JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
R23 B.TECH IIIrd Year IT COURSE STRUCTURE & SYLLABUS

B.Tech. – III Year I Semester

S.No.	Category	Title	L	T	P	C
1	Professional Core	Advanced Java	3	0	0	3
2	Professional Core	Computer Networks	3	0	0	3
3	Professional Core	Automata Theory & Compiler Design	3	0	0	3
4	Professional Elective-I	1. Object Oriented Analysis and Design 2. Cyber Security 3. Artificial Intelligence 4. Microprocessors & Microcontrollers 5. Data Warehousing & Data Mining 6. 12 week MOOC Swayam/ NPTEL course recommended by the BoS	3	0	0	3
5	Open Elective- I	OR Entrepreneurship Development & Venture Creation	3	0	0	3
6	Professional Core	Advanced Java Lab	0	0	3	1.5
7	Professional Core	Computer Networks Lab	0	0	3	1.5
8	Skill Enhancement course	Full Stack Development 1	0	1	2	2
9	Engineering Science	User Interface Design using Flutter / SWAYAM Plus - Android Application Development (with Flutter)	0	0	2	1
10	Evaluation of Community Service Internship		-	-	-	2
	Total		15	1	10	23
MC	Minor Course (Student may select from the same specialized minors pool)		3	0	3	4.5
MC	Minor Course through SWAYAM/NPTEL (minimum 12 week, 3 credit course)		3	0	0	3
HC	Honors Course (Student may select from the same honors pool)		3	0	0	3
HC	Honors Course (Student may select from the same honors pool)		3	0	0	3

B.Tech. III Year II Semester

S.No.	Category	Title	L	T	P	C
1	Professional Core	Cloud Computing	3	0	0	3
2	Professional Core	Cryptography & Network Security	3	0	0	3
3	Professional Core	Machine Learning	3	0	0	3
4	Professional Elective-II	1. Software Testing Methodologies 2. Augmented Reality & Virtual Reality 3. DevOps 4. Generative AI 5. 12 week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
5	Professional Elective-III	1. Software Project Management 2. Mobile Adhoc Networks 3. Natural Language Processing 4. Distributed Operating System 5. 12 week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
6	Open Elective – II		3	0	0	3
7	Professional Core	Cloud Computing Lab	0	0	3	1.5
8	Professional Core	Machine Learning Lab	0	0	3	1.5
9	Skill Enhancement course	Soft skills / / SWAYAM Plus - 21st Century Employability Skills	0	1	2	2
10	Audit Course	Technical Paper Writing & IPR	2	0	0	-
		Total	**20**	**1**	**08**	**23**
	Mandatory Industry Internship / Mini Project of 08 weeks duration during summer vacation					
MC	Minor Course (Student may select from the same specialized minors pool)		3	0	3	4.5
MC	Minor Course through SWAYAM/NPTEL (minimum 12 week, 3 credit course)		3	0	0	3
HC	Honors Course (Student may select from the same honors pool)		3	0	0	3
HC	Honors Course (Student may select from the same honors pool)		3	0	0	3

* Under Industry Internship interested students can pursue SWAYAM Plus courses viz.,
Hands-on Masterclass on Data Analytics OR Artificial Intelligence for Real-World
Application

Open Electives, offered to other department students:

Open Elective I: Principles of Operating Systems/ Computer Organization and Architecture
Open Elective II: Principles of Database Management Systems
Open Elective III: Object Oriented Programming Through Java
Open Elective IV: Principles of Software Engineering /Computer Networks

Minor Engineering

Note:
  1. *To obtain Minor Engineering, student needs to obtain 18 credits by successfully completing any of the following courses in the concern stream.*
  2. *During Minor/Honors Course selection, there should not be any overlapping with Regular/Major/OPEN Electives*

Minor in IT
  1. Principles of Database Management Systems   3-0-3-4.5 (II-II)
  2. Principles of Software Engineering   3-0-0-3 (III-I)
  3. Advanced Data Structures & Algorithm Analysis   3-0-3-4.5 (III-II)
  4. Principles of Operating Systems   3-0-0-3 (IV-I)
     Any of the following 12 Week 3 credit NPTEL MOOC Courses
  5. Artificial Intelligence: Knowledge Representation and Reasoning
  6. Computer Networks and Internet Protocol
  7. Machine Learning and Deep Learning - Fundamentals and Applications
  8. The Joy of Computing using Python
  9. Discrete Mathematics for CS
  10. Human Computer Interaction (In English)
  11. Data Analytics with Python
  12. Foundations of Cyber Physical Systems

III Year I Semester	ADVANCED JAVA	L	T	P	C
		3	0	0	3

Course Objectives:
This course develops programming ability of students to create dynamic web applications using server side technology with Java Database Connectivity. Students can learn networking and remote method invocation using Java API and different Java frameworks like Spring will increase ability of students in web application development.

Unit I:
JDBC Programming : JDBC Architecture, Types of JDBC Drivers, Introduction to major JDBC Classes and Interface, Creating simple JDBC Application, Types of Statement (Statement Interface, Prepared Statement, Callable Statement), Exploring Result Set Operations, Batch Updates in JDBC, Creating CRUD Application, Using Rowsets Objects, Managing Database Transaction.

Unit II:
J2EE and Web Development: J2EE Architecture Types, J2EE Containers, Types of Servers in J2EE Application, HTTP Protocols and API, Request Processing in Web Application, Web Application Structure, Web Containers and Web Architecture Models.

Unit III:
Servlet API and Overview: Servlet Introduction, Servlet Life Cycle(SLC), Types of Servlet, Servlet Configuration with Deployment Descriptor, Working with Servlet Context and Servlet Config Object, Attributes in Servelt,, Response and Redirection using Request Dispacher and using send Redirect Method, Filter API, Manipulating Responses using Filter API, Session Tracking: using Cookies, HTTP Session, Hidden Form Fields and URL Rewriting, Types of Servlet Event: Context Level and Session Level.

Unit IV:
Java Server Pages(JSP): Introduction to JSP , Comparison with Servlet, JSP Architecture, JSP: Life Cycle, Scripting Elements, Directives, Action Tags, Implicit Objects, Expression Language(EL), JSP Standard Tag Libraries(JSTL), Custom Tag, Session Management, Exception Handling, CRUD Application

Unit V:
Java Web Frameworks: Spring MVC Spring: Introduction, Architecture, Spring MVC Module, Life Cycle of Bean Factory, Explore: Constructor Injection, Dependency Injection, Inner Beans, Aliases in Bean, Bean Scopes, Spring Annotations, Spring AOP Module, Spring DAO, Database Transaction Management, CRUD Operation using DAO and Spring API.

Text Books:
1. Black Book "Java server programming" J2EE, 1st ed., Dream Tech Publishers, 2008.
2. Complete Reference J2EE, James Keogh, McGraw Hill publication
3. Professional Java Server Programming, Subrahmanyam Allamaraju, Cedric Buest, Wiley Publication
4. Spring in Action, 3rd edition , Craig walls, Manning Publication

Reference Books:
1. Core Java, Volume II: Advanced Features, Cay Horstmann, Gary Cornell Pearson Publication
2. JDBC™ API Tutorial and Reference, Third Edition, Maydene Fisher, Jon Ellis, Jonathan Bruce, Addison Wesley
3. Beginning JSP, JSF and Tomcat, Giulio Zambon, Apress

III Year I Semester	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

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

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

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

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

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

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

Text Books:
1. Computer Networksm, Andrew S Tanenbaum, Fifth Edition. Pearson Education/PHI
2. Data Communications and Networks, Behrouz A. Forouzan, Fifth Edition TMH.

References Books:
1. Data Communications and Networks- Achut S Godbole, AtulKahate
2. Computer Networks, Mayank Dave, CENGAGE

III Year I Semester	AUTOMATA THEORY & COMPILER DESIGN	L	T	P	C
		3	0	0	3

Course Objectives:
- Introduce the notion of formal languages and grammars
- Design of Grammars, FAs and PDAs
- To become familiar with the underlying theory and methods used in compiler design
- To Introduce the parsing techniques, code optimization techniques and generate code

UNIT – I: Regular Expressions, Languages and Finite Automata
Formal Languages and the Chomsky Hierarchy, Regular Expressions and Regular Languages, Algebraic Laws for Regular Expressions, Applications of Regular Expressions, Abstract model of Finite Automaton, Transition Tables and Transition Graphs, Deterministic Finite Automata (DFA), Nondeterministic Finite Automata (NFA), Converting NFA to DFA, Finite Automata with ϵ transitions (NFA-ϵ), Converting NFA-ϵ to NFA/DFA, Minimization of Finite Automata, Equivalence of FA and Regular Expressions

UNIT-II: Context Free Grammars and Push Down Automata:
Context Free Grammars (CFG) and Context Free Languages (CFL), Design of CFGs, Leftmost and Rightmost Derivations, Parse Trees, Applications of CFGs, Ambiguity in Grammars and Languages, Push Down Automata (PDA), The Language of a PDA, Equivalence of PDAs and CFGs

UNIT-III: Lexical Analysis and Top-Down Parsing
The structure of a compiler, Role of lexical analyzer, Input Buffering, Specification of tokens, Recognition of tokens, The Lexical Analyser Generator –LEX
Introduction to Syntax Analysis, Eliminating ambiguity and left recursion from a CFG, Recursive Decent Parsing, LL(1) Grammars, Nonrecursive Predictive Parsing

UNIT-IV: Bottom-Up Parsing and Syntax Directed Translation
Shift-Reduce Parsing, Simple LR parsing, Canonical LR(1) Parsing, LALR Parsing, Parser Generators
Syntax Directed Definitions, Evaluation Orders for SDDs, Syntax Directed Translation Schemes

UNIT-V: Intermediate Code Generation, Code Generation and Optimization:
Three address code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Issues in the design of a Code Generator, The Target Language, A simple Code GeneratorBasic Blocks and Flow

Textbooks:
1. Introduction to Automata Theory, Languages and Computation, J.E.Hopcroft, R.Motwani and J.D.Ullman, 3rd Edition, Pearson, 2008.
2. Compilers Principles, Techniques and Tools, 2nd Edition, Alfred V.Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Pearson

Reference Books:
1. Introduction to Languages and The Theory of Computation, John C. Martin, McGraw Hill.
2. Theory of Computer Science-Automata, Languages and Computation, K.L.P.Mishra and N.Chandrasekaran, 3rd Edition, PHI, 2007
3. Compiler Construction‖, K.V.N. Sunitha, Pearson, 2013
4. Compiler Design, SandeepSaxena, Rajkumar Singh Rathore, S.Chand publication

III Year I Semester	OBJECT ORIENTED ANALYSIS AND DESIGN	L	T	P	C
		3	0	0	3

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

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

UNIT IV:
Basic Behavioral Modeling-I: Interactions, Interaction diagrams Use cases, Use case Diagrams, Activity Diagrams. **Case Study:** Web Application: Vacation Tracking System

UNIT V:
Advanced Behavioral Modeling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams. **Architectural Modeling:** Component, Deployment, Component diagrams and Deployment diagrams. **Case Study:** Weather Forecasting

Text Books:
1. Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, Kellia Houston , "Object- Oriented Analysis and Design with Applications", 3rd edition, 2013, PEARSON.
2. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education.

Reference Books:
1. Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education.

2. Pascal Roques: Modeling Software Systems Using UML2, WILEY- Dreamtech India Pvt. Ltd.
3. Atul Kahate: Object Oriented Analysis & Design, The McGraw-Hill Companies.
4. Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.

III Year I Semester	CYBER SECURITY	L	T	P	C
		3	0	0	3

Course Objectives:
The aim of the course is to
- identify security risks and take preventive steps
- understand the forensics fundamentals
- understand the evidence capturing process
- understand the preservation of digital evidence

UNIT I: Introduction to Cybercrime: Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Cybercriminals, Classifications of Cybercrime, Cyberstalking, Cybercafe and Cybercrimes, Botnets. Attack Vector, Proliferation of Mobile and Wireless Devices, Security Challenges Posed by Mobile Devices, Attacks on Mobile/Cell Phones, Network and Computer Attacks.

UNIT II: Tools and Methods : Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, Sniffers, Spoofing, Session Hijacking Buffer over flow, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Identity Theft (ID Theft), Foot Printing and Social Engineering, Port Scanning, Enumeration.

UNIT III: Cyber Crime Investigation: Introduction, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

UNIT IV: Computer Forensics and Investigations: Understanding Computer Forensics, Preparing for Computer Investigations. Current Computer Forensics Tools: Evaluating Computer Forensics Tools, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating and Testing Forensics Software, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Graphics and Network Forensics, E-mail Investigations, Cell Phone and Mobile Device Forensics.

UNIT V: Cyber Crime Legal Perspectives: Introduction, Cybercrime and the Legal Landscape around the World, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime andPunishment, Cyberlaw, Technology and Students: Indian Scenario.

Text Books:
1. Sunit Belapure Nina Godbole "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", WILEY, 2011.
2. Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.

Reference Books:
1. Michael T. Simpson, Kent Backman and James E. Corley, "Hands on Ethical Hacking and Network Defence", Cengage, 2019.
2. Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media,

New Delhi.

3. Alfred Basta, Nadine Basta,Mary Brown and Ravinder Kumar "Cyber Security and Cyber Laws" , Cengage,2018.

E-Resources:

1. CERT-In Guidelines- http://www.cert-in.org.in/
2. https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks [Online Course]
3. https://computersecurity.stanford.edu/free-online-videos [Free Online Videos]
4. Nickolai Zeldovich. 6.858 Computer Systems Security. Fall 2014. Massachusetts Institute of Technology: MIT OpenCourseWare, https://ocw.mit.edu License: Creative Commons BY-NC-SA.

III Year I Semester	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

Pre-requisite:
1. Knowledge in Computer Programming.
2. A course on "Mathematical Foundations of Computer Science".
3. Background in linear algebra, data structures and algorithms, and probability.

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

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

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

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

UNIT - IV
Logic concepts: First order logic. Inference in first order logic, propositional vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution, Learning from observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning.

UNIT - V
Expert Systems: Architecture of expert systems, Roles of expert systems – Knowledge Acquisition Meta knowledge Heuristics. Typical expert systems – MYCIN, DART, XCON: Expert systems shells.

Textbooks:
1. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", SecondEdition, Pearson Education.
2. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Mc Graw Hill

Reference Books:

1. David Poole, Alan Mackworth, Randy Goebel,"Computational Intelligence: a logical approach", Oxford University Press.
2. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problemsolving", Fourth Edition, Pearson Education.
3. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers.
4. Artificial Intelligence, SarojKaushik, CENGAGE Learning.

Online Learning Resources:

1. https://ai.google/
2. https://swayam.gov.in/nd1_noc19_me71/preview

III Year I Semester	MICROPROCESSORS & MICROCONTROLLERS	L	T	P	C
		3	0	0	3

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

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

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

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

UNIT IV:
Microcontroller, Architecture of 8051, Special Function Registers(SFRs), I/O Pins Ports and Circuits, Instruction set, Addressing modes, Assembly language programming.

UNIT V:
Interfacing Microcontroller, Programming 8051 Timers, Serial Port Programming, Interrupts Programming, LCD & Keyboard Interfacing, ADC, DAC & Sensor Interfacing, External Memory Interface, Stepper Motor and Waveform generation, Comparison of Microprocessor, Microcontroller, PIC and ARM processors

Textbooks:
1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition,1994.
2. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.

Reference Books:
1. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013.
2. Kenneth J. Ayala, The 8051 Microcontroller, 3rd edition, Cengage Learning, 2004.

III Year I Semester	DATA WAREHOUSING & DATA MINING	L	T	P	C
		3	0	0	3

Pre-requisites: Data Structures, Algorithms, Probability & Statistics, Data Base Management Systems

Course Objectives: The main objective of the course is to
- Introduce basic concepts and techniques of data warehousing and data mining
- Examine the types of the data to be mined and apply pre-processing methods on raw data
- Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.

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

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

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

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

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

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

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

III Year I Semester	ADVANCED JAVA LAB	L	T	P	C
		0	0	3	1.5

Course Objectives: the main objectives of the course are
- To make use of Servlet and JSP API in the process of enterprise application deployment.
- Implement components such as JSTL
- Distinguish Application Server, Web Container, JDBC
- Design and Development of web application having collaboration of Servlets, JSPs, Spring

Lab should cover the following concepts:
- JDBC programming
- J2EE and Web development
- Servlets
- Java Server Pages
- Java Web Frameworks

Sample List of Experiments:
1. Write a JDBC application which will interact with Database and perform the following task.
    a. Create Student Table with Roll No, Name, and Address field and insert few records.
    b. Using Statement Object display the content of Record.
    c. Using Statement Object Insert Two Record.
    d. Using Statement Object Update One Record.
    e. Using Statement Object Delete One Record.
    f. Using Statement Object display the content of Record.

2. Write a JDBC application which will interact with Database and perform the following task.
    a. Create Student Table with Roll No, Name, and Address field and insert few records.
    b. Using Prepared Statement Object display the content of Record.
    c. Using Prepared Statement Object Insert Two Record.
    d. Using Prepared Statement Object Update One Record.
    e. Using Prepared Statement Object Delete One Record.
    f. Using Prepared Statement Object display the content of Record

3. Write a JDBC application which will interact with Database and perform the following task.
    a. Create a store procedure which will insert one record into employee table.
    b. Create a store procedure which will retrieve salary for given employee id.
    c. Write a java application which will call the above procedure and display appropriate information on screen

4. Design a JDBC application which will demonstrate Scrollable Result Set functionality.

5. Design a JDBC application which will demonstrate Updatable Result Set functionality.

6. Write down the Program for testing the Servlet and study deployment descriptor.

7. Write down the program for testing the include action for servlet collaboration.
8. Create login form and perform state management using Cookies, Http Session and URL Rewriting.

9. Write down the Program which displays the simple JSP file

10. Write down the program in which input the two numbers in an html file and then display the addition in JSP file.

11. Perform Database Access through JSP.

12. Write down a program which demonstrates the core tag of JSTL.

13. Write down a program which demonstrates the Format tag of JSTL.

14. Write down a program which demonstrates the Function tag of JSTL.

15. Write down a program which demonstrates the SQL tag of JSTL.

16. Study and Implement MVC using Spring Framework

17. Using Spring Template manage Database and Transaction.

III Year I Semester	COMPUTER NETWORKS LAB	L	T	P	C
		0	0	3	1.5

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

List of Experiments:
1. Study of Network devices in detail and connect the computers in Local Area Network.
2. Write a Program to implement the data link layer farming methods such as
   i) Character stuffing ii) bit stuffing.
3. Write a Program to implement data link layer farming method checksum.
4. Write a program for Hamming Code generation for error detection and correction.
5. Write a Program to implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.
6. Write a Program to implement Sliding window protocol for Goback N.
7. Write a Program to implement Sliding window protocol for Selective repeat.
8. Write a Program to implement Stop and Wait Protocol.
9. Write a program for congestion control using leaky bucket algorithm
10. Write a Program to implement Dijkstra's algorithm to compute the Shortest path through a graph.
11. Write a Program to implement Distance vector routing algorithm by obtaining routing table at each node (Take an example subnet graph with weights indicating delay between nodes).
12. Write a Program to implement Broadcast tree by taking subnet of hosts.
13. Wireshark
    i. Packet Capture Using Wire shark
    ii. Starting Wire shark
    iii. Viewing Captured Traffic
    iv. Analysis and Statistics & Filters.
14. How to run Nmap scan
15. Operating System Detection using Nmap
16. Do the following using NS2 Simulator
    i. NS2 Simulator-Introduction
    ii. Simulate to Find the Number of Packets Dropped
    iii. Simulate to Find the Number of Packets Dropped by TCP/UDP
    iv. Simulate to Find the Number of Packets Dropped due to Congestion
    v. Simulate to Compare Data Rate& Throughput.

III Year I Semester	FULL STACK DEVELOPMENT -1	L	T	P	C
		0	1	2	2

Course Objectives:

The main objectives of the course are to
- Make use of HTML elements and their attributes for designing static web pages
- Build a web page by applying appropriate CSS styles to HTML elements
- Experiment with JavaScript to develop dynamic web pages and validate forms

Experiments covering the Topics:
- Lists, Links and Images
- HTML Tables, Forms and Frames
- HTML 5 and Cascading Style Sheets, Types of CSS
- Selector forms
- CSS with Color, Background, Font, Text and CSS Box Model
- Applying JavaScript - internal and external, I/O, Type Conversion
- JavaScript Conditional Statements and Loops, Pre-defined and User-defined Objects
- JavaScript Functions and Events

Sample Experiments:

1. Lists, Links and Images

a. Write a HTML program, to explain the working of lists.
   Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.
b. Write a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes.
c. Create a HTML document that has your image and your friend's image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles.
d. Write a HTML program, in such a way that, rather than placing large images on a page, the preferred technique is to use thumbnails by setting the height and width parameters to something like to 100*100 pixels. Each thumbnail image is also a link to a full sized version of the image. Create an image gallery using this technique

2. HTML Tables, Forms and Frames

a. Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, rowspan, colspan)
b. Write a HTML program, to explain the working of tables by preparing a timetable. (Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.).
c. Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field, checkboxes, radio buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view).
d. Write a HTML program, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (Note: first frame □ image, second frame □ paragraph,

third frame □ hyperlink. And also make sure of using "no frame" attribute such that frames to be fixed).

3. HTML 5 and Cascading Style Sheets, Types of CSS
a. Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>, <footer>, <header>, <main>, <nav>, <section>, <div>, <span> tags.
b. Write a HTML program, to embed audio and video into HTML web page.
c. Write a program to apply different types (or levels of styles or style specification formats) - inline, internal, external styles to HTML elements. (identify selector, property and value).

4. Selector forms
a. Write a program to apply different types of selector forms
    i. Simple selector (element, id, class, group, universal)
    ii. Combinator selector (descendant, child, adjacent sibling, general sibling)
    iii. Pseudo-class selector
    iv. Pseudo-element selector
    v. Attribute selector

5. CSS with Color, Background, Font, Text and CSS Box Model
a. Write a program to demonstrate the various ways you can reference a color in CSS.
b. Write a CSS rule that places a background image halfway down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down.
c. Write a program using the following terms related to CSS font and text:
    i. font-size   ii. font-weight   iii. font-style
    iv. text-decoration   v. text-transformation   vi. text-alignment
d. Write a program, to explain the importance of CSS Box model using
    i. Content   ii. Border   iii. Margin   iv. padding

6. Applying JavaScript - internal and external, I/O, Type Conversion
a. Write a program to embed internal and external JavaScript in a web page.
b. Write a program to explain the different ways for displaying output.
c. Write a program to explain the different ways for taking input.
d. Create a webpage which uses prompt dialogue box to ask a voter for his name and age. Display the information in table format along with either the voter can vote or not

7. JavaScript Pre-defined and User-defined Objects
a. Write a program using document object properties and methods.
b. Write a program using window object properties and methods.
c. Write a program using array object properties and methods.
d. Write a program using math object properties and methods.
e. Write a program using string object properties and methods.
f. Write a program using regex object properties and methods.
g. Write a program using date object properties and methods.
h. Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.

8. JavaScript Conditional Statements and Loops

a. Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words "LARGER NUMBER" in an information message dialog. If the numbers are equal, output HTML text as "EQUAL NUMBERS".

b. Write a program to display week days using switch case.

c. Write a program to print 1 to 10 numbers using for, while and do-while loops.

d. Write a program to print data in object using for-in, for-each and for-of loops

e. Develop a program to determine whether a given number is an 'ARMSTRONG NUMBER' or not. [Eg: 153 is an Armstrong number, since sum of the cube of the digits is equal to the number i.e.,13 + 53+ 33 = 153]

f. Write a program to display the denomination of the amount deposited in the bank in terms of 100's, 50's, 20's, 10's, 5's, 2's & 1's. (Eg: If deposited amount is Rs.163, the output should be 1-100's, 1-50's, 1- 10's, 1-2's & 1-1's)

9. Java script Functions and Events

a. Design a appropriate function should be called to display
    i.   Factorial of that number
    ii. Fibonacci series up to that number
    iii. Prime numbers up to that number
    iv. Is it palindrome or not

b. Design a HTML having a text box and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to display
    i.   Factorial of that number
    ii. Fibonacci series up to that number
    iii. Prime numbers up to that number
    iv. Is it palindrome or not

c. Write a program to validate the following fields in a registration page
    i.   Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters)
    ii. Mobile (only numbers and length 10 digits)
    iii. E-mail (should contain format like xxxxxxx@xxxxxx.xxx)

Text Books:

1. Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013.
2. Web Programming with HTML5, CSS and JavaScript, John Dean, Jones & Bartlett Learning, 2019 (Chapters 1-11).
3. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, APress, O'Reilly.

Web Links:

1. https://www.w3schools.com/html
2. https://www.w3schools.com/css
3. https://www.w3schools.com/js/

III Year I Semester	USER INTERFACE DESIGN USING FLUTTER	L	T	P	C
		0	0	2	1

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

List of Experiments:
Students need to implement the following experiments

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

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

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

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

5. a) Learn about 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.

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

III Year II Semester	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

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

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

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

UNIT-III: Virtualization and Containers
Characteristics of virtualized environments, taxonomy of virtualization techniques, virtualization and cloud Computing, pros and cons of virtualization, technology examples (XEN, VMware), building blocks of containers, container platforms (LXC, Docker), container orchestration, Docker Swarm and Kubernetes, public cloud VM (e.g. Amazon EC2) and container (e.g. Amazon Elastic Container Service) offerings.

UNIT-IV: Cloud computing challenges
Economics of the cloud, cloud interoperability and standards, scalability and fault tolerance, energy efficiency in clouds, federated clouds, cloud computing security, fundamentals of computer security, cloud security architecture, cloud shared responsibility model, security in cloud deployment models.

UNIT -V: Advanced concepts in cloud computing
Serverless computing, Function-as-a-Service, serverless computing architecture, public cloud (e.g. AWS Lambda) and open-source (e.g. OpenFaaS) serverless platforms, Internet of Things (IoT), applications, cloud-centric IoT and layers, edge and fog computing, DevOps, infrastructure-as-code, quantum cloud computing.

Text Books:
1. Mastering Cloud Computing, 2ᵈ 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)

III Year II Semester	CRYPTOGRAPHY & NETWORK SECURITY	L	T	P	C
		3	0	0	3

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

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

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

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

UNIT IV:
Data Integrity, Digital Signature Schemes & Key Management : Message Integrity and Message Authentication-message integrity, Random Oracle model, Message authentication, Cryptographic Hash Functions-whirlpool, SHA-512, Digital Signature- process, services, attacks, schemes, applications, Key Management-symmetric key distribution, Kerberos.

UNIT V:
Network Security-I: Security at application layer: PGP and S/MIME, Security at the Transport Layer: SSL and TLS, **Network Security-II :** Security at the Network Layer: IPSec-two modes, two security protocols, security association, IKE, ISAKMP, System Security-users, trust, trusted systems, buffer overflow, malicious software, worms, viruses, IDS, Firewalls.

Text Books:
1. Cryptography and Network Security, 3rd Edition Behrouz A Forouzan, Deb deep Mukhopadhyay, McGraw Hill,2015
2. Cryptography and Network Security,4th Edition, William Stallings, (6e) Pearson,2006
3. Everyday Cryptography, 1st Edition, Keith M.Martin, Oxford,2016

Reference Books:
1. Network Security and Cryptography, 1st Edition, Bernard Meneges, Cengage Learning,2018

III Year II Semester	MACHINE LEARNING	L	T	P	C
		3	0	0	3

Course Objectives:
The objectives of the course is to
- Define machine learning and its different types (supervised and unsupervised) and understand their applications.
- Apply supervised learning algorithms including decision trees and k-nearest neighbours (k-NN).
- Implement unsupervised learning techniques, such as K-means clustering.

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

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

UNIT-III: Models Based on Decision Trees: Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression. The Bayes Classifier: Introduction to the Bayes Classifier, Bayes' Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification, Class Conditional Independence and Naive Bayes Classifier (NBC)

UNIT-IV: Linear Discriminants for Machine Learning: Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptrons (MLPs), Backpropagation for Training an MLP.

UNIT-V: Clustering : Introduction to Clustering, Partitioning of Data, Matrix Factorization, Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering.

Text Books:
1. "Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana, Universities Press (India), 2024

Reference Books:
1. "Machine Learning", Tom M. Mitchell, McGraw-Hill Publication, 2017
2. "Machine Learning in Action",Peter Harrington, DreamTech
3. "Introduction to Data Mining", Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th   Edition, 2019.

III Year II Semester	**SOFTWARE TESTING METHODOLOGIES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

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

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

UNIT - II
Transaction Flow Testing: transaction flows, transaction flow testing techniques.
Data Flow testing: Basics of data flow testing, strategies in data flow testing, application of data flow testing.
Domain Testing: domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability.

UNIT - III
Paths, Path products and Regular expressions: path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.
Logic Based Testing: overview, decision tables, path expressions, kv charts, specifications.

UNIT - IV
State, State Graphs and Transition testing: state graphs, good & bad state graphs, state testing, Testability tips.

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

Text Books:
1. Software Testing techniques - Baris Beizer, Dreamtech, second edition.
2. Software Testing Tools – Dr. K. V. K. K. Prasad, Dreamtech.

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

III Year II Semester	AUGMENTED REALITY & VIRTUAL REALITY	L	T	P	C
		3	0	0	3

Objectives:
- Provide a foundation to the fast growing field of AR and make the students aware of the various AR concepts.
- To give historical and modern overviews and perspectives on virtual reality. It describes the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.

UNIT - I
Introduction to Augmented Reality: Augmented Reality - Defining augmented reality, history of augmented reality, Examples, Related fields
Displays: Multimodal Displays, Visual Perception, Requirements and Characteristics, Spatial Display Model, Visual Displays
Tracking: Tracking, Calibration, and Registration, Coordinate Systems, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors

UNIT - II
Computer Vision for Augmented Reality: Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Outdoor Tracking.
Interaction: Output Modalities, Input Modalities, Tangible Interfaces, Virtual User Interfaces on Real Surfaces, Augmented Paper, Multi-view Interfaces, Haptic Interaction
Software Architectures: AR Application Requirements, Software Engineering Requirements, Distributed Object Systems, Dataflow, Scene Graphs

UNIT - III
Introduction to Virtual Reality: Defining Virtual Reality, History of VR, Human Physiology and Perception
The Geometry of Virtual Worlds: Geometric Models, Axis-Angle Representations of Rotation, Viewing Transformations
Light and Optics: Basic Behavior of Light, Lenses, Optical Aberrations, The Human Eye, Cameras, Displays

UNIT - IV
The Physiology of Human Vision: From the Cornea to Photoreceptors, From Photoreceptors to the Visual Cortex, Eye Movements, Implications for VR
Visual Perception: Visual Perception - Perception of Depth, Perception of Motion, **Perception of Color Visual Rendering:** Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates, Immersive Photos and Videos

UNIT - V
Motion in Real and Virtual Worlds: Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection
Interaction: Motor Programs and Remapping, Locomotion, Social Interaction
Audio: The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering

Text Books:
1. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India;First edition (12 October 2016),ISBN-10: 9332578494

2. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016

Reference Books:
1. Allan Fowler-AR Game Development‖, 1st Edition, A press Publications, 2018, ISBN 978-1484236178
2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009
4. Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN:9781491962381
5. Sanni Siltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0
6. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005

III Year II Semester	DevOps	L	T	P	C
		3	0	0	3

Course Objectives:
The main objectives of this course are to:
- Describe the agile relationship between development and IT operations.
- Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
- Implement automated system update and DevOps lifecycle.

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

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

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

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

UNIT-V
Configuration Management - ANSIBLE: Introduction to Ansible, Ansible tasks, Roles, Jinja templating, Vaults, Deployments using Ansible.
CONTAINERIZATION USING KUBERNETES(OPENSHIFT): Introduction to Kubernetes Namespace & Resources, CI/CD - On OCP, BC, DC & ConfigMaps, Deploying Apps on Openshift Container Pods. Introduction to Puppet master and Chef.

Text Books:

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

Reference Books:

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

III Year II Semester	GENERATIVE AI	L	T	P	C
		3	0	0	3

Course Objectives:
• Understand the basics of Generative AI.
• Know the basics of Text Generation.
• Understand the process of generating videos.
• Know about GAN and its variants.

UNIT I :
Introduction To Gen Ai: Historical Overview of Generative modelling, Difference between Gen AI and Discriminative Modeling, Importance of generative models in AI and Machine Learning, Types of Generative models, GANs, VAEs, autoregressive models and Vector quantized Diffusion models, Understanding if probabilistic modeling and generative process, Challenges of Generative Modeling, Future of Gen AI, Ethical Aspects of AI, Responsible AI, Use Cases.

UNIT II:
Generative Models For Text: Language Models Basics, Building blocks of Language models, Transformer Architecture, Encoder and Decoder, Attention mechanisms, Generation of Text, Models like BERT and GPT models, Generation of Text, Auto encoding, Regression Models, Exploring ChatGPT, Prompt Engineering: Designing Prompts, Revising Prompts using Reinforcement Learning from Human Feedback (RLHF), Retrieval Augmented Generation, Multimodal LLM, Issues of LLM like hallucination.

UNIT III:
Generation of Images: Introduction to Generative Adversarial Networks, Adversarial Training Process, Nash Equilibrium, Variational Autoencoders, Encoder-Decoder Architectures, Stable Diffusion Models, Introduction to Transformer-based Image Generation, CLIP, Visual Transformers ViT- Dall-E2 and Dall-E3, GPT-4V, Issues of Image Generation models like Mode Collapse and Stability.

UNIT IV:
Generation of Painting, Music, and Play: Variants of GAN, Types of GAN, Cyclic GAN, Using Cyclic GAN to Generate Paintings, Neural Style Transfer, Style Transfer, Music Generating RNN, MuseGAN, Autonomous agents, Deep Q Algorithm, Actor-critic Network.

UNIT V:
Open Source Models And Programming Frameworks: Training and Fine tuning of Generative models, GPT 4 All, Transfer learning and Pretrained models, Training vision models, Google Copilot, Programming LLM, LangChain, Open Source Models, Llama, Programming for TimeSformer, Deployment, Hugging Face.

Text Books:
1. Denis Rothman, "Transformers for Natural Language Processing and Computer Vision", Third Edition , Packt Books, 2024

Reference Books:

1. David Foster, "Generative Deep Learning", O'Reily Books, 2024.
2. Altaf Rehmani, "Generative AI for Everyone", BlueRose One, 2024.

III Year II Semester	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:
At the end of the course, the student shall be able to:
- To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
- To compare and differentiate organization structures and project structures
- To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

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

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

UNIT- III:
Model based software architectures: A Management perspective and technical perspective.
Work Flows of the process: Software process workflows, Iteration workflows.
Checkpoints of the process: Major mile stones, Minor Milestones, Periodic status assessments.
Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

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

UNIT-V:
Agile Methodology, ADAPTing to Scrum, Patterns for Adopting Scrum, Iterating towards Agility. **Fundamentals of DevOps**: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system. DevOps adoption in

projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

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

Reference Books:
1. Software Project Management, Bob Hughes,3/e, Mike Cotterell, TMH
2. Software Project Management, Joel Henry, PEA
3. Software Project Management in practice, Pankaj Jalote, PEA, 2005,
4. Effective Software Project Management, Robert K.Wysocki, Wiley,2006.
5. Project Management in IT, Kathy Schwalbe, Cengage

III Year II Semester	MOBILE ADHOC NETWORKS	L	T	P	C
		3	0	0	3

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

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

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

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

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

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

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

Reference Books:

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

III Year II Semester	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3

Course Objectives:

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

- Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
- The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.
- Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

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

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

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

UNIT IV:
SEMANTICS AND PRAGMATICS: Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

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

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

Reference Books:
1. Language Processing with Java and Ling Pipe Cookbook, 1stEdition, Breck Baldwin, Atlantic Publisher, 2015.

2. Natural Language Processing with Java, 2ndEdition, Richard M Reese, OReilly Media,2015.
3. Handbook of Natural Language Processing, Second, NitinIndurkhya and Fred J. Damerau, Chapman and Hall/CRC Press, 2010.Edition
4. Natural Language Processing and Information Retrieval, 3rdEdition, TanveerSiddiqui, U.S. Tiwary, Oxford University Press,2008.

III Year II Semester	**DISTRIBUTED OPERATING SYSTEM**	L	T	P	C
		3	0	0	3

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

Unit I:
Fundamentals:
What is Distributed Computing Systems? Evolution of Distributed Computing System; Distributed Computing System Models; What is Distributed Operating System? Issues in Designing a Distributed Operating System; Introduction to Distributed Computing Environment(DCE).
Message Passing:
Introduction, Desirable features of a Good Message Passing System, Issues in PC by Message Passing, Synchronization, Buffering, Multi-datagram Messages, Encoding and Decoding of Message Data, Process Addressing, Failure Handling, Group Communication, Case Study: 4.3 BSD UNIX IPC Mechanism.

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

Unit III: Distributed Shared Memory:
Introduction, General Architecture of DSM systems, Design and Implementation Issues of DSM, Granularity, Structure of Shared Memory Space, Consistency Models, Replacement Strategy, Thrashing, Other approaches to DSM, Heterogeneous DSM, Advantages of DSM. Synchronization: Introduction, Clock Synchronization, Event Ordering, Mutual Exclusion, Dead Lock, Election Algorithms

Unit IV: Resource Management:
Introduction, Desirable Features of a Good Global Scheduling Algorithm, Task Assignment Approach, Load – Balancing Approach, Load – Sharing Approach Process Management: Introduction, Process Migration, Threads.

Unit V: Distributed File Systems:
Introduction, Desirable Features of a Good Distributed File System, File models, File–Accessing Models, File – Sharing Semantics, File – Caching Schemes, File Replication, Fault Tolerance, Atomic Transactions and Design Principles.

Text books
1. Pradeep. K. Sinha: Distributed Operating Systems: Concepts and Design, PHI, 2007.

Reference Books:
1. Andrew S. Tanenbaum: Distributed Operating Systems, Pearson Education, 2013.
2. Ajay D. Kshemkalyani and MukeshSinghal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press, 2008
3. SunitaMahajan, Seema Shan, " Distributed Computing", Oxford University Press,2015

III Year II Semester	CLOUD COMPUTING LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:
- To introduce the various levels of services offered by cloud.
- To give practical knowledge about working with virtualization and containers.
- To introduce the advanced concepts such as serverless computing and cloud simulation.

Course Outcomes: At the end of the course, the student should be able to
- Demonstrate various service types, delivery models and technologies of a cloud computing environment.
- Distinguish the services based on virtual machines and containers in the cloud offerings.
- Assess the challenges associated with a cloud-based application.
- Discuss advanced cloud concepts such as serverless computing and cloud simulation.
- Examine various programming paradigms suitable to solve real world and scientific problems using cloud services.

List of Experiments:
1. Lab on web services
2. Lab on IPC, messagaging, publish/subscribe
3. Install VirtualBox/VMware Workstation with different flavours of Linux or windows OS on top of windows8 or above.
4. Install a C compiler in the virtual machine created using VirtualBox and execute Simple Programs.
5. Create an Amazon EC2 instance and set up a web-server on the instance and associate an IP address with the instance. In the process, create a security group allowing access to port 80 on the instance.

<div align="center">OR</div>

6. Do the same with OpenStack
7. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
8. Start a Docker container and set up a web-server (e.g. apache2 or Python based Flask micro web framework) on the instance. Map the host directory as a data volume for the container.
9. Find a procedure to transfer the files from one virtual machine to another virtual machine. Similarly, from one container to another container.
10. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
11. Install Hadoop single node cluster and run simple applications like word count.
12. Utilize OpenFaaS – Serverless computing framework and demonstrate basic event driven function invocation.
13. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

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

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

III Year II Semester	**MACHINE LEARNING LAB**	L	T	P	C
		0	0	3	1.5

Course Objectives:
- To learn about computing central tendency measures and Data preprocessing techniques
- To learn about classification and regression algorithms
- To apply different clustering algorithms for a problem.

Software Required: Python/R/Weka

Lab should cover the concepts studied in the course work, sample list of Experiments:

1. Compute Central Tendency Measures: Mean, Median, Mode Measure of Dispersion: Variance, Standard Deviation.
2. Apply the following Pre-processing techniques for a given dataset.
   a. Attribute selection   b. Handling Missing Values   c. Discretization
   d. Elimination of Outliers
3. Apply KNN algorithm for classification and regression
4. Demonstrate decision tree algorithm for a classification problem and perform   parameter tuning for better results
5. Demonstrate decision tree algorithm for a regression problem
6. Apply Random Forest algorithm for classification and regression
7. Demonstrate Naïve Bayes Classification algorithm.
8. Apply Support Vector algorithm for classification
9. Demonstrate simple linear regression algorithm for a regression problem
10. Apply Logistic regression algorithm for a classification problem
11. Demonstrate Multi-layer Perceptron algorithm for a classification problem
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.
13. Demonstrate the use of Fuzzy C-Means Clustering
14. Demonstrate the use of Expectation Maximization based clustering algorithm

III Year II Semester	**SOFT SKILLS**	**L**	**T**	**P**	**C**
		0	**1**	**2**	**2**

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

UNIT – I
Analytical Thinking & Listening Skills: Self-Introduction, Shaping Young Minds - A Talk by Azim Premji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception.
Communication Skills: Verbal Communication; Non Verbal Communication (Body Language)

UNIT – II
Self-Management Skills: Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities
Etiquette: Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette

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

UNIT-IV
Job-Oriented Skills: Group Discussion, Mock Group Discussions, Resume Preparation, Interview Skills, Mock Interviews

UNIT-V
Interpersonal relationships: Introduction, Importance, Types, Uses, Factors affecting interpersonal relationships, Accommodating different styles, Consequences of interpersonal relationships

Text books:
1. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011.
2. S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.

Reference books:
1. R.S.Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand& Company Ltd., 2018.
2. Raman, Meenakshi& Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.

E-resources:
1. https://swayam-plus.swayam2.ac.in/courses/course-details?id=P_CAMBR_01

III Year II Semester	**TECHNICAL PAPER WRITING & IPR**	L	T	P	C
		2	0	0	-

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

Unit I:
Introduction: An introduction to writing technical reports, technical sentences formation, using transitions to join sentences, Using tenses for technical writing.
Planning and Structuring: Planning the report, identifying reader(s), Voice, Formatting and structuring the report, Sections of a technical report, Minutes of meeting writing.

Unit II:
Drafting report and design issues: The use of drafts, Illustrations and graphics.
Final edits: Grammar, spelling, readability and writing in plain English: Writing in plain English, Jargon and final layout issues, Spelling, punctuation and Grammar, Padding, Paragraphs, Ambiguity.

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

Unit IV: Using word processor:
Adding a Table of Contents, Updating the Table of Contents, Deleting the Table of Contents, Adding an Index, Creating an Outline, Adding Comments, Tracking Changes, Viewing Changes, Additions, and Comments, Accepting and Rejecting Changes , Working with Footnotes and Endnotes, Inserting citations and Bibliography, Comparing Documents, Combining Documents, Mark documents final and make them read only., Password protect Microsoft Word documents., Using Macros,

Unit V:
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of **Patenting and Development:** technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property

Text Books:
1. Kompal Bansal & Parshit Bansal, "Fundamentals of IPR for Beginner's", 1st Ed., BS Publications, 2016.
2. William S. Pfeiffer and Kaye A. Adkins, "Technical Communication: A Practical Approach", Pearson.
3. Ramappa,T., "Intellectual Property Rights Under WTO", 2nd Ed., S Chand, 2015.

Reference Books:
1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.
2. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press(2006)

E-resources:
1. https://www.udemy.com/course/reportwriting/
2. https://www.udemy.com/course/professional-business-english-and-technical-report-writing/
3. https://www.udemy.com/course/betterbusinesswriting/

IV Year I Semester	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

Course Objectives:
From the course the student will learn
- the application areas of IOT
- the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
- building blocks of Internet of Things and characteristics

UNIT I:
Predecessors of IoT: Introduction, Wireless Sensor Networks, Machine-to-Machine Communications, Cyber Physical Systems
Emergence of IoT: Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components, Addressing Strategies in IoT

UNIT II:
IoT Sensing and Actuation: Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics
IoT Processing Topologies and Types: Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.

UNIT III:
IoT Connectivity Technologies: Introduction, IEEE 802.15.4, Zigbee, Thread, ISA100.11A, WirelessHART, RFID, NFC,DASH7, Z-Wave, Weightless, Sigfox, LoRa, NB-IT, Wi-Fi, Bluetooth
IoT Communication Technologies: Introduction, Infrastructure Protocols, Discovery Protocols, Data Protocols, Identification Protocols, Device Management, Semantic Protocols.

UNIT IV:
IoT Interoperability: Introduction, Standards, Frameworks
Fog Computing and Its Applications: Introduction, View of Fog Computing Architecture, Fog Computing in IoT, Selected Applications of Fog Computing

UNIT V:
Paradigms, Challenges, and the Future: Introduction, Evolution of New IoT Paradigms, Challenges Associated with IoT, Emerging Pillars of IoT
IoT Case Studies: Agricultural IoT, Vehicular IoT

Text Books:
1. Introduction to IoT, Sudip Misra, Anandarup Mukhaerjee, Arjit Roy, Cambridge University Press, 2021
2. Internet of Things: Architecture, Design Principles and Applications, Rajkamal, McGraw Hill Higher Education

Reference Books:
1. Fog and Edge Computing: Principles and Paradigms, Rajkumar Buyya (Editor), Satish narayana Srirama (Editor) , ISBN: 978-1-119-52498-4, January 2019
2. Getting Started with the Internet of Things, CunoPfister , Oreilly

IV Year I Semester	**HUMAN RESOURCES & PROJECT MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

IV Year I Semester	SOFTWARE ARCHITECTURE & DESIGN PATTERNS	L	T	P	C
		3	0	0	3

Course Outcomes
- Understand the basic concepts to identify state behavior of real world objects
- Apply Object Oriented Analysis and Design concepts to solve complex problems
- Construct various UML models using the appropriate notation for specific problem context
- Design models to Show the importance of systems analysis and design in solving complex problems using case studies
- Study of Pattern Oriented approach for real world problems

UNIT - I
Introduction: What is a design pattern? Describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern What is object oriented development? key concepts of object oriented design other related concepts, benefits and drawbacks of the paradigm

UNIT – II
Analysis a System: Overview of the analysis phase, stage 1 gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain Design and Implementation, discussions and further reading

UNIT – III
Design Pattern Catalog: Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.

UNIT – IV
Interactive systems and the MVC architecture: Introduction The MVC architectural pattern, analyzing a simple drawing program designing the system, designing of the subsystems, getting into implementation, implementing undo operation drawing incomplete items, adding a new feature pattern based solutions

UNIT – V
Designing with Distributed Objects: Client server system, java remote method invocation, implementing an object oriented system on the web, Web services (SOAP, Restful), Enterprise Service Bus

Text Books:
1. Object oriented analysis, design and implementation, brahma dathan, sarnath rammath , universities press,2013
2. Design patterns, Erich Gamma, Richard helan , Ralph johman , john vlissides, PEARSON Publication,2013

Reference Books:

1. Frank Bachmann, Regine Meunier , Hans Rohnert "Pattern Oriented Software Architecture" Volume 1, 1996.
2. William J Brown et al., "Anti Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998

IV Year I Semester	DEEP LEARNING	L	T	P	C
		3	0	0	3

Course Objectives: The main objective of the course is to make students:
- Learn deep learning methods for working with sequential data,
- Learn deep recurrent and memory networks,
- Learn deep Turing machines,
- Apply such deep learning mechanisms to various learning problems.
- Know the open issues in deep learning, and have a grasp of the current research directions.

UNIT I:
Fundamentals of Deep Learning: Artificial Intelligence, History of Machine learning: Probabilistic Modeling, Early Neural Networks, Kernel Methods, Decision Trees, Random forests and Gradient Boosting Machines, **Fundamentals of Machine Learning:** Four Branches of Machine Learning, Evaluating Machine learning Models, Overfitting and Under fitting. **[Text Book 2]**

UNIT II: Introducing Deep Learning: Biological and Machine Vision, Human and Machine Language, Artificial Neural Networks, Training Deep Networks, Improving Deep Networks. **[Text Book3]**

UNIT III: Neural Networks: Anatomy of Neural Network, Introduction to Keras: Keras, TensorFlow, Theano and CNTK, Setting up Deep Learning Workstation, Classifying Movie Reviews: Binary Classification, Classifying newswires: Multiclass Classification. **[Text Book 2]**

UNIT IV:
Convolutional Neural Networks: Nerual Network and Representation Learing, Convolutional Layers, Multichannel Convolution Operation, **Recurrent Neural Networks:** Introduction to RNN, RNN Code, PyTorch Tensors: Deep Learning with PyTorch, CNN in PyTorch. **[Text Book 3]**

UNIT V:
Interactive Applications of Deep Learning: Machine Vision, Natural Language processing, Generative Adversial Networks, Deep Reinforcement Learning. **[Text Book 1]**
Deep Learning Research: Autoencoders**,** Deep Generative Models: Boltzmann Machines Restricted Boltzmann Machines, Deep Belief Networks. **[Text Book 1]**

Text Books:
1. Deep Learning- Ian Goodfellow, Yoshua Bengio and Aaron Courvile, MIT Press, 2016
2. Deep Learning with Python - Francois Chollet, Released December 2017, Publisher(s): Manning Publications, ISBN: 9781617294433
3. Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence - Jon Krohn, Grant Beyleveld, Aglaé Bassens, Released September 2019, Publisher(s): Addison-Wesley Professional, ISBN: 9780135116821

4. Deep Learning from Scratch - Seth Weidman, Released September 2019, Publisher(s): O'Reilly Media, Inc., ISBN: 9781492041412

Reference Books:
1. Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, 2009.
2. Matrix Computations, Golub, G.,H., and Van Loan,C.,F, JHU Press,2013.
3. Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-Hill Education, 2004.

Web Link:
1. Swayam NPTEL: Deep Learning: https://onlinecourses.nptel.ac.in/noc22_cs22/preview

IV Year I Semester	COMPUTER VISION	L	T	P	C
		3	0	0	3

Course Objectives:
- To understand the Fundamental Concepts related to sources, shadows and shading
- To understand the Geometry of Multiple Views

UNIT –I:
CAMERAS: Pinhole Cameras Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

UNIT-II:
Linear Filters:Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection:Noise, Estimating Derivatives, Detecting Edges Texture0:Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.

UNIT-III:
The Geometry of Multiple Views: Two Views Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras Segmentation by Clustering: What Is Segmentation? Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,

UNIT-IV:
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples

UNIT- V:
Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry,
Case study: Mobile Robot Localization Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Case study: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.

Text Books:
1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.

Reference Books:
1. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.
2. R. C. Gonzalez and R. E. Woods "Digital Image Processing" Addison Wesley 2008. 3. Richard Szeliski "Computer Vision: Algorithms and Applications" Springer-Verlag London Limited 2011.

IV Year I Semester	**BLOCK CHAIN TECHNOLOGY**	L	T	P	C
		3	0	0	3

Course Objectives:
1. To learn the fundamentals of Block Chain and various types of block chain and consensus mechanism.
2. To understand public block chain system, Private block chain system and consortium block chain.
3. Able to know the security issues of blockchain technology.

UNIT – I:
Fundamentals of Blockchain: Introduction, Origin of Blockchain, Blockchain Solution, Components of Blockchain, Block in a Blockchain, The Technology and the Future.
Blockchain Types and Consensus Mechanism: Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol.
Cryptocurrency: Bitcoin, Altcoin and Token: Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrencies, Cryptocurrency Usage.

UNIT – II:
Public Blockchain System: Introduction, Public Blockchain, Popular Public Blockchains, The Bitcoin Blockchain, Ethereum Blockchain.
Smart Contracts: Introduction, Smart Contract, Characteristics of a Smart Contract, Types of Smart Contracts, Types of Oracles, Smart Contracts in Ethereum, Smart Contracts in Industry.

UNIT – III:
Private Blockchain System: Introduction, Key Characteristics of Private Blockchain, Private Blockchain, Private Blockchain Examples, Private Blockchain and Open Source, E-commerce Site Example, Various Commands (Instructions) in E-commerce Blockchain, Smart Contract in Private Environment, State Machine, Different Algorithms of Permissioned Blockchain, Byzantine Fault, Multichain.
Consortium Blockchain: Introduction, Key Characteristics of Consortium Blockchain, Need of Consortium Blockchain, Hyperledger Platform, Overview of Ripple, Overview of Corda.
Initial Coin Offering: Introduction, Blockchain Fundraising Methods, Launching an ICO, Investing in an ICO, Pros and Cons of Initial Coin Offering, Successful Initial Coin Offerings, Evolution of ICO, ICO Platforms.

UNIT – IV:
Security in Blockchain: Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp), Security Aspects in Hyperledger Fabric.
Applications of Blockchain: Introduction, Blockchain in Banking and Finance, Blockchain in Education, Blockchain in Energy, Blockchain in Healthcare, Blockchain in Real-estate, Blockchain in Supply Chain, The Blockchain and IoT. Limitations and Challenges of Blockchain.

UNIT – V:
Blockchain Case Studies:

Case Study 1 – Retail,
Case Study 2 – Banking and Financial Services,
Case Study 3 – Healthcare,
Case Study 4 – Energy and Utilities.
Blockchain Platform using Python: Introduction, Learn How to Use Python Online Editor, Basic Programming Using Python, Python Packages for Blockchain.
Blockchain platform using Hyperledger Fabric: Introduction, Components of Hyperledger Fabric Network, Chain codes from Developer.ibm.com, Blockchain Application Using Fabric Java SDK.

Text book:
1. "Block chain Technology", Chandramouli Subramanian, Asha A.George, Abhilasj K A and Meena Karthikeyan , Universities Press.

Reference Books:
1. Blockchain Blue print for Economy, Melanie Swan, SPD Oreilly.
2. Blockchain for Business, Jai Singh Arun, Jerry Cuomo, Nitin Gauar, Pearson Addition Wesley

IV Year I Semester	AGILE METHODOLOGIES	L	T	P	C
		3	0	0	3

Course Objectives:
The main objectives of this course are to introduce the important concepts of Agile software development Process, emphasize the role of stand-up meetings in software collaboration, impart the knowledge on values and principles in understanding agility

UNIT I :
Learning Agile: Getting Agile into your brain, Understanding Agile values, No Silver Bullet, Agile to the Rescue, adding Agile makes a difference. A fractured perspective, How a fractured perspective causes project problems. The Agile Manifesto, Purpose behind Each Practice. Individuals and Interactions Over Processes and Tools, Working Software over Comprehensive Documentation, Customer Collaboration over Contract Negotiation, Responding to Change over Following a Plan, Principles over Practices. Understanding the Elephant, Methodologies Help You Get It All in Place at Once, Where to Start with a New Methodology.

UNIT II :
The Agile Principles: The 12 Principles of Agile Software, The Customer Is Always Right, "Do As I Say, Not As I Said". Delivering the Project, Better Project Delivery for the Ebook Reader Project. Communicating and Working Together, Better Communication for the Ebook Reader Project. Project Execution—Moving the Project Along, A Better Working Environment for the Ebook Reader Project Team. Constantly Improving the Project and the Team. The Agile Project: Bringing All the Principles Together

UNIT III :
SCRUM and Self-Organizing Teams: The Rules of Scrum, Act I: I Can Haz Scrum?, Everyone on a Scrum Team owns the Project, The Scrum Master Guides the Team's Decisions, The Product Owner Helps the Team Understand the Value of the Software, Everyone Owns the Project, Scrum Has Its Own Set of Values ,Status Updates Are for Social Networks!, The Whole Team Uses the Daily Scrum, Feedback and the Visibility-Inspection-Adaptation Cycle, The Last Responsible Moment, How to Hold an Effective Daily Scrum. Sprinting into a Wall, Sprints, Planning, and Retrospectives, Iterative or Incremental?, The Product Owner Makes or Breaks the Sprint, Visibility and Value, How to Plan and Run an Effective Scrum Sprint
Scrum Planning And Collective Commitment: Not Quite Expecting the Unexpected, User Stories, Velocity, and Generally Accepted Scrum Practices, Make Your Software Useful, User Stories Help Build Features Your Users Will Use, Conditions of Satisfaction, Story Points and Velocity, Burndown Charts, Planning and Running a Sprint Using Stories, Points, Tasks, and a Task Board. Victory Lap, Scrum Values Revisited, Practices Do Work Without the Values (Just Don't Call It Scrum), Is Your Company's Culture Compatible with Scrum Values.

UNIT IV :
XP And Embracing Change: Going into Overtime, The Primary Practices of XP, Programming Practices, Integration Practices, Planning Practices, Team Practices, Why Teams Resist Changes, and How the Practices Help. The Game Plan Changed, but We're

Still Losing, The XP Values Help the Team Change Their Mindset, XP Helps Developers Learn to Work with Users, Practices Only "Stick" When the Team Truly Believes in Them, An Effective Mindset Starts with the XP Values, The XP Values, Paved with Good Intentions. The Momentum Shifts, Understanding the XP Principles Helps You Embrace Change, The Principles of XP, XP Principles Help You Understand Planning, XP Principles Help You Understand Practices—and Vice Versa, Feedback Loops.

XP, Simplicity, and Incremental Design: Code and Design, Code Smells and Antipatterns (or, How to Tell If You're Being Too Clever), XP Teams Look for Code Smells and Fix Them, Hooks, Edge Cases, and Code That Does Too Much. Make Code and Design Decisions at the Last Responsible Moment, Fix Technical Debt by Refactoring Mercilessly, Use Continuous Integration to Find Design Problems, Avoid Monolithic Design, Incremental Design and the Holistic XP Practices. Teams Work Best When They Feel Like They Have Time to Think, Team Members Trust Each Other and Make Decisions Together. The XP Design, Planning, Team, and Holistic Practices Form an Ecosystem Incremental Design Versus Designing for Reuse, When Units Interact in a Simple Way, the System Can Grow Incrementally, Great Design Emerges from Simple Interactions, Final Score.

UNIT V:
Lean, Eliminating Waste, and Seeing the whole: Lean Thinking, Commitment, Options Thinking, and Set-Based Development, Creating Heroes and Magical Thinking. Eliminate Waste, Use a Value Stream Map to Help See Waste Clearly, Gain a Deeper Understanding of the Product, See the Whole, Find the Root Cause of Problems That You Discover. Deliver As Fast As Possible, Use an Area Chart to Visualize Work in Progress, Control Bottlenecks by Limiting Work in Progress.

Kanban, Flow, and Constantly Improving: The Principles of Kanban, Find a Starting Point and Evolve Experimentally from There. Stories Go into the System; Code Comes Out, Improving Your Process with Kanban, Visualize the Workflow, Limit Work in Progress. Measure and Manage Flow, Managing Flow with WIP Limits Naturally Creates Slack. Make Process Policies Explicit So Everyone Is on the Same Page. Emergent Behavior with Kanban.

The Agile Coach: Coaches Understand Why People Don't Always Want to Change. The Principles of Coaching.

Text Books :
1. Andrew Stellman, Jill Alison Hart, Learning Agile, O'Reilly, 2015.

Reference Books:
1. Andrew stellman, Jennifer Green, Head first Agile, O'Reilly, 2017.
2. Rubin K , Essential Scrum : A practical guide to the most popular Agile process, Addison-Wesley, 2013

IV Year I Semester	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

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

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

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

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

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

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

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

5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012

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

IV Year I Semester	MOBILE COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives: the main objectives of the course are
1. To introduce the basic concepts and principles in mobile computing. This includes major itechniques involved, and networks & systems issues for the design and implementation of mobile computing systems and applications.
2. To explore both theoritical 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

UNIT-I:
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:
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,and4G
 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:
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:
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:
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.

TEXTBOOK:
1. RAJ KAMAL, "Mobile Computing," second edition, Oxford.
2. ASOKE K TALUKDER, HASANAHMED, ROOPA R YAVAGAL, "Mobile Computing, Technology Applications and Service Creation" Second Edition, Mc Graw Hill.

3. UWE Hansmann, Lother Merk, Martin S. Nocklous, Thomas Stober, "Principles of Mobile Computing," Second Edition, Springer

IV Year I Semester	**CYBER PHYSICAL SYSTEMS**	L	T	P	C
		3	0	0	3

Course Objectives:
The main objectives of the course are to understand the core principles behind Cyber Physical Systems, Identify Security mechanisms of Cyber physical system, Understand Synchronization in Distributed Cyber-Physical Systems

UNIT I:
Symbolic Synthesis for Cyber-Physical Systems: Introduction and Motivation, Basic Techniques - Preliminaries, Problem Definition, Solving the Synthesis Problem, Construction of Symbolic Models, Advanced Techniques: Construction of Symbolic Models, Continuous-Time Controllers, Software Tools

UNIT II:
Security of Cyber-Physical Systems: Introduction and Motivation, Basic Techniques - Cyber Security Requirements, Attack Model, Countermeasures, Advanced Techniques: System Theoretic Approaches

UNIT III:
Synchronization in Distributed Cyber-Physical Systems: Challenges in Cyber-Physical Systems, A Complexity-Reducing Technique for Synchronization, Formal Software Engineering, Distributed Consensus Algorithms, Synchronous Lockstep Executions, Time-Triggered Architecture, Related Technology, Advanced Techniques

UNIT IV:
Real-Time Scheduling for Cyber-Physical Systems: Introduction and Motivation, Basic Techniques - Scheduling with Fixed Timing Parameters, Memory Effects, Multiprocessor/Multicore Scheduling, Accommodating Variability and Uncertainty

UNIT V:
Model Integration in Cyber-Physical Systems: Introduction and Motivation, Causality, Semantic Domains for Time, Interaction Models for Computational Processes, Semantics of CPS DSMLs, Advanced Techniques, ForSpec, The Syntax of CyPhyML, Formalization of Semantics, Formalization of Language Integration.

Text Books:
1. Raj Rajkumar, Dionisio De Niz, and Mark Klein, Cyber-Physical Systems, Addison-Wesley Professional, 2016
2. Rajeev Alur, Principles of Cyber-Physical Systems, MIT Press

Reference Books:
1. E.A.Lee, Sanjit Seshia, Introduction to Embedded Systems: A Cyber-Physical Systems Approach, MIT Press
2. Andre Platzer, Logical Foundations of Cyber-Physical Systems, (2e), Springer Publishing, 2018

IV Year I Semester	PROMPT ENGINEERING	L	T	P	C
		0	1	2	2

IV Year I Semester	**CONSTITUTION OF INDIA**	L	T	P	C
		2	0	0	-

Course Objectives:
- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT–I: History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working)
Philosophy of the Indian Constitution- Preamble, Salient, Features

UNIT–II: Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT–III: Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, **Executive-** President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

UNIT–IV: Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: ZilaPachayat, Elected officials and their roles, CEO ZilaPachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT–V: Election Commission: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

Text Books:
1. The Constitution of India, 1st Edition, (Bare Act), Government Publication, 1950
2. Framing of Indian Constitution, 1st Edition, Dr. S. N. Busi, Dr. B. R. Ambedkar 2015

Reference Books:
1. Indian Constitution Law, 7th Edition, M. P. Jain, Lexis Nexis, 2014