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 AND INFORMATION TECHNOLOGY

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
B23CT3101	Internet of Things	PC	3	0	0	3	30	70	100
B23CD3102	Computer Networks	PC	3	0	0	3	30	70	100
B23CD3103	Data Mining and Data Warehousing	PC	3	0	0	3	30	70	100
# PE - I	Professional Elective-I	PE - 1	3	0	0	3	30	70	100
# OE - I	Open Elective-I	OE-1	3	0	0	3	30	70	100
B23CT3106	Full Stack Development-2 Lab	PC	0	0	3	1.5	30	70	100
B23CT3107	Data Mining and Data Warehousing Lab	PC	0	0	3	1.5	30	70	100
B23BS3101	Soft Skills	SEC	0	1	2	2	30	70	100
B23CT3108	Tinkering Lab	ES	0	0	2	1	30	70	100
B23CT3109	Evaluation of Community Service Internship	PR	--	--	--	2	--	50	50
		TOTAL	**15**	**01**	**10**	**23**	**270**	**680**	**950**

	Course Code	Course
# PE - I	B23CT3102	Visual Design and Communication
	B23CT3103	Mobile Computing
	B23CT3104	No SQL
	B23CD3107	Artificial Intelligence
	B23CT3105	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
B23CT3101	**PC**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

INTERNET OF THINGS

(For CSIT)

Course Objectives: Students are expected

1.	Vision and Introduction to Internet of Things (IoT). Understand IoT Market perspective
2.	Data and Knowledge Management and use of Devices in IoT Technology.
3.	Understand State of the Art – IoT Architecture. Understand Real World IoT Design Constraints, Industrial Automation and Commercial.

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

S.No	Outcome	Knowledge Level
1.	**Compute** the apply knowledge of Internet and Internet of Things architecture to explain their functioning in practical scenarios.	K3
2.	**Apply** understanding of wireless and mobile network constraints and capabilities to analyze their impact on IoT applications.	K3
3.	**Use** basic sensing and measurement and tools to determine the real-time performance of network of devices.	K3
4.	**Interpret** the prototype models for various applications using IoT technology.	K3
5.	**Illustrate** cloud-based data collection, storage, and computing techniques to develop IoT/M2M applications using various service models and platforms such as Xively, Nimbits, and participatory sensing technologies.	K3

SYLLABUS

UNIT-I (10Hrs)	**The Internet of Things:** An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, M2M Communication, Examples of IoTs, Design Principles for Connected Devices Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.
UNIT-II (10 Hrs)	Business Models for Business Processes in the Internet of Things, IoT/M2M systems LAYERS AND designs standardizations, Modified OSI Stack for the IoT/M2M Systems, ETSI M2M domains and High- level capabilities, Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability
UNIT-III (10 Hrs)	Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.

UNIT-IV (10 Hrs)	Data Acquiring, Organizing and Analytics in IoT/M2M, Applications /Services /Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.
UNIT-V (10 Hrs)	Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology, Sensing the World.
Textbooks:	
1.	Internet of Things: Architecture, Design Principles and Applications, Rajkamal, McGraw Hill Higher Education
2.	Internet of Things, A. Bahgya and V. Madisetti, Univesity Press, 201
Reference Books:	
1.	Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley Getting Started with the Internet of Things, Cuno Pfister, Oreilly
e-Resources	
1.	S. Misra, **"Introduction to Internet of Things,"** NPTEL Online Course, IIT Kharagpur, 2023. Available via SWAYAM/NPTEL NPTEL:http://nptel.ac.in/courses/106105166
2.	Yonsei University, *IoT (Internet of Things) Wireless & Cloud Computing Emerging Technologies*, Coursera, https://www.coursera.org/learn/iot-wireless-cloud-emerging-technologies

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CD3102	PC	3	--	--	3	30	70	3 Hrs.

COMPUTER NETWORKS

(For CSD & CSIT)

Course Objectives: Students are expected

1.	To understand the different types of networks
2.	To develop an understanding of the principles of computer networks.
3.	To familiarize with Reference model OSI and TCP/IP
4.	To understand various layers of Reference models functions
5.	To explore network protocols

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

S.No	Outcome	Knowledge Level
1.	**Apply** the concepts of reference models and network protocols to analyze communication between networked systems.	K3
2.	**Apply** knowledge of data transmission media and the data link layer to design basic communication setups.	K3
3.	**Apply** network layer design principles and protocols to implement efficient routing mechanisms.	K3
4.	**Analyze** transport layer services and their protocols	K4
5.	**Analyze** application layer protocols to real-world networking scenarios and service configurations.	K4

SYLLABUS

UNIT-I (10Hrs)	**Introduction:** Types of Computer Networks, Reference Models- The OSI Reference Model, The TCP/IP Reference Model, A Critique of the OSI Model and Protocols, A Critique of the TCP/IP Reference Model. History of Internet.
UNIT-II (10 Hrs)	**The Data Link Layer:** Transmission Media, Guided and Un-guided media, Data Link Layer Design Issues, Services Provided to the Network Layer, Error detecting and Error Correcting codes, Elementary Data Link Protocols, Sliding Window Protocols, HDLC, PPP. Multiple Access Protocols Wired Lans: Ethernet, Fast Ethernet, Gigabit Ethernet.
UNIT-III (10 Hrs)	**The Network Layer**: Network Layer Design Issues, Routing Algorithms, Congestion, Congestion control algorithms. The Network Layer on the Internet, The IP Version 4 Protocol, IP Addresses- Classful, CIDR, NAT, IP Version 6 Protocol, Transition from IPV4 to IPV6

UNIT-IV (10 Hrs)	**The Transport Layer:** The Transport Layer Services, Transport Layer Protocols: UDP, TCP and SCTP.
UNIT-V (10 Hrs)	**The Application Layer:** The World Wide Web, HTTP, Domain Name Space, Remote Loging, Electronic Mail and File Transfer.
Textbooks:	
1.	"Computer Networks", Andrew S Tanenbaum, David J Wetherall, 5th Edition, Pearson.
2.	"Data Communications and Networking", Behrouz A Forouzan, 4th Edition, Tata McGraw Hill Education.
Reference Books:	
1.	"Data and Computer Communication", William Stallings, Pearson
2.	"TCP/IP Protocol Suite", Behrouz Forouzan, McGraw Hill.
e-Resources	
1.	D. P. Agrawal, *Computer Networks and Internet Protocol*, NPTEL Course, IIT Kharagpur. : https://archive.nptel.ac.in/courses/106/105/106105183
2.	P. K. Das, *Data Communication*, NPTEL Course, IIT Kharagpur. : https://archive.nptel.ac.in/courses/117/105/117105143
3.	S. Misra, *Computer Networks*, NPTEL Course, IIT Kharagpur. : https://archive.nptel.ac.in/courses/106/105/106105081
4.	S. Kar, *Communication Networks*, NPTEL Course, IIT Kharagpur. : https://onlinecourses.nptel.ac.in/noc22_ee61
5.	A. Mahanti and R. K. Ghosh, *Advanced Computer Networks*, NPTEL Course, IIT Indore & IIT Gandhinagar. : https://onlinecourses.nptel.ac.in/noc25_cs02/preview

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CD3103	PC	3	--	--	3	30	70	3 Hrs.

DATA MINING AND DATA WAREHOUSING

(For CSD & CSIT)

Course Objectives: The main objective of the course is 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

S.No	Outcome	Knowledge Level
1.	**Explain** the concepts of data warehousing & OLAP technology.	K2
2.	**Apply** data pre processing techniques.	K3
3.	**Formulate** and apply classification algorithms and their performance evaluation metrics on sample datasets.	K4
4.	**Analyze** Apriori and FP-Growth algorithms to generate frequent itemsets and strong rules using pruning and compact representations.	K4
5.	**Categorize** and compare partitioning, hierarchical, density based and grid based clustering algorithms.	K4

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 Patten Mining, Technologies, Applications, Major issues, Data Objects & Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity. (Text Book- 1).
UNIT-II (10 Hrs)	**Data Preprocessing:** An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization. (Text Book- 1).
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.	Mitra, *"Data Warehouse and OLAP Technology,"* NPTEL, : https://nptel.ac.in/courses/106105174.
2.	Ghosh, *"Big Data Computing,"* SWAYAM/NPTEL, : https://swayam.gov.in/nd1_noc20_cs48.
3.	Chakraborti, *"Introduction to Data Analytics,"* SWAYAM, : https://swayam.gov.in/nd1_noc19_mg53.

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CT3102	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

VISUAL DESIGN AND COMMUNICATION

(For CSD & CSIT)

Course Objectives:

1.	To understand the principles of the visual language and their semantic use. A multi- disciplinary domain, design consists of, aesthetics, architecture, products, communication, processes, systems, technology, business/commerce, ramification on environment and society and demands.
2.	To communicate more concisely and in a visually appropriate manner, it is necessary to use commonly understood principles, perspective and design layout standards.
3.	To understand the fundamentals of Typography and Photography.

Course Outcomes

S.No	Outcome	Knowledge Level
1.	**Apply** the basic elements of visual language—dots, lines, forms, space, pattern, texture, and colour—in creating visually coherent compositions.	K3
2.	**Use** concepts of proximity, gradation, dominance, and subordination to develop coherent and expressive visual narratives.	K3
3.	**Demonstrate** an understanding of vernacular and Indian letterforms by incorporating them in culturally relevant typographic compositions.	K3
4.	**Apply** basic digital post-production techniques in software like Photoshop, including resizing, resolution adjustment, and file format optimization.	K4
5.	**Analyze** the components of visual storytelling by breaking down storyboards into narrative, framing, and camera movement elements.	K4

SYLLABUS

UNIT-I (10Hrs)	**Introduction to Visual Design:** Importance of understanding visual language-its relation in context to nature and environment-Exploring and understanding Dots, Lines, Forms, Space, Pattern, Texture and Colour as an element of visual language
UNIT-II (10 Hrs)	**Introduction to the Principles of Visual Language:** Visual explorations and experiments with Form, Colour, and Space, Texture, in relation to the context and environments – Concepts of harmony, balance, contrast, proportion, order, symmetry, asymmetry, rhythm, tension, juxtaposition, proximity, size, scale, proportion, orientation, alignment, variety, gradation, dominance, subordination, transition etc.
UNIT-III	**Introduction to Fundamentals of Typography:** Introduction to Type and its History-

(10 Hrs)	Type as a form and means of communication in our environment-Introduction to Indian type: Vernacular letter-forms-Classification of types: Typefaces, type families and type designers-Anatomy of the type: x-height, ascenders, descenders, counter, cap-height, baseline, etc-Typographic variables: Kerning, tracking, leading, spacing etc.-Semantics of type: Legibility & readability issues in type and meaning attributed to type. 4h. Expressive Typography-Introduction to printing techniques
UNIT-IV (10 Hrs)	**Introduction to Photography:** Introduction and Orientation: Art and Science of Photography. Drawing out parallels / differences between the EYE and the CAMERA-Camera: Understanding the various controls on a Digital SLR Camera Features and Details. Shooting Modes. Aperture and Depth of Field. Shutter Speed. Critical Shutter Speeds and Effects- Exposure: Exposure as function of Quantity of Light and Time. Getting used to shoot in Manual Mode and learning to measure light using the camera's built-in exposure meter-Film Speed/Sensor Sensitivity: Understanding the role of sensitivity in Exposure. ISO/ASA and Digital Noise-Lenses: Different Types of Lenses. Classification of Lenses by Focal Lengths. Angle of View. Fixed Focal Length and Zoom Lenses. Close up and Macro Lenses-Light and Color Temperature- Digital Post-Production: Introduction to File-Formats. RAW vs.JPG. Understanding resolution, resizing and basic image post processing using Photoshop. Exploring the software to visualize and create digital mosaics.
UNIT-V (10 Hrs)	**Introduction to Videography**: Concept development Storyboarding-Video Shooting - Framing, Camera movement etc. Video Editing- Defining communication-Sender, Channel and Receiver-Semiotics - Study of sign process (semiosis), meaning making and meaningful communication. Sign, Signifier, Signified-Denotation and Connotation.Story, narrative and see different perspectives-Identifying problems, opportunities and improvements. Differentiating problem, need and conflict-Persona study-Scenario study .
Textbooks:	
1.	Wallschlaeger, Charles, & Busic-Synder, Cynthia, Basic Visual Concepts and Principles for Artists, Architects and Designers, McGraw-Hill, (1992).
Reference Books:	
1.	Buxton, Bill, Sketching User Experience: Getting the Design Right and the Right Design (Interactive Technologies), Morgan Kaufmann, (2007).
2.	Caplin, Steve; Banks, Adam,The Complete Guide to Digital Illustration, Publisher: Watson - Guptill Publications, (2003).
e-Resources	
1.	S. Kolay, "Visual Communication Design for Digital Media – Jan–Feb 2019 (SEM1)," NPTEL, IIT Roorkee, : https://archive.nptel.ac.in/noc/courses/noc20/SEM2/noc20-ar15.
2.	B. K. Chakravarthy, "Visual Communication – Engineering Design," NPTEL, IIT Bombay, : https://archive.nptel.ac.in/courses/107/101/107101001

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CT3103	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

MOBILE COMPUTING

(For CSIT)

Course Objectives: Students are expected

1.	To introduce the basic concepts and principles in mobile computing. This includes major techniques involved, and networks & systems issues for the design and implementation of mobile computing systems and applications.
2.	To explore both theoretical and practical issues of mobile computing.
3.	To provide an opportunity for the students to understand the key components and technologies involved and to gain hands-on experience in building mobile applications.
4.	To understand latest network architecture and its interfaces.

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

S.No	Outcome	Knowledge Level
1.	**Explain** how mobile communication works, including signal types, modulation, and mobile device limitations.	K2
2.	**Describe** GSM, GPRS, and 2G–4G technologies, and compare wireless communication methods like CDMA and WCDMA.	K2
3.	**Analyze** how Mobile IP, handover, and location management work, and understand MANETs and wireless sensor networks.	K3
4.	**Understand** how mobile devices keep data in sync, and explain how mobile agents work.	K3
5.	**Determine** how WLAN, WAP, and mobile Internet protocols work and their use in short-range communication.	K3

SYLLABUS

UNIT-I (10Hrs)	**Mobile Communications**: An Overview- Mobile Communication-guided transmission, unguided transmission- signal propagation frequencies, antennae, modulation, modulation methods and standards for voice-oriented data communication standards, modulation methods and standards for data and voice communication, mobile computing- novel applications and limitations, mobile computing architecture, mobile system networks. Mobile devices and systems: Cellular networks and frequency reuse, Mobile smart phones, Smart mobiles and systems, handheld pocket computers, Handheld devices, Smart systems, Limitations of mobile devices
UNIT-II (10 Hrs)	**GSM and other 2G Architectures**: GSM-services and system architecture, Radio interfaces of GSM, Protocols of GSM, Localization, Call handling, GPRS system

	architecture. Wireless medium access control, CDMA, 3G,and 4G **Communication:** Modulation, Multiplexing, Controlling the medium access, Spread spectrum, Coding methods, IMT-20003G wireless communication standards, WCDMA 3G communication standards, CDMA 3G communication standards, Broadband wireless access, 4Gnetworks.
UNIT-III (10 Hrs)	**Mobile IP Network layer:** IP and Mobile IP network layers: OSI layer functions, TCP/IP and Internet protocol, Mobile internet protocol; Packet delivery and Handover Management; Location Management: Agent Discovery; Mobile TCP Introduction to Mobile Adhoc network: fixed infrastructure architecture, MANET infrastructure architecture; MANET: properties, spectrum, applications; Security in Ad-hoc network; Wireless sensor networks; sensor network applications.
UNIT-IV (10 Hrs)	**Synchronization:** Synchronization in mobile computing systems, Usage models for Synchronization in mobile application, Domain-dependant specific rules for data synchronization, Personal information manager, synchronization and conflict resolution strategies, synchronizer; Mobile agent: mobile agent design, aglets; Application Server
UNIT-V (10 Hrs)	**Mobile Wireless Short Range Networks and Mobile Internet**: Wireless networking and wireless LAN, Wireless LAN (WLAN) architecture, IEEE 802.11protocol layers, Wireless application protocol (WAP)-WAP1.1 architecture, wireless datagram protocol (WDP), Wireless Transport Layer Security (WTLS), wireless transaction and session layers, wireless application environment.
Textbooks:	
1.	"Mobile Computing," RAJ KAMAL 2nd edition, Oxford.
2.	ASOKE K TALUKDER, HASANAHMED, ROOPA R YAVAGAL, "Mobile Computing, Technology Applications and Service Creation" 2nd Edition, Mc Graw Hill.
3.	UWE Hansmann, Lother Merk, Martin S. Nocklous, Thomas Stober, "Principles of Mobile Computing," 2nd Edition, Springer.
Reference Books:	
1.	"Principles of Mobile Computing,", UWE Hansmann, Lother Merk, Martin S. Nocklous, Thomas Stober, 2nd Edition Springer.2003
2.	"Mobile Communications" 2nd Edition JOCHEN SCHILLER
e-Resources	
1.	S. Sen, *Mobile Computing*, NPTEL, https://onlinecourses.nptel.ac.in/noc23_cs81/preview
2.	Yonsei University, *Wireless Communications for Everybody*, Coursera, https://www.coursera.org/learn/wireless-communication

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CT3104	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

No SQL

(For CSIT)

Course Objectives: Students are expected

1.	Define, compare and use the four types of NoSQL Databases (Document-oriented, Key-Value Pairs, Column-oriented and Graph).
2.	Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
3.	Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases.

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

S.No	Outcome	Knowledge Level
1.	Explain Aggregate Data Models	K2
2.	Use distribution models for handling data replication and consistency	K3
3.	Apply key-value features for databases by considering suitable use cases	K3
4.	Use document and column-family features for databases	K3
5.	Model graph and schemaless databases	K3

SYLLABUS

UNIT-I (10Hrs)	Why NoSQL, The Value of Relational Databases, Impedance Mismatch, Application and Integration Databases, Aggregate Data Models; Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases.
UNIT-II (10 Hrs)	Distribution Models: Single Server, Shading, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication. Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums.
UNIT-III (10 Hrs)	What Is a Key-Value Store, Key-Value Store Features, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets.

UNIT-IV (10 Hrs)	Document Databases, What Is a Document Database, Features, Suitable Use Cases, When Not to Use, what is Column-Family Data Store, Features, Suitable use cases, when not to use
UNIT-V (10 Hrs)	Graph Databases, What Is a Graph Database, Features, Suitable Use Cases, Connected Data, Routing, Dispatch and Location-Based Services, Recommendation Engines, When Not to Use, Schema changes in RDBMS, Schema changes in a NOSQL Data Store
Textbooks:	
1.	Sadalage, P. & Fowler, No SQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012.
Reference Books:	
1.	Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN13: 978-9332557338)
2.	Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022)
3.	Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694)
e-Resources	
1.	G. Sen, *Introduction to NoSQL Databases and Key-Value Stores*, NPTEL (IIT Kanpur), Lecture 8. https://www.youtube.com/watch?v=-s29jUAkg70
2.	A.Chelliah, Introduction to NoSQL Databases, Coursera, University of Michigan. https://www.coursera.org/learn/introduction-to-nosql-databases

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CD3107	PE	3	--	--	3	30	70	3 Hrs.

ARTIFICIAL INTELLIGENCE

(For CSD & CSIT)

Course Objectives:

1.	Gain a historical perspective of Artificial Intelligence (AI) and its foundations.
2.	Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
3.	Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
4.	Experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool. Experiment with a machine learning model for simulation and analysis.
5.	Explore the current scope, potential, limitations, and implications of intelligent systems.

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

S.No	Outcome	Knowledge Level
1.	Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents.	K3
2.	Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game-based techniques to solve them.	K4
3.	Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing.	K3
4.	Attain the capability to represent various real life problem domains using logic-based techniques and use this to perform inference or planning.	K3
5.	Solve problems with uncertain information using Bayesian approaches.	K3

SYLLABUS

UNIT-I (10Hrs)	**Introduction to artificial intelligence:** Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of AI languages, current trends in AI, **Problem solving: state-space search and control strategies:** Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative-deepening a*, constraint satisfaction
UNIT-II (10 Hrs)	**Problem reduction and game playing:** Introduction, problem reduction, game playing, alpha-beta pruning, two-player perfect information games, **Logic concepts:** Introduction, propositional calculus, proportional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic

UNIT-III (10 Hrs)	**Knowledge representation:** Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames, **advanced knowledge representation techniques:** Introduction, conceptual dependency theory, script structure, cyc theory, case grammars, semantic web
UNIT-IV (10 Hrs)	**Uncertainty measure: probability theory:** Introduction, probability theory, Bayesian belief networks, certainty factor theory, dempster-shafer theory
UNIT-V (10 Hrs)	**Fuzzy sets and fuzzy logic:** Introduction, fuzzy sets, fuzzy set operations, types of membership functions, multi valued logic, fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems.

Textbooks:	
1.	Artificial intelligence, A modern Approach, 2nded, Stuart Russel, Peter Norvig, Prentice Hall
2.	Artificial Intelligence, Saroj Kaushik, 1st Edition, CENGAGE Learning, 2011.
Reference Books:	
1.	Artificial intelligence, structures and Strategies for Complex problem solving, 5th Edition, George F Lugar, PEA
2.	Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer, 2017
3.	Artificial Intelligence, A new Synthesis, 1st Edition, Nils J Nilsson, Elsevier, 1998
4.	Artificial Intelligence- 3rd Edition, Rich, Kevin Knight, Shiv Shankar B Nair, TMH
5.	Introduction To Artificial Intelligence and Expert Systems, 1st Edition, Patterson, Pearson India, 2015.
e-Resources	
1.	D. Khemani, *Artificial Intelligence: Search Methods for Problem Solving*, NPTEL, : https://onlinecourses.nptel.ac.in/noc23_cs67/preview
2.	IBM, *Introduction to Artificial Intelligence (AI)*, Coursera, : https://www.coursera.org/learn/introduction-to-ai

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CT3105	**PC**	**--**	**--**	**3**	**1.5**	**30**	**70**	**3 Hrs.**

FULL STACK DEVELOPMENT – MODULE – II LAB

(For CSD & CSIT)

Course Objectives: The main objective of the course is to

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

Course Outcomes:

S.No	Outcome	Knowledge Level
1	**Apply** routing, middleware, and HTTP methods in ExpressJS to handle server-side operations.	K3
2	**Analyze** dynamic web applications using ExpressJS with form handling, sessions, and authentication mechanisms.	K4
3	**Differentiate** MongoDB with ExpressJS to perform database operations and build RESTful APIs.	K4
4	**Examine** interactive user interfaces using ReactJS components, props, state, and event handling.	K4
5	**Outline** single-page applications using ReactJS features like routing, hooks, and form handling to enhance user experience.	K4

SYLLABUS

1.	**ExpressJS – Routing, HTTP Methods, Middleware.** a. Write a program to define a route, Handling Routes, Route Parameters, Query Parameters and URL building. b. Write a program to accept data, retrieve data and delete a specified resource using http methods. **c.** Write a program to show the working of middleware.
2.	**ExpressJS – Templating, Form Data** a. Write a program using templating engine. b. Write a program to work with form data.
3.	**ExpressJS – Cookies, Sessions, Authentication** a. Write a program for session management using cookies and sessions. **b.** Write a program for user authentication.

4.	**ExpressJS – Database, RESTful APIs** a. Write a program to connect MongoDB database using Mangoose and perform CRUD operations. b. Write a program to develop a single page application using RESTful APIs.
5.	**ReactJS – Render HTML, JSX, Components – function & Class** a. Write a program to render HTML to a web page. b. Write a program for writing markup with JSX. c. Write a program for creating and nesting components (function and class).
6.	**ReactJS – Props and States, Styles, Respond to Events** a. Write a program to work with props and states. b. Write a program to add styles (CSS & Sass Styling) and display data. c. Write a program for responding to events.
7.	**ReactJS – Conditional Rendering, Rendering Lists, React Forms** a. Write a program for conditional rendering. b. Write a program for rendering lists. c. Write a program for working with different form fields using react forms.
8.	**ReactJS – React Router, Updating the Screen** a. Write a program for routing to different pages using react router. b. Write a program for updating the screen.
9.	**ReactJS – Hooks, Sharing data between Components** a. Write a program to understand the importance of using hooks. **b.** Write a program for sharing data between components.
10.	**MongoDB – Installation, Configuration, CRUD operations** a. Install MongoDB and configure ATLAS b. Write MongoDB queries to perform CRUD operations on document using insert(), find(), update(), remove()
11.	**MongoDB – Databases, Collections and Records** a. Write MongoDB queries to Create and drop databases and collections. b. Write MongoDB queries to work with records using find(), limit(), sort(), createIndex(), aggregate().
12.	**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.
Text Books:	
1.	Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, APress, O'Reilly.
2.	Node.Js in Action, Mike Cantelon, Mark Harter, T.J. Holowaychuk, Nathan Rajlich, Manning Publications. (Chapters 1-11)
3.	React Quickly, AzatMardan,Manning Publications(Chapters 1-8,12-14)
e-Resources:	

1.	MDN Contributors, "Express routing," *Mozilla Developer Network*. https://developer.mozilla.org/en-US/docs/Learn/Server-side/Express_Nodejs/routes
2.	GeeksforGeeks, "Express.js Routing," *GeeksforGeeks*. [Online]. https://www.geeksforgeeks.org/express-js-routing/
3.	NPTEL, "Server-side Development using NodeJS, Express and MongoDB," *NPTEL Online Course*. https://onlinecourses.nptel.ac.in/noc23_cs96

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CT3106	**PC**	**--**	**--**	**3**	**1.5**	**30**	**70**	**3 Hrs.**

DATA MINING AND DATA WAREHOUSING LAB

(For CSD & CSIT)

Course Objectives: The main objective of the course is 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:

S.No	Outcome	Knowledge Level
1	Design and build data warehouses and perform OLAP operations using ETL tools and multidimensional schemas.	K3
2	Explore and apply WEKA toolkit features for data preprocessing, visualization, and model evaluation.	K4
3	Perform association rule mining using Apriori and FP-Growth; analyze rules and effects of discretization.	K4
4	Evaluate classification techniques and compare results using performance metrics like ROC and confusion matrix.	K4
5	Apply clustering techniques in analyze clusters, and visualize results for insights.	K4

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 type 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 ➢ 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. ➢ Explore various options available in Weka for preprocessing data and apply Unsupervised filters like Discretization, Resample filter, etc. on each dataset
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.	Write a java program to prepare a simulated data set with unique instances.
9.	Write a Python program to generate frequent item sets / association rules using Apriori algorithm.
10.	Write a program to calculate chi-square value using Python/R. Report your observation.
11.	Write a program of Naive Bayesian classification using Python/R programming language.
12.	Implement a Java/R program to perform Apriori algorithm.
13.	Write a R program to cluster your choice of data using simple k-means algorithm using JDK.
14.	Write a program of cluster analysis using simple k-means algorithm Python/R programming language.
15.	Write a program to compute/display dissimilarity matrix (for your own dataset containing at least four instances with two attributes) using Python.
16.	Visualize the datasets using matplotlib in python/R.(Histogram, Box plot, Bar chart, Pie chart etc
Reference Books:	
1.	Data Warehousing Fundamentals for IT Professionals: Paulraj Ponniah, Wiley.
2.	Machine Learning with WEKA: Ian H. Witten, Eibe Frank, The University of Waikato.
e-resource:	
1.	https://online.stanford.edu/courses/xine257-data-warehousing-and-business-intelligence
2.	https://www.cs.waikato.ac.nz/ml/weka/documentation.html

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23BS3101	SEC		1	2	2	30	70	3 Hrs.

SOFT SKILLS

(For AIDS, CIC, CSIT, CSD, ECE and EEE)

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.

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CT3107	**ES**	**--**	**--**	**2**	**1**	**30**	**70**	**3 Hrs.**

TINKERING LAB (UI DESIGN USING FLUTTER)

(For CSD & CSIT)

Course Objectives: The main objective of the course is to

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

Course Outcomes:

S.No	Outcome	Knowledge Level
1	Install Flutter and Dart SDK, and write basic Dart programs to demonstrate syntax and language fundamentals.	K3
2	Build responsive UIs using Flutter widgets, layout structures, and media queries for multiple screen sizes.	K4
3	Implement navigation and state management using Navigator, setState, and Provider.	K4
4	Design forms with validation, apply themes, and create custom widgets for reusable UI components.	K4
5	Integrate REST APIs, display dynamic data, and debug Flutter apps using unit testing and developer tools.	K5

SYLLABUS

1.	a) Install Flutter and Dart SDK. b) Write a simple Dart program to understand the language basics.
2.	a) Explore various Flutter widgets (Text, Image, Container, etc.). b) Implement different layout structures using Row, Column, and Stack widgets.
3.	a) Design a responsive UI that adapts to different screen sizes. b) Implement media queries and breakpoints for responsiveness.
4.	a) Set up navigation between different screens using Navigator. b) Implement navigation with named routes.
5.	a) Learn about stateful and stateless widgets. b) Implement state management using set State and Provider.
6.	a) Create custom widgets for specific UI elements. b) Apply styling using themes and custom styles.

7.	a) Design a form with various input fields. b) Implement form validation and error handling.
8.	a) Add animations to UI elements using Flutter's animation framework. b) Experiment with different types of animations (fade, slide, etc.).
9.	a) Fetch data from a REST API. b) Display the fetched data in a meaningful way in the UI.
10.	a) Write unit tests for UI components. b) Use Flutter's debugging tools to identify and fix issues.
Reference Books:	
1.	Marco L. Napoli, Beginning Flutter: A Hands-on Guide to App Development.
2.	Rap Payne, Beginning App Development with Flutter: Create Cross-Platform Mobile Apps 1st Edition, Apres.

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

COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

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
B23CT3201	Cryptography & Network Security	PC	3	0	0	3	30	70	100
B23CD3202	Machine Learning	PC	3	0	0	3	30	70	100
B23CT3202	Software Engineering	PC	3	0	0	3	30	70	100
#PE-II	Professional Elective-II	PE-II	3	0	0	3	30	70	100
#PE-III	Professional Elective-III	PE-III	3	0	0	3	30	70	100
#OE-II	Open Elective-II	OE-2	3	0	0	3	30	70	100
B23CT3211	Cryptography & Network Security Lab	PC	0	0	3	1.5	30	70	100
B23CT3212	Machine Learning using Python Lab	PC	0	0	3	1.5	30	70	100
B23CT3213	Internet of Things Lab	SEC	0	1	2	2	30	70	100
B23AC3201	Technical Paper Writing & IPR	AC	2	--	--	--	30	--	30
B23MC3201	Employability Skills	MC	2	--	--	--	30	--	30
		TOTAL	**22**	**01**	**08**	**23**	**330**	**630**	**960**

	Course Code	Course
# PE-II	B23CT3203	Automata Theory and Compiler Design
	B23CT3204	Reinforcement Learning
	B23CD3206	Cloud Computing
	B23CT3205	Network Programming
	B23CT3206	MOOCS-II
# PE -III	B23CD3209	Object Oriented Analysis and Design
	B23CT3207	Data Visualization
	B23CT3208	Distributed Systems
	B23CT3209	Information Retrieval System
	B23CT3210	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
B23CT3201	**PC**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

CRYPTOGRAPHY & NETWORK SECURITY

(For CSD & CSIT)

Course Objectives:

1.	Student will be able to understand security issues related to computer networks and learn different symmetric key techniques
2.	Students will be able learn mathematic of cryptography for symmetric and Asymmetric algorithms and apply this knowledge to understand the Cryptographic algorithms
3.	Students will be able learn different types of symmetric and Asymmetric algorithms
4.	Students will be able learn different algorithms of Hash functions, message authentication and digital signature and their importance to the security
5.	Discuss the fundamental ideas of Symmetric and Asymmetric cryptographic Algorithms
6.	Students will be able learn different Enhanced security protocols of Application Layer, Transport Layer and Network layer

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

S.No	Outcome	Knowledge Level
1.	**Explain** the objectives of information security.	K2
2.	**Demonstrate** the importance and application of each of confidentiality, integrity, authentication and availability	K3
3.	**Interpret** the basic categories of threats to computers and networks	K3
4.	**Analyze** the Mathematics of Cryptography	K4
5.	**Examine** the Network layer, Transport Layer and Application layer Protocols Enhanced security mechanisms	K4

SYLLABUS

UNIT-I (10Hrs)	**Security Concepts:** Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography. Classical Encryption Techniques-symmetric cipher model, Substitution techniques, Transposition techniques, Rotor Machines, Steganography.
UNIT-II (10 Hrs)	**Introduction to Symmetric Cryptography: Algebraic Structures**-Groups, Rings, Fields, GF(2^n) fields, Polynomials. **Mathematics of Asymmetric cryptography:** Primes, Checking For Primness, Eulers phi-functions, Fermat's Little Theorem, Euler's Theorem, Generating Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Quadratic Congruence, Exponentiation And Logarithm.
UNIT-III	**Symmetric key Ciphers:** Block Cipher principles, DES, AES, Blowfish, IDEA, Block

(10 Hrs)	cipher operation, Stream ciphers: RC4, RC5 **Asymmetric key Ciphers:** Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange, Elgamal Cryptographic system, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.
UNIT-IV (10 Hrs)	**Cryptographic Hash Functions:** Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithms (SHA) **Message Authentication Codes:** Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MAC'S, MAC'S Based on Hash Functions: HMAC, MAC'S Based on Block Ciphers: DAA And CMAC **Digital Signatures:** Digital Signatures, Elgamal Digital Signature Scheme, Elliptic Curve Digital Signature Algorithm, RSA-PSS Digital Signature Algorithm.
UNIT-V (10 Hrs)	**Network and Internet Security: Transport-Level Security:** Web Security Considerations, Transport Level Security, HTTPS, SSH. **IP Security:** IP Security Overview, IP Security Policy, Encapsulating Security Payload, Authentication Header Protocol. **Electronic-Mail Security:** Internet-mail Security, Email Format, Email Threats and Comprehensive Email Security, S/MIME, PGP.

Textbooks:	
1.	Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 7th Edition, 2017
2.	Cryptography and Network Security: Behrouz A. Forouzan Debdeep, Mc Graw Hill, 3rd Edition, 2015
Reference Books:	
1.	Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition
2.	Introduction to Cryptography with Coding Theory: Wade Trappe, Lawrence C. Washington, Pearson.
3.	Modern Cryptography: Theory and Practice ByWenbo Mao. Pearson
e-Resources	
1.	Cyber Security Experts, "Cyber Security Course: Learn Network Security," Udemy https://www.udemy.com/course/cyber-security-course/
2.	Cybrary, "Cryptography Course,"https://www.cybrary.it/course/cryptography/
3.	RITx, "Network Security," edX, https://www.edx.org/course/network-security
4.	D. Boneh, "Cryptography I," Coursera, Stanford University, https://www.coursera.org/learn/crypto
5.	D. Mukhopadhyay, "Computer Networks and Internet Protocol,", https://nptel.ac.in/courses/106105031

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ENGINEERING COLLEGE
AUTONOMOUS

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CD3202	**PC**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

MACHINE LEARNING

(For CSD & CSIT)

Course Objectives:

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

Course Outcomes

S.No	Outcome	Knowledge Level
1.	**Apply** the fundamentals of Machine Learning including learning paradigms, stages, and types of data involved in the ML pipeline.	K2
2.	**Apply** proximity-based models like K-Nearest Neighbor for classification and regression, and *evaluate* their performance using appropriate metrics.	K2
3.	**Construct** decision tree and Bayes-based models for classification and regression and *assess* their strengths and limitations in practical scenarios.	K3
4.	**Implement** and analyze Perceptions, SVM, and Logistic Regression for linearly and non-linearly separable data.	K4
5.	**Design** clustering techniques for unsupervised learning, and *evaluate* their performance on complex datasets.	K4

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)	**Nearest Neighbor-Based Models:** Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures, K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.
UNIT-III (10 Hrs)	**Models Based on Decision Trees:** Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random

	Forests for Classification and Regression. The Bayes Classifier: Introduction to the Bayes Classifier, Bayes' Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification, Class Conditional Independence and Naive Bayes Classifier (NBC).
UNIT-IV (10 Hrs)	**Linear Discriminants for Machine Learning:** Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Nonseparable Case, Nonlinear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multilayer Perceptrons (MLPs), Backpropagation for Training an MLP.
UNIT-V (10 Hrs)	**Clustering :** Introduction to Clustering, Partitioning of Data, Matrix Factorization, Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering.
Text Books:	
1.	"Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana, Universities Press (India), 2024
Reference Books:	
1.	"Machine Learning", Tom M. Mitchell, McGraw-Hill Publication, 2017.
2.	"Machine Learning in Action", Peter Harrington, Dream Tech
3.	"Introduction to Data Mining", Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th Edition, 2019.
e-Resources	
1.	Prof. Balaraman Ravindran Professor in Computer Science at IIT Madras, Introduction to Machine Learning NPTEL:https://onlinecourses.nptel.ac.in/noc21_cs24/preview

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CT3202	PC	3	--	--	3	30	70	3 Hrs.

SOFTWARE ENGINEERING

(For CSIT)

Course Objectives: Students are expected

1.	Software life cycle models, Software requirements and SRS document.
2.	Project Planning, quality control and ensuring good quality software.
3.	Software Testing strategies, use of CASE tools, Implementation issues, validation &verification procedures.

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

S.No	Outcome	Knowledge Level
1.	Explain the evolution of software engineering, life cycle models, and development practices, and distinguish between traditional and agile methodologies.	K3
2.	Estimate effort, time, and cost using COCOMO and Halstead models, and analyze requirements using formal methods to create a complete SRS."	K3
3.	Design software systems using structured and function-oriented methodologies, and demonstrate understanding of good design principles, modularity, cohesion, and coupling	K3
4.	Build and test software, fix errors, and check quality using ISO 9000 and Six Sigma.	K3
5.	Use CASE tools, maintenance methods, and reuse techniques to improve productivity and manage the software lifecycle.	K3

SYLLABUS

UNIT-I (10Hrs)	**Introduction:** Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering. **Software Life Cycle Models:** Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model, Spiral model.
UNIT-II (10 Hrs)	**Software Project Management:** Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, risk management. **Requirements Analysis and Specification:** Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.

UNIT-III (10 Hrs)	**Software Design:** Overview of the design process, how to characterize a good software design? Layered arrangement of modules, Cohesion and Coupling. Approaches to software design. **Agility:** Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, Tool Set for the Agile Process (Text Book 2) **Function-Oriented Software Design:** Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review. **User Interface Design:** Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.
UNIT-IV (10 Hrs)	**Coding And Testing:** Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Debugging, Program analysis tools, Integration testing**,** testing object-oriented programs, Smoke testing, and some general issues associated with testing. **Software Reliability and Quality Management:** Software reliability. Statistical testing,Softwarequality,SoftwarequalitymanagementsystemISO9000.SEICapabilitymaturitymodel.Fewother important quality standards, and Six Sigma
UNIT-V (10 Hrs)	**Computer-Aided Software Engineering (Case):** CASE and its scope, CASE environment, CASE support in the software life cycle, other characteristics of CASE tools, Towards second generation CASE Tool, and Architecture of a CASE Environment. **Software Maintenance:** Characteristics of software maintenance, Software reverse engineering, and Software maintenance process models and Estimation of maintenance cost. **Software Reuse:** Reuse-definition, introduction, reason behind no reuse so far, Basic issues in any reuse program, A reuse approach, and Reuse at organization level.

Textbooks:	
1.	Fundamentals of Software Engineering, Rajib Mall, 5th Edition, PHI.
2.	Software Engineering A practitioner's Approach, Roger S. Pressman, 9thEdition, McGraw Hill International Edition.
Reference Books:	
1.	Software Engineering, Ian Sommerville, 10th Edition,Pearson.
2.	Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.
e-Resources	
1.	R. Mall, *Software Engineering*, National Programme on Technology Enhanced Learning (NPTEL), IIT Kharagpur. : https://nptel.ac.in/courses/106/105/106105182/
2.	Infosys Ltd., *Software Engineering*, Infosys Springboard. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01260589506387148827_shared/overview.
3.	Infosys Ltd., *Agile Software Development*, Infosys Springboard. : https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CT3203	PE	3	--	--	3	30	70	3 Hrs.

AUTOMATA THEORY AND COMPILER DESIGN

(For CSD & CSIT)

Course Objectives: The main objective of the course is 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

S.No	Outcome	Knowledge Level
1.	**Explain** the concepts of data warehousing & OLAP technology.	K3
2.	**Apply** data pre processing techniques.	K3
3.	**Formulate** and apply classification algorithms and their performance evaluation metrics on sample datasets.	K4
4.	**Apply** Apriori and FP-Growth algorithms to generate frequent itemsets and strong rules using pruning and compact representations.	K4
5.	**Apply** and compare partitioning, hierarchical, density based and grid based clustering algorithms.	K4

SYLLABUS

UNIT-I (10Hrs)	Introduction to Finite Automata: Structural Representations, Automata and Complexity, the Central Concepts of Automata Theory – Alphabets, Strings, Languages, Problems. Nondeterministic Finite Automata: Formal Definition, an application, Text Search, Finite Automata with Epsilon-Transitions. Deterministic Finite Automata: Definition of DFA, How A DFA Process Strings, The language of DFA, Conversion of NFA with €-transitions to NFA without €-transitions. Conversion of NFA to DFA.
UNIT-II (10 Hrs)	Regular Expressions: Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Conversion of Finite Automata to Regular Expressions. Pumping Lemma for Regular Languages: Statement of the pumping lemma, Applications of the Pumping Lemma. Context-Free Grammars: Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Parse Trees, Ambiguity in Grammars and Languages.

UNIT-III (10 Hrs)	Push Down Automata: Definition of the Pushdown Automaton, the Languages of a PDA, Equivalence of PDA's and CFG's, Acceptance by final state Turing Machines: Introduction to Turing Machine, Formal Description, Instantaneous description, The language of a Turing machine Undecidability: Undecidability, A Language that is Not Recursively Enumerable, An Undecidable Problem That is RE, Undecidable Problems about Turing Machines.
UNIT-IV (10 Hrs)	Introduction: The structure of a compiler, Lexical Analysis: The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, The Lexical- Analyzer Generator Lex, Syntax Analysis: Introduction, Context-Free Grammars, Writing a Grammar, Top-Down Parsing, Bottom Up Parsing, Introduction to LR Parsing: Simple LR, More Powerful LR Parsers.
UNIT-V (10 Hrs)	Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Syntax Directed Translation Schemes, Implementing L-Attributed SDD's. Intermediate-Code Generation: Variants of Syntax Trees, Three-Address Code Run-Time Environments: Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management.
Textbooks:	
1.	Introduction to Automata Theory, Languages, and Computation, 3nd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
2.	Compilers: Principles, Techniques and Tools, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman, 2nd Edition, Pearson.
3.	Theory of Computer Science – Automata languages and computation, Mishra and Chandrashekaran, 2nd Edition, PHI.
Reference Books:	
1.	Introduction to Formal languages Automata Theory and Computation, Kamala Krithivasan, Rama R, Pearson.
2.	Introduction to Languages and The Theory of Computation, John C Martin, TMH.
3.	lex &yacc – John R. Levine, Tony Mason, Doug Brown, O'reilly.
4.	Compiler Construction, Kenneth C. Louden, Thomson. Course Technology.
e-Resources:	
1.	Dr. Sukhendu Das, Associate Professor, Dept. of Computer Science and Engineering, NPTEL, Indian Institute of Technology Madras. https://nptel.ac.in/courses/106106090
2.	Dariush Derakhshani, Théotime Vaillant, Game Design: Art and Concepts Specialization,California Institute of the Arts https://www.coursera.org/learn/game-design

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CT3204	PE	3	--	--	3	30	70	3 Hrs.

REINFORCEMENT LEARNING

(For CSIT)

Course Objectives:

1.	Define the key features of reinforcement learning that distinguishes it from AI and non-interactive machine learning.
2.	Given an application problem decide if it should be formulated as a RL problem; if yes be able to define it formally, state what algorithm is best suited for addressing it and justify your answer.

Course Outcomes

S.No	Outcome	Knowledge Level
1.	**Explain** basic concepts of reinforcement learning and solve simple problems like multi-armed bandits.	K2
2.	**Illustrate** Markov Decision Processes and use dynamic programming to find optimal policies.	K3
3.	**Apply** Monte Carlo and Temporal-Difference methods like TD(0), Sarsa, and Q-learning for prediction and control.	K3
4.	**Describe** how eligibility traces work in TD learning and implement advanced methods like TD(λ) and Q(λ).	K4
5.	**Apply** planning techniques like prioritized sweeping and Monte Carlo Tree Search to improve learning.	K4

SYLLABUS

UNIT-I (10Hrs)	**Reinforcement Learning Problem**: Introduction, Elements of Reinforcement Learning, Limitations and Scope, Tic-Tac-Toe, **Multi-arm Bandits**: n-Armed Bandit Problem, Action-Value Methods, Incremental Implementation, Tracking Nonstationary Problem, Optimistic Initial Values, Upper-Confidence-Bound Action Selection, Gradient Bandit, Associative Search.
UNIT-II (10 Hrs)	**Finite Markov Decision Processes:** Agent-Environment Interface, Markov Property, Markov Decision Processes, Value Functions, Optimal Value Functions, Optimality and Approximation, **Dynamic Programming**: Policy- Evaluation, Improvement, Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming.

UNIT-III (10 Hrs)	**Monte Carlo Methods**: Monte Carlo- Prediction, Estimation of Action Values, Control, Control without Exploring Start, **Temporal- Difference learning**: TD Prediction, Advantages of TD Prediction Methods, Optimality of TD(0), Sarsa: On-Policy TD Control, Q-Learning, Games, Afterstates.
UNIT-IV (10 Hrs)	**Eligibility Traces:** n-Step TD Prediction, Forward and Backward View of TD(λ), Equivalences of Forward and Backward Views, saras(λ), Watkin's Q(λ), Off-policy Eligibility Traces using Important Sampling, Variable λ.
UNIT-V (10 Hrs)	**Planning and Learning with Tabular Methods:** Models and Planning, Integrating Planning, Acting and Learning, Prioritized Sweeping, Full vs. Sample Backups, Trajectory Sampling, Heuristic Search, Monte Carlo Tree Search.
Textbooks:	
1.	Rich S. Sutton, Andrew G. Barto, Reinforcement Learning: An Introduction, 2nd Edition, MIT Press, 2015.
2.	Boris Belousov, Hany Abdulsamad, Pascal Klink, Simone parisi, Reinforcement Learning Algorithms: Analysis and Applications, 1st Edition, Springer, 2021.
Reference Books:	
1.	Phil Winder, Reinforcement Learning: Industrial Applications of Intelligent Agent, 1st Edition, O'Reilly, 2020.
2.	Kyriakos G. Vamvoudakis, Yan Wan, Frank, L. Lewis, Derya Cansever, Handbook of Reinforcement Learning and Control, 1st Edition, Springer, 2021.
e-Resources:	
1.	B. Ravindran, "Reinforcement Learning," NPTEL, https://onlinecourses.nptel.ac.in/noc22_cs34/preview.

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CD3206	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

CLOUD COMPUTING

(For CSD & CSIT)

Course Objectives: The main objectives of the course is to provide students with:

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

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

S.No	Outcome	Knowledge Level
1.	Summarize concepts for state-of-the-art cloud computing	K2
2.	Explain how virtualization technology enabling cloud computing.	K2
3.	Use algorithms for cloud resource management and scheduling.	K3
4.	Describe storage system architectures and security fundamentals for cloud applications.	K2
5.	Determine suitable host provider for cloud applications development.	K4

SYLLABUS

UNIT-I (10Hrs)	**Introduction to Cloud Computing**: Fundamentals Cloud computing at a glance, defining a cloud, cloud computing reference model, types of services (IaaS, PaaS, SaaS), cloud deployment models (public, private, hybrid), utility computing, cloud computing characteristics and benefits, cloud service providers (Amazon Web Services, Microsoft Azure, Google App Engine).
UNIT-II (10 Hrs)	**Cloud Enabling Technologies**: 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), building blocks of containers, container platforms (LXC, Docker), container orchestration, public cloud VM (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, cloud shared responsibility model, 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. Open Faas) serverless platforms, Internet of Things (IoT), applications, cloud-centric IoT and layers, edge and fog computing, DevOps, infrastructure-as-code, quantum cloud 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)
e-Resources	
1.	NPTEL, "Cloud Computing," https://onlinecourses.nptel.ac.in/noc25_cs11.

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CT3205	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

NETWORK PROGRAMMING

(For CSIT)

Course Objectives:

1.	Demonstrate mastery of main protocols comprising the Internet.
2.	Develop skills in network programming techniques.
3.	Implement network services that communicate through the Internet.
4.	Apply the client-server model in networking applications.
5.	Practice networking commands available through the operating system.

Course Outcomes

S.No	Outcome	Knowledge Level
1.	**Identifying** various models and sockets	K3
2.	**Demonstrate** different TCP Echo server functions and I/O models	K3
3.	**Analyze** IPV4 and IPV6 Socket options	K4
4.	**Identifying** daemon processing and Advanced input and output functions	K4
5.	**Analyze** Broadcasting and multicasting	K4

SYLLABUS

UNIT-I (10Hrs)	**Introduction to Network Programming**: Introduction to Network Programming: OSI model, UNIX standards, TCP and UDP & TCP connection establishment and Format, Buffer sizes and limitation, standard internet services, Protocol usage by common internet application Elementary Sockets: Sockets introduction, Elementary TCP sockets.
UNIT-II (10 Hrs)	**TCP client server:** Introduction, TCP Echo server functions, Normal startup, terminate and signal handling server process termination, Crashing and Rebooting of server host shutdown of server host.I/O Multiplexing: I/O Models, the select and poll functions, Batch input and buffering, shutdown function.
UNIT-III (10 Hrs)	**UDP and Socket options**: Elementary UDP sockets: Introduction UDP Echo server functions, lost datagram, summary of UDP example, Lack of flow control with UDP. **Socket options**: getsockopt and setsockopt functions. Socket states, Generic socket options IPV4 socket options, IPV6 socket options, ICMPV6 socket options and TCP socket options, SCTP socket options, fcntl function.

UNIT-IV (10 Hrs)	**Advanced Sockets and Daemon Processes**: IPV4 and IPV6 interoperability, introduction, IPV4 client: IPV6 server, IPV6 client: IPV4 Server, IPV6 Address-testing macros. Daemon Processes and inetdSuperserver –Introduction, syslogd Daemon, syslog Function, daemon_init Function, inetd Daemon, daemon_inetd. Advanced I/O functions: Socket timeouts, recv and send functions, ready and writev functions, recvmsg and send msg functions, Ancillary data.
UNIT-V (10 Hrs)	**Broadcasting and Multicasting**: Broadcasting introduction, broadcast addresses, unicast versus Broadcast, dg_cli function using broadcasting, race conditions, Multicasting addresses, multicasting versus broadcasting on a LAN, multicasting on a WAN, source-specific multicast, multcast socket options. **Raw Sockets**: Introduction, Raw Socket Creation, Raw Socket Output, Raw Socket Input, Ping Program, Traceroute Program
Textbooks:	
1.	UNIX Network Programming, by W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, Pearson Education
2.	UNIX Network Programming, 1st Edition, W. Richard Stevens. PHI.
Reference Books:	
1.	UNIX Systems Programming using C++ T CHAN, PHI.
2.	UNIX for Programmers and Users, 3rd Edition Graham GLASS, King abls, Pearson Education.
3.	Advanced UNIX Programming 2nd Edition M. J. ROCHKIND, Pearson Education.
e-Resources	
1.	TutorialsPoint, "Computer Network TCP/IP Model," *TutorialsPoint*. https://www.tutorialspoint.com/data_communication_computer_network/tcp_ip_model.htm
2.	NPTEL, “Computer Networks and Internet Protocol,” *NPTEL Online Certification*, https://onlinecourses.nptel.ac.in/noc23_cs88
3.	GeeksforGeeks, "Socket Programming in C/C++,"https://www.geeksforgeeks.org/socket-programming-cc/

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CD3209	PE	3	--	--	3	30	70	3 Hrs.

OBJECT ORIENTED ANALYSIS AND DESIGN

(For CSD & CSIT)

Course Objectives:

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

Course Outcomes

S.No	Outcome	Knowledge Level
1.	Understand the inherent complexity in software systems and describe strategies for designing and managing complex systems.	K2
2.	Apply the principles and concepts of UML modeling to analyze and design object-oriented systems.	K3
3.	Construct class, object, and package diagrams for advanced structural modeling of real-world systems.	K3
4.	Develop behavioral models such as use case, activity, and interaction diagrams to represent system functionality and user interactions.	K4
5.	Design state machines, component, and deployment diagrams to model advanced behaviors and architecture of complex systems.	K4

SYLLABUS

UNIT-I (10Hrs)	**Introduction:** The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems. **Case Study:** System Architecture: Satellite-Based Navigation
UNIT-II (10 Hrs)	**Introduction to UML:** Importance of modeling, principles of modeling, object-oriented modeling, conceptual model of the UML, Architecture, and Software Development Life Cycle. **Basic Structural Modeling:** Classes, Relationships, common Mechanisms, and diagrams. **Case Study:** Control System: Traffic Management.

UNIT-III (10 Hrs)	**Class & Object Diagrams:** Terms, concepts, modelling techniques for Class & Object Diagrams. **Advanced Structural Modeling:** Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. **CaseStudy:** AI: Cryptanalysis.
UNIT-IV (10 Hrs)	**Basic Behavioral Modeling-I:** Interactions, Interaction diagrams Use cases, Use case Diagrams, Activity Diagrams. **Case Study:** Web Application: Vacation Tracking System.
UNIT-V (10 Hrs)	**Advanced Behavioral Modelling:** Events and signals, state machines, processes and Threads, time and space, state chart diagrams. **Architectural Modelling:** Component, Deployment, Component diagrams and Deployment diagrams **CaseStudy:** Weather Forecasting.
Textbooks:	
1.	Grady BOOCH, RobertA.Maksimchuk, Michael W.ENGLE, Bobbi J.Young, JimConallen, KelliaHouston, "Object- Oriented Analysis and Design with Applications", 3rd edition,2013,PEARSON.
2.	Grady Booch, James Rumbaugh, IvarJacobson: The Unified Modeling Language User Guide, Pearson Education.
Reference Books:	
1.	Meilir Page- Jones: Fundamentals of Object-Oriented Design in UML, Pearson Education.
2.	Pascal Roques: Modeling Software Systems Using UML2, WILEY- Dream tech India Pvt. Ltd.
3.	Atul Kahate: Object Oriented Analysis &Design, The McGraw-Hill Companies.
4.	Appling UML and Patterns: An introduction to Object–Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.
e-Resources:	
1.	TutorialsPoint: https://www.tutorialspoint.com/object_oriented_analysis_design/index.htm
2.	Dr. Das is currently the Head of Rajendra Mishra School of Engineering Entrepreneurship, the Professor-in Charge of the upcoming Research Park of IIT Kharagpur. https://onlinecourses.nptel.ac.in/noc19_cs48/

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CT3207	PE	3	--	--	3	30	70	3 Hrs.

DATA VISUALISATION

(For CSIT)

Course Objectives:

1.	To learn different statistical methods for Data visualization.
2.	To know categories of visualization and application areas
3.	To understand the role of user interaction within visualizations
4.	To understand the visualization design process

Course Outcomes

S.No	Outcome	Knowledge Level
1.	Explain the basics of Data Visualization for various representations	K2
2.	Apply visualizing distributions techniques in data representation.	K3
3.	Find visualization of time series, proportions & associations.	K3
4.	Apply visualization on Trends and uncertainty.	K3
5.	Apply principles of proportions	K3

SYLLABUS

UNIT-I (10Hrs)	**Introduction To Visualization**: Visualizing Data-Mapping Data onto Aesthetics, Aesthetics and Types of Data, Scales Map Data Values onto Aesthetics, Coordinate Systems and Axes- Cartesian Coordinates, Nonlinear Axes, Coordinate Systems with Curved Axes, Color Scales-Color as a Tool to Distinguish, Color to Represent Data Values, Color as a Tool to Highlight, Directory of Visualizations- Amounts, Distributions, Proportions, x–y relationships, Geospatial Data.
UNIT-II (10 Hrs)	**Visualizing Distributions**: Visualizing Amounts-Bar Plots, Grouped and Stacked Bars, Dot Plots and Heat maps, Visualizing Distributions: Histograms and Density Plots-Visualizing a Single Distribution, Visualizing Multiple Distributions at the Same Time, Visualizing Distributions: Empirical Cumulative Distribution Functions and Q-Q Plots Empirical Cumulative Distribution Functions, Highly Skewed Distributions, Quantile Plots, Visualizing Many Distributions at Once-Visualizing Distributions Along the Vertical Axis, Visualizing Distributions Along the Horizontal Axis.

UNIT-III (10 Hrs)	**Visualizing Associations & Time Series**: Visualizing Proportions-A Case for Pie Charts, A Case for Side-by-Side Bars, A Case for Stacked Bars and Stacked Densities, Visualizing Proportions Separately as Parts of the Total Visualizing Nested Proportions- Nested Proportions Gone Wrong, Mosaic Plots and Tree maps, Nested Pies ,Parallel Sets. Visualizing Associations Among Two or More Quantitative Variables-Scatter plots, Correlograms, Dimension Reduction, Paired Data. Visualizing Time Series and Other Functions of an Independent Variable-Individual Time Series , Multiple Time Series and Dose–Response Curves, Time Series of Two or More Response Variables.
UNIT-IV (10 Hrs)	**Visualizing Uncertainty**: Visualizing Trends-Smoothing, Showing Trends with a Defined Functional Form, Detrending and Time-Series Decomposition, Visualizing Geospatial Data-Projections, Layers, Choropleth Mapping, Cartograms, Visualizing Uncertainty Framing Probabilities as Frequencies, Visualizing the Uncertainty of Point Estimates, Visualizing the Uncertainty of Curve Fits, Hypothetical Outcome Plots.
UNIT-V (10 Hrs)	**Principle Of Proportiona Link**: The Principle of Proportional Ink-Visualizations Along Linear Axes, Visualizations Along Logarithmic Axes, Direct Area Visualizations, Handling Overlapping Points-Partial Transparency and Jittering, 2DHistograms, Contour Lines, Common Pitfalls of Color Use-Encoding Too Much or Irrelevant Information ,Using Non-monotonic Color Scales to Encode Data Values, Not Designing for Color-Vision Deficiency.
Textbooks:	
1.	Claus Wilke, “Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures”, 1st edition, O’Reilly Media Inc, 2019.
2.	Ossama Embarak, Data Analysis and Visualization Using Python: Analyze Data to Create Visualizations for BI Systems, Apress, 2018.
Reference Books:	
1.	Tony Fischetti, Brett Lantz, R: Data Analysis and Visualization,O’Reilly, 2016.
e-Resources	
1.	S. Mukhopadhyay, *Data Visualization*, NPTEL, https://onlinecourses.nptel.ac.in/noc21_ma69/preview
2.	C. O. Wilke, *Fundamentals of Data Visualization*, O’Reilly Media, 2019. https://clauswilke.com/dataviz/
3.	Univ. of California, Davis, *Data Visualization with Tableau*, Coursera, https://www.coursera.org/learn/data-visualization-tableau

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CT3208	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

DISTRIBUTED SYSTEMS

(For CSIT)

Course Objectives:

1.	To understand the foundations of distributed systems.
2.	To learn issues related to clock Synchronization and the need for global state in distributed systems.
3.	To learn distributed mutual exclusion and deadlock detection algorithms.
4.	To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems.
5.	To learn the characteristics of peer-to-peer and distributed shared memory systems.

Course Outcomes

S.No	Outcome	Knowledge Level
1.	Elucidate the foundations and issues of distributed systems	K2
2.	**Illustrate** the various synchronization issues and global state for distributed systems	K2
3.	**Apply** the Mutual Exclusion and Deadlock detection algorithms in distributed systems	K3
4.	**Examine** the agreement protocols and fault tolerance mechanisms in distributed systems	K3
5.	**Examine** the features of peer-to-peer and distributed shared memory systems	K3

SYLLABUS

UNIT-I (10Hrs)	**Distributed Systems**: Definition, Relation to computer system components, Motivation, Relation to parallel systems, Message-passing systems versus shared memory systems, Primitives for distributed communication, Synchronous versus asynchronous executions, Design issues and challenges. A model of distributed computations: A distributed program, A model of distributed executions, Models of communication networks, Global state, Cuts, Past and future cones of an event, Models of process communications. Logical Time: A framework for a system of logical clocks, Scalar time, Vector time, Physical clock synchronization: NTP.
UNIT-II (10 Hrs)	**Message Ordering & Snapshots**: Message ordering and group communication: Message ordering paradigms, Asynchronous execution with synchronous communication, Synchronous program order on an asynchronous system, Group communication, Causal

	order (CO), Total order. Global state and snapshot recording algorithms: Introduction, System model and definitions, Snapshot algorithms for FIFO channels.
UNIT-III (10 Hrs)	**Distributed Mutex & Deadlock**: Distributed mutual exclusion algorithms: Introduction, Preliminaries, Lamport's algorithm, Ricart-Agrawala algorithm, Maekawa's algorithm, Suzuki–Kasami's broadcast algorithm. Deadlock detection in distributed systems: Introduction, System model, Preliminaries, Models of deadlocks, Knapp's classification, Algorithms for the single resource model, the AND model and the OR model.
UNIT-IV (10 Hrs)	**Recovery & Consensus**: Check pointing and rollback recovery: Introduction, Background and definitions, Issues in failure recovery, Checkpoint-based recovery, Log-based rollback recovery, Coordinated check pointing algorithm, Algorithm for asynchronous check pointing and recovery. Consensus and agreement algorithms: Problem definition, Overview of results, Agreement in a failure, free system, Agreement in synchronous systems with failures.
UNIT-V (10 Hrs)	**Peer-to-peer computing and overlay graphs**: Introduction, Data indexing and overlays, Chord – Content addressable networks, Tapestry. Distributed shared memory: Abstraction and advantages, Memory consistency models, Shared memory Mutual Exclusion.
Textbooks:	
1.	Distributed Systems Concepts and Design, George Coulouris, Jean Dollimore and Tim Kindberg, Fifth Edition, Pearson Education, 2012.
2.	Distributed computing: Principles, algorithms, and systems, Ajay Kshemkalyani and Mukesh Singhal, Cambridge University Press, 2011.
Reference Books:	
1.	Distributed Operating Systems: Concepts and Design, Pradeep K Sinha, Prentice Hall of India, 2007.
2.	Advanced concepts in operating systems. Mukesh Singhal and Niranjan G. Shivaratri, McGraw Hill, 1994.
3.	Distributed Systems: Principles and Paradigms, Tanenbaum A.S., Van Steen M.,Pearson Education, 2007.
e-Resources:	
1.	Indranil Gupta, Cloud Computing Concepts, University of Illinois Urbana-Champaign./ Available:https://www.coursera.org/learn/cloud-computing
2.	K. Kingsbury, An Introduction to Distributed Systems, 1st ed. San Francisco, CA, USA: GitHub, 2014. https://github.com/aphyr/distsys-class

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CT3209	PE	3	--	--	3	30	70	3Hrs.

INFORMATION RETRIEVAL SYSTEM

(For CSIT)

Course Objectives:

1.	**Understand** different information retrieval models such as vector space, probabilistic, and language models.
2.	**Learn** how to use retrieval utilities like relevance feedback, clustering, and N-grams to enhance search quality.
3.	**Explore** techniques for efficient retrieval including indexing, query processing, and duplicate detection.
4.	Gain knowledge of advanced retrieval topics like cross-language search, semantic tools, and distributed information retrieval systems.

Course Outcomes

S.No	Outcome	Knowledge Level
1.	Understand basic retrieval models like vector space, probabilistic, and language models.	K3
2.	Use tools like relevance feedback, clustering, and N-grams to improve search results.	K3
3.	Explain semantic networks, parsing, and how information can be retrieved across languages.	K3
4.	Learn how search engines work efficiently using inverted indexes, query processing, and duplicate detection.	K3
5.	Understand how structured and unstructured data are combined, and how distributed and web search systems work.	K3

SYLLABUS

UNIT-I (10Hrs)	Introduction: Retrieval strategies: vector space model, Probabilistic retrieval strategies: Simple term weights, Non binary independence model, Language models.
UNIT-II (10 Hrs)	Retrieval Utilities: Relevance feedback, clustering, N-grams, Regression analysis, Thesauri.
UNIT-III (10 Hrs)	Retrieval utilities: Semantic networks, parsing Cross –Language: Information Retrieval: Introduction, Crossing the Language barrier

UNIT-IV (10 Hrs)	Efficiency: Inverted Index, Query processing, Signature files, Duplicate document detection.
UNIT-V (10 Hrs)	Integrating structured data and text. A historical progression, Information retrieval as relational application, Semi Structured search using a relational schema. Distributed Information Retrieval: A theoretical Model of Distributed retrieval, web search

Textbooks:	
1.	David A. Grossman, OphirFrieder, Information Retrieval – Algorithms and Heuristics, Springer, 2nd Edition(Distributed by Universal Press), 2004
Reference Books:	
1.	Gerald J Kowalski, Mark T Maybury Information Storage and Retrieval Systems: Theory and Implementation, Springer, 2004.
2.	SoumenChakrabarti, Mining the Web : Discovering Knowledge from Hypertext Data, Morgan – Kaufmann Publishers, 2002.
3.	Christopher D Manning, PrabhakarRaghavan, HinrichSchutze, An Introduction to Information Retrieval By Cambridge University Press, England, 2009.
e-Resources	
1.	P. CAMBR, “Everyday English for General Purposes,” SWAYAM Plus, https://swayam-plus.swayam2.ac.in/courses/course-details?id=P_CAMBR_01.

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CT3211	PC	--	--	3	1.5	30	70	3Hrs.

CRYPTOGRAPHY AND NETWORK SECURITY LAB

(For CSD)

Course Objectives: Students are expected to

1.	Learn Traditional cryptographic techniques.
2.	Understand basic concepts of security services with symmetric and asymmetric algorithms.
3.	Understand user and message authentication with MD-5, SHA-1 and Digital Signature algorithms.

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

S.No	Outcome	Knowledge Level
1.	Develop simple XOR operation for encryption of data	K3
2.	Develop Symmetric & Asymmetric cryptography.	K3
3.	Implement Diffie-Hellman Key exchange algorithm.	K3
4.	Develop programs on MD-5, SHA-1 algorithms.	K3
5.	Implement Digital Signature Standard.	K3

SYLLABUS

1.	Write a 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 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 program to perform encryption and decryption using the following algorithms 1. Ceaser cipher 2. Substitution cipher 3. Hill Cipher
4.	Write a program to implement the DES algorithm logic.
5.	Write a program to implement the AES algorithm logic.
6.	Write a program to implement RSA algorithm.
7.	Implement the Diffie-Hellman Key Exchange mechanism.
8.	Calculate the message digest of a text using the SHA-1 algorithm.
9.	Calculate the message digest of a text using the MD5 algorithm.
10.	Implement the Signature Scheme using Digital Signature Standard

Textbooks:

1.	Cryptography and Network Security- William Stallings, Pearson Education, 7th Edition.

Reference Books:

1.	Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010

	edition.
2.	Cryptography and Network Security- Behrouz A Forouzan, DebdeepMukhopadhyaya, Mc GrawHill, 3rd Edition, 2015.
3.	Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall PTR
4.	Cryptography: Theory and Practice by Douglas R. Stinson, CRC press.

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CT3212	PC	--	--	3	1.5	30	70	3 Hrs.

MACHINE LEARNING USING PYTHON LAB

(For CSD & CSIT)

Course Objectives: The main objective of the course is to

1	To learn about computing central tendency measures and Data preprocessing techniques.
2	To learn about classification and regression algorithms
3	To apply different clustering algorithms for a problem.

Course Outcomes:

S.No	Outcome	Knowledge Level
1	Apply statistical and data pre-processing techniques using Python for effective data analysis.	K3
2	Implement and evaluate various classification and regression algorithms using Python.	K3
3	Apply clustering techniques and analyze their performance using suitable evaluation metrics.	K3

SYLLABUS

1.	Compute Central Tendency Measures: Mean, Median, Mode Measure of Dispersion: Variance, Standard Deviation using Python.
2.	Apply the following Pre-processing techniques for a given dataset using Python. a. Attribute selection b. Handling Missing Values c. Discretization d. Elimination of Outliers
3.	Apply KNN algorithm for classification and regression using Python.
4.	Demonstrate decision tree algorithm for a classification problem and perform parameter tuning for better results using Python.
5.	Demonstrate decision tree algorithm for a regression problem using Python.
6.	Apply Random Forest algorithm for classification and regression using Python.
7.	Demonstrate Naïve Bayes Classification algorithm using Python.
8.	Apply Support Vector algorithm for classification using Python.
9.	Demonstrate simple linear regression algorithm for a regression problem using Python.
10.	Apply Logistic regression algorithm for a classification problem using Python.
11.	Demonstrate Multi-layer Perceptron algorithm for a classification problem using Python.
12.	Implement the K-means algorithm and apply it to the data you selected. Evaluate performance by measuring the sum of the Euclidean distance of each example from its class center. Test the performance of the algorithm as a function of the parameters K.

Reference Books:	
1.	**“Introduction to Machine Learning with Python” ,** Andreas C. Müller & Sarah Guido
2.	**“Python Machine Learning”** by Sebastian Raschka

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CT3213	SEC	--	1	2	2	30	70	3 Hrs.

INTERNET OF THINGS LAB

(For CSD & CSIT)

Course Objectives:

1	To know how to use various hardware components and Protocols in IoT applications
2	To Know how to develop various IoT applications

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

S.No	Outcome	Knowledge Level
1	Use sensors, actuators, Arduino and Raspberry pi in IoT applications	K3
2	Design and Develop various IoT applications.	K5

SYLLABUS

1.	To interface Bluetooth with Raspberry Pi/Arduino and write a program to send sensor data to smart phone using Bluetooth.
2.	To interface Bluetooth with Raspberry Pi/Arduino and write a program to to turn ON/OFF LED when '1'/'0' is received from smart phone using Bluetooth.
3.	Application of WiFi in IoT Systems.
4.	App design for WiFi application to ON/OFF Light.
5.	Use of various network protocols in IoT systems.
6.	Application of 802.15.4 Zigbee in IoT Systems.
7.	Design a simple IoT System comprising sensor, Wireless Network connection, Data Analytics
8.	Design and Interface ESP32 with DC motor using L298 motor driver.
9.	Experiment on connectivity of Rasberry Pi with existing system components.

Text Books:

1.	Internet of Things: Architecture, Design Principles and Applications, Rajkamal, McGraw Hill Higher Education. 2017
2.	Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 1st edition, 2014.

Reference Books:

1.	Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley, 1st edition, 2014.
2.	Getting Started with the Internet of Things CunoPfister,Oreilly. 2011
3.	Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD),2014.

e-Resources:	
1.	Introduction to Internet of Things, https://swayam.gov.in/nd1_noc20_cs66/preview
2.	An Introduction to Programming the Internet of Things(IoT) specialization, https://www.coursera.org/specializations/iot

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AC3201	AC	2	--	--	--	30	--	3 Hrs.

TECHNICAL PAPER WRITING & IPR

(Common to AI&DS, CSE, AIML, CSIT, IT, CSD, CSBS, CIC, CE, ME)

Course Objectives:

1.	To appreciate the difference in English used in Academic, Business, Legal and other contexts.
2.	To know the fundamentals of basic technical report structure and writing.
3.	To understand the filing and processing of patent application.

Course Outcomes

S.No	Outcome	Knowledge Level
1.	Construct grammatically sound and concise technical write-ups.	K3
2.	Prepare the outline and structure of a technical paper with essential sections.	K3
3.	Develop a project proposal and dissertation framework aligned with academic conventions.	K3
4.	Use a word processor effectively for document formatting, citations, and version control.	K3
5.	Identify appropriate IPR mechanisms for protecting various types of intellectual creations.	K3

SYLLABUS

UNIT-I (10Hrs)	**Introduction:** An introduction to writing technical reports, technical sentences formation, using transitions to join sentences, Using tenses for technical writing. **Planning and Structuring:** Planning the report, identifying reader(s), Voice, Formatting and structuring the report, Sections of a technical report, Minutes of meeting writing.
UNIT-II (10 Hrs)	**Drafting report and design issues:** The use of drafts, Illustrations and graphics. **Final edits:** Grammar, spelling, readability and writing in plain English: Writing in plain English, Jargon and final layout issues, Spelling, punctuation and Grammar, Padding, Paragraphs, Ambiguity.
UNIT-III (10 Hrs)	**Proofreading and summaries:** Proofreading, summaries, Activities on summaries. **Presenting final reports:** Printed presentation, Verbal presentation skills, Introduction to proposals and practice.

UNIT-IV (10 Hrs)	**Using word processor:** Adding a Table of Contents, Updating the Table of Contents, Deleting the Table of Contents, Adding an Index, Creating an Outline, Adding Comments, Tracking Changes, Viewing Changes, Additions, and Comments, Accepting and Rejecting Changes, Working with Footnotes and Endnotes, Inserting citations and Bibliography, Comparing Documents, Combining Documents, Mark documents final and make them read only., Password protect Microsoft Word documents., Using Macros
UNIT-V (10 Hrs)	**Nature of Intellectual Property:** Patents, Designs, Trade and Copyright. Process of **Patenting and Development:** technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property
Textbooks:	
1.	Kompal Bansal &Parshit Bansal, "Fundamentals of IPR for Beginner's", 1st Ed., BS Publications, 2016.
2.	William S. Pfeiffer and Kaye A. Adkins, "Technical Communication: A Practical Approach", Pearson.
Reference Books:	
1.	Ramappa,T., "Intellectual Property Rights Under WTO", 2nd Ed., S Chand, 2015.
2.	Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.
3.	Day R, How to Write and Publish a Scientific Paper, Cambridge University Press(2006)
e-Resources	
1.	https://www.udemy.com/course/reportwriting/
2.	https://www.udemy.com/course/professional-business-english-and-technical-report-writing/
3.	https://www.udemy.com/course/betterbusinesswriting/

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23MC3201	MC	2	--	--		30	--	

EMPLOYABILITY SKILLS

(For AIDS, CIC, CSIT, CSD, ECE and EEE)

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