
UNIT-V (10 Hrs)	**Cyber Crime Legal Perspectives:** Introduction, Cybercrime and the Legal Landscape around the World, The Indian IT Act, Challenges to Indian Law and Cyber Crime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment, Cyberlaw, Technology and Students: Indian Scenario.
Textbooks:	
1.	Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley,2011.
2.	Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
Reference Books:	
1.	Introduction to Cyber Security , Chwan-Hwa(john) Wu,J.David Irwin.CRC Press T&F Group
e-Resources	
1.	https://nptel.ac.in/courses/106106248

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3211	PE	3	--	--	3	30	70	3 Hrs.

NATURAL LANGUAGE PROCESSING

(For CSE)

Course Objectives: Students are expected to

1.	To gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
2.	The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.
3.	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: At the end of the course, Students will be able to

S.No.	Outcome	Knowledge Level
1.	**Apply** NLP concepts to process languages and build basic models	K3
2.	**Apply** word and syntactic level analysis techniques to process text using automata, parsing methods, and POS tagging for NLP task	K3
3.	**Apply** semantic and discourse analysis techniques to interpret meaning, resolve ambiguity, and ensure coherence in texts.	K3
4.	**Use** natural language generation and machine translation techniques to build simple NLG systems and translate texts, including those in Indian languages.	K3
5.	**Apply** NLP tools and resources to develop applications like information extraction, text summarization, and question-answering systems.	K3

SYLLABUS

UNIT-I (10Hrs)	**Introduction:** What is Natural Language Processing (NLP), Origins of NLP, Language and Knowledge, The challenges of NLP, Language and Grammar, Processing Indian Languages, NLP Applications, Some successful Early NLP Systems, Information Retrieval, Tokenization. **Language Modelling:** Introduction, Various Grammar-based Language Models, Statistical Language Model.
UNIT-II (10 Hrs)	**Word Level Analysis:** Introduction, Regular Expressions, Finite State Automata, Morphological Parsing, Spelling Error Detection and Correction, Minimum Edit Distance, Words and Word Classes, Part-of-Speech Tagging, **Syntactic Analysis:** Introduction, Context- Free Grammar, Constituency, Parsing, Probabilistic Parsing, Indian Languages.
UNIT-III (10 Hrs)	**Semantic Analysis:** Introduction, Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation, **Discourse Processing:** Introduction, Cohesion, Reference Resolution, Discourse Coherence and Structure

UNIT-IV (10 Hrs)	**Natural Language Generation:** Introduction, Architectures of NLG Systems, Generation task and Representations, Applications of NLG, **Machine Translation:** Introduction, Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches, Direct Machine Translation, Rule-based Machine Translation, Corpus-based Machine Translation, Semantic or Knowledge-based MT Systems, Translation involving Indian Languages.
UNIT-V (10 Hrs)	**NLP Applications:** Introduction, Information Extraction, Automatic Text Summarization, Question-Answering System, Lexical Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Word Net, Frame Net, Stemmers, Part-of-Speech Tagger, PropBank, Brown Corpus, British National Corpus (BNC).
Textbooks:	
1.	Tanveer Siddiqui, U.S. Tiwary, ―Natural Language Processing and Information Retrieval, Oxford University Press, 2008
2.	Daniel Jurafsky, James H. Martin―Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
Reference Books:	
1.	Natural Language Processing with Python, First Edition, Steven Bird, Ewan Klein and Edward Loper, OReilly Media,2009.
2.	Language Processing with Java and Ling Pipe Cookbook, 1st Edition, Breck Baldwin, Atlantic Publisher, 2015.
3.	Natural Language Processing with Java, 2nd Edition, Richard M Reese, OReilly Media,2015.
e-Resources	
1.	https://medium.com/nlplanet/awesome-nlp-18-high-quality-resources-for-studying-nlp-1b4f7fd87322

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3212	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

BIG DATA ANALYTICS

(For CSE)

Course Objectives: Students are expected to

1.	To provide an overview of an exciting growing field of big data analytics.
2.	To introduce the tools required to manage and analyze big data like Hadoop, Map Reduce, HIVE, Spark.
3.	To optimize business decisions and create competitive advantage with Big Data analytics

Course Outcomes: At the end of the course, Students will be able to

S.No.	Outcome	Knowledge Level
1.	Understand the existing technologies and the need of distributed files Systems to analyze the Big Data	K3
2.	Demonstrate the setup and configuration of the Hadoop ecosystem and its components for big data processing	K3
3.	Develop MapReduce programs using Hadoop API and components.	K3
4.	Use Spark to process big data with RDD operations and cluster deployment	K3
5.	Identify the need of modern tools Pig and hive, HBase and its application on Big Data Analytics	K3

SYLLABUS

UNIT-I (10Hrs)	**Introduction to Big Data:** Introduction to Big Data, Characteristics of Big Data, Types of Data, Applications of Big data, Importance of Big Data, Concept of Serialization, Wrapper Classes**.** **Distributed File System**: Scaling Out, Google File System (GFS)
UNIT-II (10 Hrs)	**Working with Big Data:** Hadoop Echo Systems, Hadoop Distributed File System (HDFS) Building blocks of Hadoop. Introducing and Configuring Hadoop cluster (Local, Pseudo-distributed mode, Fully Distributed mode), Configuring XML files. Scaling Out, Java interfaces to HDFS Basics, HDFS Read & Write
UNIT-III (10 Hrs)	**Writing Map Reduce Programs:** A Weather Dataset, Filtering Streams using Bloom filters, Understanding Hadoop API for Map Reduce Framework (Old and New), Hadoop Streaming, Basic programs of Hadoop Map Reduce Types and Formats, Anatomy of a Map Reduce Job run, Failures, Map Reduce: Driver code, Mapper code, Reducer code, Record Reader, Combiner, Partitioner.
UNIT-IV (10 Hrs)	**Spark:** Hadoop vs Spark, Introduction to Spark Concept, Spark Architecture and components, Spark installation, Spark RDD (Resilient Distributed Dataset) – Spark RDD

	operations. Cluster Deployments, Cluster Managers- Standalone Mode, Spark on YARN, Spark Logs, Streaming live data with spark
UNIT-V (10 Hrs)	**Pig:** Hadoop Programming Made EasierAdmiring the Pig Architecture, Going with the Pig Latin Application Flow, working through the ABCs of Pig Latin, Evaluating Local and Distributed Modes of Running Pig Scripts. **Applying Structure to Hadoop Data with Hive:** Hive architecture, Hive QL, Working with Hive Data Types, Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works, Querying and Analyzing data. Fundamentals and components of HBase and Zookeeper
Textbooks:	
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.
Reference Books:	
1.	Wiley & Big Java 4th Edition, Cay Horstmann, Wiley John Sons, INC
2.	Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012
e-Resources	
	https://www.ibm.com/think/topics/big-data-analytics

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3213	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

DISTRIBUTED OPERATING SYSTEMS

(For CSE)

Course Objectives: Students are expected to

1.	To provide a foundational understanding of distributed computing systems, their architecture, and operating system models.
2.	To explore mechanisms for inter-process communication, including message passing and remote procedure calls.
3.	To examine issues related to memory sharing, synchronization, and process coordination in distributed environments.
4.	To present approaches to resource management and file system design in distributed computing systems.

Course Outcomes: At the end of the course, Students will be able to

S. No.	Outcome	Knowledge Level
1.	**Demonstrate** various distributed system models and examine key challenges in message-passing communication	K3
2.	**Use** remote procedure call mechanisms and demonstrate their role in client-server communication.	K3
3.	**Analyze** the design and consistency challenges in distributed shared memory systems and assess various synchronization techniques.	K4
4.	**Apply** load balancing and process migration techniques for effective resource and process management.	K3
5.	**Analyze** various distributed file system architectures to determine the effectiveness of their caching, replication, and fault tolerance mechanisms.	K4

SYLLABUS

UNIT-I (10Hrs)	**Fundamentals:** What is Distributed Computing System? 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 IPC by Message Passing, Synchronization, Buffering, Multi-datagram Messages, Encoding and Decoding of Message Data, Process Addressing, Failure Handling, Group Communication
UNIT-II (10 Hrs)	**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
UNIT-III (10 Hrs)	**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, Advantages of DSM. **Synchronization:** Introduction, Clock Synchronization, Event Ordering, Mutual Exclusion, Dead Lock, Election Algorithms
UNIT-IV (10 Hrs)	**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 (10 Hrs)	**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.

Textbooks:	
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.	Sunita Mahajan, Seema Shan, “Distributed Computing”, Oxford University Press,2015
e-Resources	
1.	https://onlinecourses.nptel.ac.in/noc21_cs87

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3215	**PC**	**--**	**--**	**3**	**1.5**	**30**	**70**	**3 Hrs.**

CLOUD COMPUTING LAB

(For CSE)

Course Objectives: Students are expected to

1	To introduce the various levels of services offered by cloud.
2	To give practical knowledge about working with virtualization and containers.
3	To introduce the advanced concepts such as serverless computing and cloud simulation.

Course Outcomes: At the end of the course, Students will be able to

S.No.	Outcome	Knowledge Level
1	**Demonstrate** inter-process communication, messaging, and publish/subscribe techniques in distributed systems.	K3
2	**Analyze** the deployment and configuration strategies of virtual machines, containers, and cloud instances across platforms such as VirtualBox, Docker, AWS, and OpenStack	K4
3	**Use** cloud simulation and serverless platforms to deploy and test basic cloud applications and services.	K3

SYLLABUS

1	Lab on web services.
2	Lab on IPC, messaging, publish/subscribe
3	Install VirtualBox/VMware Workstation with different flavours of Linux or windows OS on top of windows8 or above.
4	Install a C compiler in the virtual machine created using VirtualBox and execute Simple Programs.
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. (OR) Do the same with OpenStack
6	Install Google App Engine. Create a hello world app and other simple web applications using python/java.
7	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.
8	Find a procedure to transfer the files from one virtual machine to another virtual machine. Similarly, from one container to another container
9	Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

10	Utilize OpenFaaS – Serverless computing framework and demonstrate basic event driven function invocation
Additional Programs	
11	Install Hadoop single node cluster and run simple applications like word count.
12	Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
Reference 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
e-References	
1	Online documentation and tutorials from cloud service providers (e.g. AWS, Google App Engine)
2	Docker, Reference documentation, https://docs.docker.com/reference/
3	OpenFaaS, Serverless Functions Made Simple, https://docs.openfaas.com/

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CS3216	PC	--	--	3	1.5	30	70	3 Hrs.

CRYPTOGRAPHY AND NETWORK SECURITY LAB

(For CSE)

Course Objectives: Students are expected to

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

Course Outcomes: At the end of the course, Students will be able to

S.No.	Outcome	Knowledge Level
1	**Apply** the mathematical foundations of symmetric key cryptography to evaluate modern symmetric encryption algorithms.	K3
2	**Apply** the mathematical foundations to evaluate and implement symmetric and asymmetric encryption algorithms	K3
3	**Apply** cryptographic techniques to ensure data integrity, authentication by using different algorithms.	K3

SYLLABUS

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.
2	Write a C program that contains a string (char pointer) with a value \Hello World'. The program should AND or and XOR each character in this string with 127 and display the result
3	Write a Java program to perform encryption and decryption using the following algorithms: a) Ceaser Cipher b) Substitution Cipher c) Hill Cipher
4	Write a Java program to implement the DES algorithm logic
5	Write a C/JAVA program to implement the BlowFish algorithm logic
6	Write a C/JAVA program to implement the Rijndael algorithm logic.
7	Using Java Cryptography, encrypt the text "Hello world" using BlowFish. Create your own key using Java key tool.
8	Write a Java program to implement RSA Algorithm.
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).
10	Calculate the message digest of a text using the SHA-1 algorithm in JAVA.

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
References:	
1	Everyday Cryptography, 1st Edition, Keith M.Martin, Oxford,2016
2	Network Security and Cryptography, 1st Edition, Bernard Meneges, Cengage Learning,2018
e-Resources	
1	https://www.geeksforgeeks.org/cryptography-and-network-security-principles/

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23BS3201	**SEC**	**--**	**1**	**2**	**2**	**30**	**70**	**3 Hrs.**

SOFT SKILLS

(For AIML, CSBS, CSE, IT and MECH)

Course Objectives:

1	To familiarise students with soft skills and how they influence their professional growth.
2	To build/refine the professional qualities/skills necessary for a productive career and to instill confidence through attitude building.

Course Outcomes:

S.No	Outcome	Knowledge Level
1	Interpret the essence of key soft skills such as creativity & problem solving, emotional intelligence, leadership qualities, etc.	K2
2	Outline interview essentials for graduate-job prospects.	K2
3	Apply presentation skills in academic and professional settings.	K3
4	Demonstrate knowledge about domain specific industry and the prospective workplace.	K2

SYLLABUS

1	**INTRODUCTION** Introduction to soft skills, definition and meaning, importance and need in personal and professional settings; soft skills vs. hard skills; personality development.
2	**INTRA-PERSONAL AND INTER-PERSONAL COMMUNICATION** Significance of Inter & Intra-Personal Communication; SWOT Analysis; Goal Setting – Guidelines for Goal Setting; Emotional Intelligence; Creativity & Problem Solving; Stress and Time Management; Leadership & Team Work; Building a positive attitude, Social Consciousness.
3	**WRITTEN COMMUNICATION** Resume Preparation: Common resume blunders, Tips for betterment, Resume Review; Report Writing; Writing an SOP (Statement of purpose).
4	**PRESENTATION SKILLS** Importance of Presentation Skills; JAM; Essential guidelines for Group Discussions; Debates; Role Plays; PPTs etc.
5	**INTERVIEW SKILLS** Employability Skills: Knowing about Selection Process; Interview Skills, types of Interviews, E-Interviews, Do's and Don'ts of Interviews, FAQs, Mock Interviews; Awareness about Industries; Importance of researching the prospective workplace.

Text Books:

1	Sherfield, M. Robert et al, Cornerstone Developing Soft Skills,(4th edition), Pearson Publication, New Delhi, 2014.

2	Alka Wadkar, Life Skills for Success,(1st edition), Sage Publications India Private Limited, 2016.
3	Soft Skills : Know Yourself and Know the World by Dr. K. Alex, S. Chand & Company Ltd., New Delhi, 2009.

Reference Books:

1	Sambaiah.M. Technical English, Wiley Publishers India. New Delhi. 2014.
2	Gangadhar Joshi, From Campus to Corporate, SAGE TEXT, 2015.
3	Alex.K, Soft Skills, 3rd ed. S. Chand Publication, New Delhi, 2014.
4	Meenakshi Raman and Sangeeta Sharma, Technical Communication: Principle and Practice, Oxford University Press, 2009.
5	Emotional Intelligence by Daniel Goleman, Random House Publishing Group, 2012.