B.Tech. – III Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Designing the IOT	3	0	0	3
2	Professional Core	Wireless Sensor Networks	3	0	0	3
3	Professional Core	Cryptography &Network Security	3	0	0	3
4	Professional Elective-I	1.Software Engineering 2.Automata Theory & Compiler Design 3.Artificial Intelligence 4.Public Block chain – Ethereum 5. Light weight Cryptography 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	Internet of Things Lab	0	0	3	1.5
7	Professional Core	Cyber Security Lab	0	0	3	1.5
8	Skill Enhancement course	Full Stack development-2	0	1	2	2
9	Engineering Sciences	UI Design-Flutter Lab	0	0	2	1
10	Evaluation of Community Service Internship		0	0	0	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	Credits
1	Professional Core	Cyber Security and digital forensics	3	0	0	3
2	Professional Core	Cloud Computing	3	0	0	3
3	Professional Core	Blockchain Technology	3	0	0	3
4	Professional Elective-II	1. DevOps 2. Microprocessors & Microcontrollers 3. Machine Learning 4. 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. Security Assessment and Risk Analysis 5. 12 week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
6	Open Elective – III		3	0	0	3
7	Professional Core	Cloud Computing Lab	0	0	3	1.5
8	Professional Core	BlockchainTechnology Lab	0	0	3	1.5
9	Skill Enhancement Course	Soft skills OR IELTS	0	1	2	2
10	Audit Course	Technical Paper Writing & IPR	2	0	0	0
Total			**20**	**1**	**08**	**23**
Mandatory Industry Internship of 08 weeks duration during summer vacation						
MC	Student may select from the same minors pool		3	0	3	4.5
MC	Minor Course (Student may select from the same specialized minors pool)		3	0	0	3
HC	Student may select from the same honors pool		3	0	0	3
HC	Honors Course (Student may select from the honors pool)		3	0	0	3

Remarks :
1. In place of IOT applications development on cloud platform incudedCyber Security And Digital Forensics
2. In professional elective - II Automata Theory and Compiler Design Removed
3. In professional elective -II included 12week MOOC Swayam/NPTEL course recommended by the BoS.

4. In professional elective -III included 12week MOOC Swayam/NPTEL course recommended by the BoS.

Minor Courses & Honor Courses

Sl.No.	Category	L	T	P	Credits
1	Minor Course (Student may select from the specialized minors pool)	3	0	3	4.5
2	Honors Course (Student may select from the honors pool)	3	0	0	3

Note: *ToobtainMinorEngineering,studentneedstoobtain18creditsbysuccessfullycompletinganyofthefollowingcoursesintheconcernstream.*

ForMinor in CSE (IoT and CYBER SECURITY including BCT):	**L-T-P-C**
1. Operating Systems	3-0-0-3
2.Introduction to IOT	3-0-0-3
3. Blockchain technology	3-0-0-3
4. Cloud computing	3-0-0-3
5. Cyber Security	3-0-0-3
6. IOT Lab Using Python	0-0-3-1.5
7. Cyber Security Lab	0- 0- 3-1.5

OpenElectives,offeredtootherdepartmentstudents:

Open ElectiveI	:	Java Programming
Open ElectiveII	:	Operating Systems
Open ElectiveIII	:	DataBase Management Systems
Open ElectiveIV	:	ComputerNetworks

COURSES OFFERED FOR HONOURS DEGREE IN
CSE (IoT and CYBER SECURITY including   BCT):

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1		Vulnerability Analysis and Penetration Testing	3	0		3
2		Cloud Computing Security	3	0		3
3		Machine Learning for Cyber security	3	0		3
4		IOT security	3	0		3
5		Cyber Physical Systems and Security	3	0		3
6		IOT security Lab			3	1.5
7		Cyber Physical Systems and Security Lab			3	1.5
		Total:				**18**

III Year I Semester	DESIGNING THE IOT	L	T	P	C
		3	0	0	3

Prerequisite: Embedded hardware design.

CourseObjectives:
1. To understand the architectural over view of the Internet of Things (IoT).
2. To acquires kills on data acquisition and communication in IoT.
3. To understand the threats of loT.

CourseOutcome:
1. Understand how the IoT is different from traditional systems.
2. Demonstrate the revolution of internet in mobile and cloud.
3. Examine the architecture and operation of IoT.
4. Explore various tools and programming paradigms for IoT applications.
5. Develop an IoT prototype for realtime scenario.
6. Understand the building blocks of IoT and security aspects.

UNIT-I
Design Principles of IoT: Design principles of connected devices, data acquiring organizing and analytics in IoT, system architecture of loT.

UNIT-II
Prototyping the Embedded Devices for IoT: System hardware and prototyping, sensors and actuators for IoT, Radio module and wireless sensor network, gateways internet and web, software components.

UNIT-III
EmbeddedProgrammingforIoT: Programming connected devices, C and python for IoT,Cases tudy: Temperature controller, Smart irrigation system.

UNIT-IV
Embedded RTOS: Program structure and real time, multi tasking and scheduling, RTOS services, signals, semaphores, NucleusSE, application timers, interrupts in nucleus ES, Nucleus S Einitialization and starn1p.

UNIT-V
ToolsforIoT: Introduction, chefpuppet, NETCONF-YANGcasestudies.
loT physical Devices: Basic building blocks of an IoT device and endpoints, family of ploT devices, pcDuino, Beagle bone black, cubie board, domain specific IoTs.

TextBooks:

1. RajKamal, Internet of Things, Architecture and Design Principles, lstedition, McGrawHill Education, May 2017.

2. Arsheep Bagaand Vijay Madisetti, Internet of Things: AHands-OnApproach, 1stEdition, Universities press, 2015.

ReferenceBooks:

1. David Etter, IoT (Internet of Things Programming: A simple and fastway of Learning IoT, Kindle edition 2016.

2. FeiHU,Security and Privacy in Internet of Things (loTs): Models, Algorithms, and Implementations, 1st Edition, CRC Press, 2016.

3. Colin Walls, Embedded RTOS Design Insights and Implementation.1stedition.Elsevier. December 2020**.**

III Year I Semester	**WIRELESS SENSOR NETWORKS**	L	T	P	C
		3	0	0	3

Course Objectives:
- To acquire the knowledge about various architectures and applications of Sensor Networks
- To understand issues, challenges, and emerging technologies for wireless sensor networks
- To learn about various routing protocols and MAC Protocols
- To understand various data gathering and data dissemination methods
- To study about design principles, node architectures, hardware, and software required for implementation of wireless sensor networks.

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

- Analyze and compare various architectures of Wireless Sensor Networks
- Understand design issues and challenges in wireless sensor networks
- Analyze and compare various data gathering and data dissemination methods
- Design, simulate, and compare the performance of various routing and MAC protocols

UNIT-I
Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

UNIT-II
 Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

UNIT-III
Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee

UNIT-IV
 Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

UNIT-V
 Design Principles for WSNs, Gateway Concepts, Need for gateway, WSN to Internet Communication, and Internet to WSN Communication. Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

Text Books:
1. Ad-Hoc Wireless Sensor Networks - C. Siva Ram Murthy, B.S. Manoj, Pearson
2. Principles of Wireless Networks – Kaveh Pahlavan and P. Krishna Murthy, 2002, PE

Reference Books:
1. Wireless Digital Communications – Kamilo Feher, 1999, PHI.
2. Wireless Communications - Andrea Goldsmith, 2005, Cambridge University Press.
3. Mobile Cellular Communication – GottapuSasibhushana Rao, Pearson Education, 2012.
4. Wireless Communication and Networking – William Stallings, 2003, PHI.

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

Course Objectives:
- Explain the objectives of information security
- Explain the importance and application of each of confidentiality, integrity, authentication and availability
- Understand the basic categories of threats to computers and networks
- Discusses the Mathematics of Cryptography
- Discuss the fundamental ideas of Symmetric and Asymmetric cryptographic Algorithms
- Discusses the Network layer, Transport Layer and Application layer Protocols Enhanced security mechanisms

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

CO	Course Outcomes	Knowledge Level (K)#
CO1	Student will be able to understand security issues related to computer networks and learn different symmetric key techniques	**K2**
CO2	Students will be able learn mathematic of cryptography for symmetric and Asymmetric algorithms and apply this knowledge to understand the Cryptographic algorithms	**K3**
CO3	Students will be able learn different types of symmetric and Asymmetric algorithms	**K3**
CO4	Students will be able learn different algorithms of Hash functions, message authentication and digital signature and their importance to the security	**K4**
CO5	Students will be able learn different Enhanced security protocols of Application Layer, Transport Layer and Network layer	**K4**

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2	1	2	1	1	1	1		1		2	2	2	2
CO 2	3	1	1	2	2	2	1	2		3	3	2	3	2	1
CO 3	2	2	2	1	2	1	1	1		2		3	1		
CO 4	3	2	3	2	3	2	1	1		2	1	2	2	1	
CO 5	3	2	3	1	2	2	1	1		2	2	2	1	2	1

(Please fill the above with Levels of Correlation, viz., L-1, M-2, H-3)

UNIT-I
Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography.Classical Encryption Techniques-symmetric cipher model, Substitution techniques, Transposition techniques, Rotor Machines, Stenography.

UNIT-II
Introduction to Symmetric Cryptography: Algebraic Structures-Groups, Rings, Fields, GF(2^n) fields, Polynomials.**Mathematics of Asymmetric cryptography:** Primes, Checking For Primness, Eulers phi-functions, Fermat's Little Theorem, Euler's Theorem, Generating Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Quadratic Congruence, Exponentiation And Logarithm.

UNIT-III
Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, IDEA, Block cipher operation, Stream ciphers: RC4, RC5. **Asymmetric key Ciphers:** Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange, Elgamal Cryptographic system, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.

UNIT-IV
Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithms (SHA). **Message Authentication Codes:** Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MAC'S,MAC'S Based On Hash Functions: HMAC, MAC'S Based On Block Ciphers: DAA And CMAC. **Digital Signatures:** Digital Signatures, Elgamal Digital Signature Scheme, Elliptic Curve Digital Signature Algorithm, RSA-PSS Digital Signature Algorithm.

UNIT-V
Network and Internet Security: Transport-Level Security: Web Security Considerations, Transport Level Security, HTTPS, SSH.**IP Security:** IP Security Overview, IP Security Policy, Encapsulating Security Payload, Authentication Header Protocol.**Electronic-Mail Security:** Internet-mail Security, Email Format, Email Threats and Comprehensive Email Security, S/MIME, PGP.

Text Books:
1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 7th Edition, 2017
2. Cryptography and Network Security: Behrouz A. Forouzan Debdeep, Mc Graw Hill, 3rd Edition, 2015

Reference Books:
1. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition
2. Introduction to Cryptography with Coding Theory: Wade Trappe, Lawrence C. Washington, Pearson.
3. Modern Cryptography: Theory and Practice ByWenbo Mao. Pearson

III Year I Semester	**SOFTWARE ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

CourseObjectives:

The objectives of this course are to introduce
- Softwarelifecyclemodels
- SoftwarerequirementsandSRSdocument.
- How to plan for a project.
- Thequalitycontrolandhowtoensuregoodqualitysoftware.
- Testing methods of software, use of CASE tools
- Implementation issues,validationand verificationprocedures.

CourseOutcomes:

CO	Course Outcomes	**Knowledge Level(K)#**
CO1	Compare and analyse various process models	**K1**
CO2	Develop SRS document and estimate the modularity of the project	**K2**
CO3	Develop data flow diagrams and compare the user interface design	**K2**
CO4	Compare testing strategies and analyse the software quality	**K3**
CO5	Apply Computer Aided Software Engineering tools and analyse the components of software maintenance and reuse.	**K2**

UNIT-I

INTRODUCTION: Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering.

SOFTWARE LIFE CYCLE MODELS: Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model and Spiral model.

UNIT -II

SOFTWARE PROJECT MANAGEMENT: Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, and risk management.

REQUIREMENTS ANALYSIS AND SPECIFICATION: Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.

UNIT-III

SOFTWARE DESIGN: Overview of the design process, How to characterise a good software design? Layered arrangement of modules, Cohesion and Coupling.approaches to software design.

FUNCTION-ORIENTED SOFTWARE DESIGN: Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review.

USER INTERFACE DESIGN: Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.

UNIT-IV

CODING AND TESTING: Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Debugging, Program analysis tools, Integration testing**,** Testing object-oriented programs, Smoke testing, and Some general issues associated with testing.

SOFTWARE RELIABILITY AND QUALITY MANAGEMENT: Software reliability. Statistical testing, Software quality, Software quality management system, ISO 9000.SEI Capability maturity model. Few other important quality standards, and Six Sigma**.**

UNIT-V

COMPUTER-AIDED SOFTWARE ENGINEERING (CASE): CASE and its scope, CASE environment, CASE support in the software life cycle, Other characteristics of CASE tools, Towards second generation CASE Tool, and Architecture of a CASE Environment. **SOFTWARE MAINTENANCE:** Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost.**SOFTWARE REUSE:** What can be reused? Why almost no reuse so far? Basic issues in any reuse program, A reuse approach, and Reuse at organisation level.

Text Books::

1. Fundamentals of Software Engineering, Rajib Mall, Fifth Edition, PHI.

Reference Books
1. Software Engineering Apractitioner's Approach, Roger S.Pressman, Ninth Edition, Mc Graw Hill International Edition.
2. Software Engineering, IanSommerville,Tenth Edition, Pearson Education.
3. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

e-Resources:
1) https://nptel.ac.in/courses/106/105/106105182/
2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01260589506387148827_shared/overview
3) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview

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

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

CO1. Acquire fundamental understanding of the core concepts in automata theory and Theory of Computation

CO2. Design and develop lexical analyzers, parsers and code generators

CO3. Design Grammars and Automata (recognizers) for different language classes and become knowledgeable about restricted models of Computation (Regular, Context Free) and their relative powers.

CO4. Acquire fundamental understanding of the structure of a Compiler and Apply concepts automata theory and Theory of Computation to design Compilers

CO5. Design computations models for problems in Automata theory and adaptation of such model in the field of compilers

UNIT I
Introduction to Automata Theory: Central Concepts of Automata theory, Deterministic Finite Automata(DFA), Non- Deterministic Finite Automata(NFA) ,Epsilon- NFA, NFA to DFA Conversion, Minimization of DFA. **Introduction to Compiler Design:**Language Processors, Phases of Compilers

UNIT II
Regular Expressions and Languages: Regular Expressions, Finite Automata and Regular Expressions, Proving Languages Not to Be Regular. **Lexical Analysis Phase of compiler Design:**Role of Lexical Analyzer, Input Buffering, Specification of Token, Recognition of Token.

UNIT III
Context Free Grammars: Definition and designing CFGs, Derivations Using a Grammar, Parse Trees, Ambiguity and Elimination of Ambiguity, Elimination of Left Recursion, Left Factoring.**Syntax Analysis Phase of Compilers:part-1:**Role of Parser , Top-Down Parsing

UNIT IV
Push Down Automata: Definition of the Pushdown Automata, The Languages of a PDA.
 Syntax Analysis Phase of Compilers: Part-2: Bottom-up Parsing, Introduction to LR Parsing: SLR, More Powerful LR parsers

UNIT V
Introduction to Turing Machine: Problems that Computers Cannot Solve, The Turing machine, problems, Programming Techniques for Turing Machine, Extensions to the Basic Turing Machine
Undecidability:A language That Is Not Recursively Enumerable, An Undecidable Problem That Is RE.**Other Phases of Compilers:**Syntax Directed Translation- Syntax-Directed Definitions, Evaluation Orders for SDD's. Intermediate-Code Generation- Variants of Syntax Trees, Three-Address Code.
Code Generation-Issues in the Design of a Code Generator

Text Books:
1. John E Hopcroft, Rajeev Motwani, Jeffrey D. Ullman," Introduction to Automata Theory, Languages and Computation", Third Edition, Pearson.
2. Alfred V.Aho, Monica S.Lam,RaviSethi, Jeffrey D. Ullman, " Compilers Principles, Techniques and Tools", Second Edition,Perason.

Reference Books:
1. Elain Rich, "Automata,Computability and complexity", 1st Edition, Pearson Education,2018.
2. K.L.P Mishra, N Chandrashekaran , 3rd Edition , 'Theory of Computer Science",PHI,2012.
3. Peter Linz, "An introduction to Formal Languages and Automata ", 3rd Edition, Narosa Publishers,1998.
4. K Muneeswaran, "Compiler Design", Oxford University Press 2013.

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

Course Outcome(s):
This course introduces students to the basic knowledge representation, problem solving, and learning methods of artificial intelligence.

UNIT–I
Introduction, Overview of Artificial intelligence: Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.
Problem Solving, Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

UNIT–II
Search techniques: Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best-first search, A* search, AO* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search

UNIT-III
Constraint satisfaction problems: Local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

UNIT– IV
Knowledge & reasoning: Knowledge representation issues, representation & mapping, approaches to knowledge representation. Using predicate logic, representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. Representing knowledge using rules, Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

UNIT–V
Probabilistic reasoning: Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Planning Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques
Expert Systems: Representing and using domain knowledge, expert system shells, and knowledge acquisition.
Home Assignments:
Assignments should include problems related to the topics covered in lectures, like heuristics, optimal search, and graph heuristics. Constraint satisfaction problems, k-nearest neighbors, decision trees, etc. can be included in home assignments.

Text Books:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach
2. Artificial Intelligence, Russel, Pearson

Reference Books:

3. Artificial Intelligence, Ritch & Knight, TMH
4. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
5. Logic & Prolog Programming, Saroj Kaushik, New Age International
6. Expert Systems, Giarranto, VIKAS

III Year I Semester	**PUBLIC BLOCKCHAIN – ETHEREUM**	L	T	P	C
		3	0	0	3

Course Objectives
- Explain the fundamentals of distributed computing and blockchain
- Discuss the concepts in bitcoin
- Demonstrate Ethereum platform

Course outcome
At the end of the course, the student will be able to:
CO1. Describe the concepts of Distributed computing and its role in Blockchain
CO2. Describe the concepts of Cryptography and its role in Blockchain
CO3. List the benefits, drawbacks and applications of Blockchain
CO4. Appreciate the technologies involved in Bitcoin
CO5. Appreciate and demonstrate the Ethereum platform to develop blockchain applications.

UNIT-I
Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.**Decentralization and Cryptography:** Decentralization using blockchain, Methods of decentralization,Routes to decentralization, Decentralized organizations

UNIT-II
Introduction to Cryptography & Cryptocurrencies: Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency, How Bitcoin Achieves Decentralization: Distributed consensus, Consensus without identity using a block chain, Incentives and proof of work, Putting it all together,

UNIT-III
Mechanics of Bitcoin: Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bitcoin network, Limitations and improvements How to Store and Use Bitcoins: Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets

UNIT-IV
Bitcoin Mining: The task of Bitcoin miners, Mining Hardware, Energy consumption and ecology,Mining pools, Mining incentives and strategies.
 Bitcoin and Anonymity: Anonymity Basics, Howto De-anonymize Bitcoin, Mixing, Decentralized
Mixing, Zerocoin and Zerocash.

UNIT-V
Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian contracts.
Ethereum 101: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts.

Textbooks:
1. Mastering Blockchain – Distributed ledgers, decentralization and smart contracts explained, Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1-78712-544-5, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward W. Felten, Andrew Miller, Steven Goldfeder and Jeremy Clark., Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction. Princeton University Press, 2016.

Reference Books:
1. Mastering Bitcoins: Unlocking Digital Cryptocurrencies by Andreas Antonopoulos. O'ReillyMedia, Inc, 2013.

III Year I Semester	LIGHT WEIGHT CRYPTOGRAPHY	L	T	P	C
		3	0	0	3

CourseObjectives:
1. Gain in-depth knowledge on Lightweight Cryptography and its relation to the new security in RFID tags.
2. Apply proactive and defensive measures to counter potential threats, attacks and intrusions.

CourseOutcomes:
1. Ability to learn Cryptographic based solutions, attacks and intrusions.
2. Understand security and privacy issues in radio frequency identification (RFID) systems.
3. Understanding multiple ways to attack and defend in industrial systems.

UNIT-I
Anti-counterfeiting and RFID - Anti-Counterfeiting and Supply Chain Security, Networked RFID Systems, PC Network Architecture, A Security Primer.

UNIT-II
Security and Privacy Current Status - Addressing Insecurities and Violations of Privacy, RFID Tag Vulnerabilities in RFID Systems, From Identification to Authentication – A Review of RFID Product Authentication Techniques.

UNIT-III
Network-BasedSolutions-EPCSystemforaSafe&SecureSupplyChainandHowitisApplied,The Potential of RFID and NFC in Anti-Counterfeiting, Improving the Safety and Security of the Pharmaceutical Supply Chain.

UNIT-IV
Cryptographic Solutions - Product Specific Security Based on RFID Technology, Strengthening the Security of Machine-Readable Documents, Enhancing Security of Class I Generation 2 RFID against Traceability and Cloning.

UNIT-V
Low-cost Cryptographic Solutions: A Random Number Generator for Application in RFID Tags, A Low-Cost Solution to Cloning and Authentication Based on a Lightweight Primitive, Lightweight Cryptography for Low Cost RFID.

TextBook:
1. Networked RFID Systems and Light weight Cryptography by Peter H.Cole·Damith C.RanasingheFirstedition,Springerpublication2008.

ReferenceBooks:
1. RFID Security and Privacy by YingjiuLi,Robert H.Deng.
2. RFIDHANDBOOK by Klaus Finkenzeller, Thirdedition Wiley Publications.

III Year I Semester	INTERNET OF THINGS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives: This Course focuses on hands-on IoT concepts such as sensing, actuation and communication. This Course focuses on Internet of Things (IoT) prototypes—including devices for Course focuses on real world applications of IoT.

Course Outcomes: Upon successful completion of the course/Lab the students will be able to

- After the completion of the course, the students will be able design some IOT based prototypes.
- The student will able to learn about embedded OS used for IoT application.
- Able to learn about communication protocol of IoT.
- Develop knowledge of IoT hardware and software.
- Develop knowledge of sensors and actuators.
- Study of some real world IoT applications.

List of Experiments:
1. Write a program to find the mean and the median of the numbers stored in an array.
2. Write a program to insert one element in an array and delete an element from an- array.
3. Write a program to Linear & Binary search for a number in an array.
4. Write a program to store the marks obtained by 10 students in 5 courses in a two- dimensional array.
5. Write a program to implement single linked list, including insertion, deletion and searching in the linked list.
6. Write a program to print the elements of a linked list in reverse order without disturbing the linked list.
7. Write a program to reverse a linked list.
8. Write a program to add two polynomials using linked lists.
9. Write a program to implement a doubly linked list including insertion, deletion and searching in the linked list.
10. Write a program to implement a stack using an array and linked list.
11. .Write a program to implement a queue using an array and linked list.
12.   Write a program to implement a circular queue using an array.
13. Write a program to implement a priority queue using a linked list.
14. Write a program to implement a double-ended queue using a linked list.
15.   Write a program to implement different types of sorting. (Bubble, Insertion, Quick, Selection, Merge, Heap)
16. Write a program to construct a binary tree and display its preorder, inorder and postorder traversals.
17. Write a program to perform insertion, deletion and searching in Binary Search Tree.
18. Write a program to construct a graph.
19. Write a program to calculate the distance between two vertices in a graph.
20. Write a program to calculate the distances between every pair of vertices in a graph
21. Write a program to construct a minimal spanning tree of a graph.

Text Books:
1. Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms , Third edition, MIT Press, 2009.
2. Ellis Horowitz, S. Sahni, Freed, "Fundamentals of Data Structures in C",2nd edition,2015.
3. Y. Langsam, M. J. Augenstein & A. M. Tanenbaum, Data Structures using C, Pearson Edu. Asia, 2004.
4. Data Structures – Lipshutz TMH

References:
https://www.geeksforgeeks.org/getting-started-with-arduino/
https://www.geeksforgeeks.org/raspberry-pi-a-computer-for-geeks/
https://www.geeksforgeeks.org/digital-storage-oscilloscope/
https://www.geeksforgeeks.org/temperature-sensor-types-of-sensor/
https://www.geeksforgeeks.org/ultrasonic-sensor-vs-ir-sensor/
https://www.geeksforgeeks.org/python-programming-language-tutorial/
https://www.geeksforgeeks.org/what-is-home-automation/

III Year I Semester	**CYBER SECURITY LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objective: To get practical exposure to Cybersecurity threats and Forensics tools.

Course Outcome:
CO1: Get the skill to identify cyber threats/attacks.
CO2: Get the knowledge to solve security issues in day-to-day life.
CO3: Able to use Autopsy tools
CO4: Perform Memory capture and analysis
CO5: Demonstrate Network analysis using Network miner tools

List of Experiments:
1. Perform an Experiment for port scanning with nmap
2. Set up a honeypot and monitor the honeypot on the network
3. Install Jscript/Cryptool tool (or any other equivalent) and demonstrate Asymmetric, Symmetric crypto algorithm, Hash and Digital/PKI signatures.
4. Generate minimum 10 passwords of length 12 characters using openSSL command
5. Perform practical approach to implement Footprinting - Gathering target information using Dmitry-Dmagic, UA tester
6. Work with sniffers for monitoring network communication (Wireshark).
7. Using Snort, perform real-time traffic analysis and packet logging.
8. Perform email analysis using the Autopsy tool.
9. Perform Registry analysis and get boot time logging using process monitor tool
10.Perform File type detection using Autopsy tool
11.Perform Memory capture and analysis using FTK imager tool
12.Perform Network analysis using the Network Miner tool

Text Books:
1. Real Digital Forensics for Handheld Devices, E.P. Dorothy, Auerback Publications, 2013.
2. The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics, J. Sammons, Syngress Publishing, 2012.

Reference Books:
1. Handbook of Digital Forensics and Investigation, E. Casey, Academic Press, 2010.
2. Malware Forensics Field Guide for Windows Systems: Digital Forensics Field Guides, C.H. Malin, E. Casey and J.M. Aquilina, Syngress, 2012.
3. The Best Damn Cybercrime and Digital Forensics Book Period, J. Wiles and A. Reyes, Syngress, 2007.

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

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

CO1: Make use of router, template engine and authentication using sessions to develop application in Express JS.

CO2: Build a single page application using RESTful APIs in Express JS.

CO3: Make use of components, props, stats and render data in ReactJS.

CO4: Apply router and hooks in designing ReactJS application.

CO5: Make use of MongoDB queries to perform CRUD operations on document database.

Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1
CO 1	2	2	3		2				2	2		2
CO 2	2	3	2		2				2	2		2
CO 3	2	2	3		2				2	2		2
CO 4	2	3	2		2				2	2		2
CO 5	2	2	3		2				2	2		2

List of Experiments:

Experiment 1: Node.js
a. Write a program to show the workflow of JavaScript code executable by creating web server in Node.js.
b. Write a program to transfer data over http protocolusing http module.
c. Create a text file src.txt and add the following content to it. (HTML, CSS, Javascript, Typescript, MongoDB, Express.js, React.js, Node.js)
d. Write a program to parse an URL using URL module.
e. Write a program to create an user-defined module and show the workflow of Modularization of application using Node.js

Experiment 2: Typescript
a. Write a program to understand simple and special types.
b. Write a program to understand function parameter and return types.
c. Write a program to show the importance with Arrow function. Use optional, default and REST parameters.
d. Write a program to understand the working of typescript with class, constructor, properties, methods and access specifiers.
e. Write a program to understand the working of namespaces and modules.
f.Write a program to understand generics with variables, functions and constraints.

Experiment 3-15:
Augmented Programs: (Any 2 must be completed from Experiment 3-5)
3. Write a CSS program, to apply 2D and 3D transformations in a web page.
4. a web page with new features of HTML5 and CSS3.
5. Design a to-do list application using JavaScript.

Experiment 6:
ExpressJS – Routing, HTTP Methods, Middleware
a. Write a program to define a route, Handling Routes, Route Parameters, Query Parameters and URL building.
b. Write a program to accept data, retrieve data and delete a specified resource using http methods.
c. Write a program to show the working of middleware.

Experiment 7:
ExpressJS – Templating, Form Data
a. Write a program using templating engine.
b. Write a program to work with form data.

Experiment 8:
ExpressJS – Cookies, Sessions, Authentication
a. Write a program for session management using cookies and sessions.
b. Write a program for user authentication

Experiment 9:
ExpressJS – Database, RESTful APIs
a. Write a program to connect MongoDB database using Mangoose and perform CRUD operations.
b. Write a program to develop a single page application using RESTful APIs

Experiment 10:
ReactJS – Render HTML, JSX, Components – function & Class
a. Write a program to render HTML to a web page.
b. Write a program for writing markup with JSX.
c. Write a program for creating and nesting components (function and class).

Experiment 11:
ReactJS – Props and States, Styles, Respond to Events
a. Write a program to work with props and states.
b. Write a program to add styles (CSS & Sass Styling) and display data.
c. Write a program for responding to events.

Experiment 12:
ReactJS – Conditional Rendering, Rendering Lists, React Forms
a. Write a program for conditional rendering.
b. Write a program for rendering lists.
c. Write a program for working with different form fields using react forms

Experiment 13:
ReactJS – React Router, Updating the Screen
a. Write a program for routing to different pages using react router.
b. Write a program for updating the screen.

Experiment 14:
ReactJS – Hooks, Sharing data between Components
a.Write a program to understand the importance of using hooks.
b.Write a program for sharing data between components

Experiment 15:
ReactJS Applications – To-do list and Quiz
a. Design to-do list application

Experiment 16:
MongoDB – Installation, Configuration, CRUD operations
a. Install MongoDB and configure ATLAS
b. Write MongoDB queries to perform CRUD operations on document using insert(), find(), update(), remove()

Experiment 17:
MongoDB – Databases, Collections and Records
g. Write MongoDB queries to Create and drop databases and collections.
Write MongoDB queries to work with records using find(), limit(), sort(), createIndex(), aggregate()

Experiment 18-20:
Augmented Programs: (Any 2 must be completed)
18. Design a to-do list application using NodeJS and ExpressJS.
19. Design a Quiz app using ReactJS.
20. Complete the MongoDB certification from MongoDB University website.

Text Books:
1.Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013.
2.Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, A Press, O'Reilly.

Web Links:
1.ExpressJS - https://www.tutorialspoint.com/expressjs
2.ReactJS - https://www.w3schools.com/REACT (and)   https://react.dev/learn#
3.MongoDB - https://learn.mongodb.com/learning-paths/introduction-to-mongodb

III Year I Semester	UI DESIGN-FLUTTER LAB	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

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

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

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

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

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

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

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

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

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

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

Text Book:
  1. Marco L. Napoli, Beginning Flutter: A Hands-on Guide to App Development.
  2. Rap Payne, Beginning App Development with Flutter: Create Cross-Platform Mobile Apps 1st
     Edition, Apres

III Year II Semester	CYBER SECURITY AND DIGITAL FORENSICS	L	T	P	C
		3	0	0	3

Course Objectives: To analyze how to conduct a digital forensics investigation and validate forensics data.

Course Outcomes:
• Understand the fundamentals of cybercrime and issues.
• Understand different investigation tools for cybercrime.
• Understand basics of Forensic Technology and Practices.
• Analyze different laws, ethics, and evidence handling procedures.

UNIT-I
Introduction: Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime: Social Engineering, Categories of Cyber Crime, Property Cyber Crime.

UNIT-II
Cyber Crime Issues: Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses.

UNIT-III
Investigation: Introduction to Cyber Crime Investigation, 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
Digital Forensics: Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Network Forensics.

UNIT-V
Laws and Acts: Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT, IPC and CrPC, Electronic Communication Privacy ACT, Legal Policies.

Text Books:
• Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.
• Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics", Tata McGraw-Hill, New Delhi, 2006.

Reference Books:
• Robert M Slade, "Software Forensics", Tata McGraw-Hill, New Delhi, 2005.
• Bernadette H Schell, Clemens Martin, "Cybercrime", ABC–CLIO Inc, California, 2004.
• "Understanding Forensics in IT", NIIT Ltd, 2005.

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, serverless 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 AppEngine).

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, 2nd edition, RajkumarBuyya, Christian Vecchiola, ThamaraiSelvi, ShivanandaPoojara, 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	BLOCKCHAIN TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives:
- To learn the fundamentals of Block Chain and various types of block chain and consensus mechanism.
- To understand public block chain system, Private block chain system and consortium block chain.
- 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 E ducation, 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

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, Jinjatemplating, 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 MihailsKonoplows, 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, 1stEdition, Packt Publishing, 2016.
4. Joakim Verona. Practical Devops, Ingram short title; 2ndedition (2018). ISBN10: 1788392574
5. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

III Year II 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

Text Books:
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.

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

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.

Course Outcomes: At the end of the course, student will be able to
- Enumerate the Fundamentals of Machine Learning
- Build Nearest neighbour based models
- Apply Models based on decision trees and Bayes rule
- Make use of Linear discriminants for machine Learning
- Choose appropriate clustering technique

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 NearestNeighbor 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 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, 1stedition*,CharlesE.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.

Course Outcomes:
After completion of this course
- Demonstrate a given text with basic Language features
- To design an innovative application using NLP components
- Explain a rule based system to tackle morphology/syntax of a language
- To design a tag set to be used for statistical processing for real-time applications
- To compare and contrast the use of different statistical approaches for different types of NLP applications.

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

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

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

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

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

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

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

III Year II Semester	SECURITY ASSESSMENT AND RISK ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives:
- The course takes a software development perspective to the challenges of engineering software systems that are secure.
- This course addresses design and implementation issues critical to producing secure software systems.
- The course deals with the question of how to make the requirements for confidentiality, integrity, and availability integral to the software development process.
- Secure software requirements gathering to design, development, configuration, deployment, and ongoing maintenance
- Security of enterprise information systems.

Course Outcomes:
1. Understand various aspects and principles of software security.
2. Devise security models for implementing at the design level.
3. Identify and analyze the risks associated with s/w engineering and use relevant models to mitigate the risks.
4. Understand the various security algorithms to implement for secured computing and computer networks
5. Explain different security frameworks for different types of systems including electronic systems.

UNIT-I
Defining computer security, the principles of secure software, trusted computing base, etc, threat modeling, advanced techniques for mapping security requirements into design specifications. Secure software implementation, deployment and ongoing management.

UNIT-II
Software design and an introduction to hierarchical design representations.Difference between high-level and detailed design.Handling security with high-level design. General Design Notions. Security concerns designs at multiple levels of abstraction, Design patterns, quality assurance activities and strategies that support early vulnerability detection, Trust models, security Architecture & design reviews .

UNIT-III
Software Assurance Model: Identify project security risks & selecting risk management strategies, Risk Management Framework, Security Best practices/ Known Security Flaws, Architectural risk analysis, Security Testing & Reliability (Penn testing, Risk- Based Security Testing

UNIT-IV
Security in Enterprise Business: Identification and authentication, Enterprise Information Security, Symmetric and asymmetric cryptography, including public key cryptography, data encryption standard (DES), advanced encryption standard (AES), algorithms for hashes and message digests. Authentication, authentication schemes , access control models, Kerberos protocol, public key infrastructure (PKI), protocols specially designed for e-commerce and web applications, firewalls and VPNs.

UNIT-V
Security development frameworks. Security issues associated with the development and deployment of information systems, including Internet-based e-commerce, e-business, and e-service systems.

Text Books:
1. W. Stallings, Cryptography and network security: Principles and practice, 5 th Edition, Upper Saddle River, NJ: Prentice Hall., 2011
2. C. Kaufman, r. Perlman, & M. Speciner, Network security: Private communication in a public world, 2 nd Edition, Upper Saddle River, NJ:PrenticeHalL, 2002
3. C. P. Pfleeger, S. L. Pfleeger, Security in Computing, 4 th Edition, Upper Saddle River, NJ:Prentice Hall, 2007
4. T. M. Merkow, & J. Breithaupt, Information security: Principles and practices. Upper Saddle River, NJ:Prentice Hall, 2005

Reference Books:
1. Gary McGraw, Software Security: Building Security In, Addison-Wesley, 2006

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.
OR
6. Do the same with OpenStack
7. Instll 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, RajkumarBuyya, Christian Vecchiola, ThamaraiSelvi, ShivanandaPoojara, 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 RajkumarBuyya, 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	BLOCK CHAIN TECHNOLOGY LAB	L	T	P	C
		0	0	3	1.5

Course Objectives: This course will enable the students:

1. Understanding Block chain Fundamentals and creating basic blocks.

2. Able to Develop Block chain Applications in a structured manner

3. Ability to create own crypto currency and get familiarity with future currencies.

4. Able to Evaluate and Analyze Block chain Systems

Course Outcomes:

1. Knowledge of Block chain Concepts and creating basic blocks.

2. Proficiency in Block chain Development.

3. Ability to Design and Implement Block chain Applications.

4. Evaluation and Analysis of Block chain Systems.

5. Knowledgeofcryptocurrencyand creatingabasicformofit

Listof Experiments:

Week1: Creating Merkle tree

Week2: Creation of Block

Week3: Block chain Implementation Programming code.

Week4: Creating ERC20token

Week 5: Java code to implement block chain in Merkle Trees

Week 6: Java Code to implement Mining using block chain

Week7: Java Code to implement peer-to-peer using block chain

Week8: Creating a Crypto-currency Wallet

III Year II Semester	SOFT SKILLS or IELTS	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
		0	0	3	1.5

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/

MINORS

	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.
,
Course Outcomes: At the end of the course, student will be able to
- Enumerate the Fundamentals of Machine Learning
- Build Nearest neighbour based models
- Apply Models based on decision trees and Bayes rule
- Make use of Linear discriminants for machine Learning
- Choose appropriate clustering technique

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 NearestNeighbor 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.

	INTRODUCTION TO IOT	L	T	P	C
		3	0	0	3

Course Outcome(s):
This course will help students understand basic principles and concepts of Internet-of-Things use cases, applications, architecture and technologies. Students will get an overview of an end to endIoT system encompassing the edge, cloud and application tiers. This course will build upon the foundations created in the pre-requisite courses and will equip the students to architect a complete IoT application on their own. The lab exercises will consist of hands-on experiments that will lead to building an IoT application end-to-end. Some of the specialized topics will be covered via student seminars where students are expected to research and present their findings in a seminar format.

UNIT– I
Introduction to IoT and Use cases: Understanding basic concepts of IoT, Consumer IoT vs Industrial Internet, Fundamental building blocks, Use Cases of IoT in various industry domains.

UNIT- II
Architecture: IoT reference architectures, Industrial Internet Reference Architecture, Edge Computing, IoT Gateways, Data Ingestion and Data Processing Pipelines, Data Stream Processing.

UNIT-III
Sensors and Industrial Systems: Introduction to sensors and transducers, integrating sensors to sensor processing boards, introduction to industrial data acquisition systems, industrial control systems and their functions.

UNIT–IV
Networking and Communication for IoT: Recap of OSI 7 layer architecture and mapping to IoT architecture, Introduction to proximity networking technologies (ZigBee, Bluetooth, Serial Communication), Industrial network protocols (Modbus, CANbus), Communicating with cloud applications (web services, REST, TCP/IP and UDP/IP sockets, MQTT, WebSockets, protocols. Message encoding (JSON, Protocol Buffers).

UNIT –V
IoT Data Processing and Storage: Time Series Data and their characteristics, time series databases, basic time series analytics, data summarization and sketching, dealing with noisy and missing data, anomaly and outlier detection.

IoT Seminars: Selected topics in IoTshould be handled via student seminars. Recommended that students form a group do research on at least one of the following topics and present it through seminars. They are expected to do a literature survey of the topic and present their survey paper to the class. The suggested topics are –

IoT Applications

- Smart Cities
- Connected Vehicles and Telematics
- Smart Grids
- Smart Homes

a) **IoT data visualization**
b) **Survey of cloud based IoT platforms**
c) **Low power wide area networks for IoT**
d) **IoT device management**
e) **Survey of chips, embedded modules and development boards for IoT devices**
f) **Embedded and real-time operating systems for IoT**
g) **IoT Security**

- Security risks in IoT
- Securing IoT endpoint devices and secure communication protocols for IoT
- Security and Privacy of IoT data

Text Books:
1. The Internet of Things, Samuel Greengard, MIT Press Essential Knowledge Series,

Reference Books / Links:
1. Industrial Internet Reference Architecture - http://www.iiconsortium.org/IIRA.htm
2. World Economic Forum Report on Industrial Internet of Things - https://www.weforum.org/reports/industrial-internet-things
3. 50 Sensor Applications for a Smarter World - http://www.libelium.com/resources/top_50_iot_sensor_applications_ranking/
4. Visualizing Data-Exploring and Explaining Data with the Processing Environment, By Ben Fry, Publisher: O'Reilly Media
5. Raspberry Pi Computer Architecture Essentials, by Andrew K Dennis
6. Getting Started with Arduino, M. Banzi, O Reilly Media
7. GSMA IoT Security Guidelines & Assessment - https://www.gsma.com/iot/future-iot-networks/iot-security-guidelines/

	BLOCKCHAIN TECHNOLOGIES	**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

	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, serverless 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 AppEngine).

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, 2ⁿᵈ edition, RajkumarBuyya, Christian Vecchiola, ThamaraiSelvi, ShivanandaPoojara, 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)

	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 Cyber crime: 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/CellPhones, Network and Computer Attacks.

UNIT-II
Tools and Methods : Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers 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, AudioVideo 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 and Punishment, 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 CommonsBY-NC-SA.

	IOT LAB USING PYTHON	L	T	P	C
		0	0	3	1.5

Course Objectives: This Course focuses on hands-on IoT concepts such as sensing, actuation and communication. This Course focuses on Internet of Things (IoT) prototypes—including devices for sensing, actuation, processing, and communication—to help you develop skills and experiences. This Course focuses on real world applications of IoT.

Course Outcomes: Upon successful completion of the course/Lab the students will be able to
- After the completion of the course, the students will be able design some IOT based prototypes.
- The student will able to learn about embedded OS used for IoT application.
- Able to learn about communication protocol of IoT.
- Develop knowledge of IoT hardware and software.
- Develop knowledge of sensors and actuators.
- Study of some real world IoT applications.

List of Experiments:
1. Write a program to find the mean and the median of the numbers stored in an array.
2. Write a program to insert one element in an array and delete an element from an- array.
3. Write a program to Linear & Binary search for a number in an array.
4. Write a program to store the marks obtained by 10 students in 5 courses in a two- dimensional array.
5. Write a program to implement single linked list, including insertion, deletion and searching in the linked list.
6. Write a program to print the elements of a linked list in reverse order without disturbing the linked list.
7. Write a program to reverse a linked list.
8. Write a program to add two polynomials using linked lists
9. Write a program to implement a doubly linked list including insertion, deletion and searching in the linked list.
10. Write a program to implement a stack using an array and linked list.
11. Write a program to implement a queue using an array and linked list.
12.   Write a program to implement a circular queue using an array.
13. Write a program to implement a priority queue using a linked list.
14. Write a program to implement a double-ended queue using a linked list.
15.   Write a program to implement different types of sorting. (Bubble, Insertion, Quick, Selection, Merge, Heap)
16.   Write a program to construct a binary tree and display its preorder, inorder and postorder traversals.
17. Write a program to perform insertion, deletion and searching in Binary Search Tree.
18. Write a program to construct a graph.
19. Write a program to calculate the distance between two vertices in a graph.
20. Write a program to calculate the distances between every pair of vertices in a graph
21. Write a program to construct a minimal spanning tree of a graph.

Text Books:
1. Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms , Third edition, MIT Press, 2009.
2. Ellis Horowitz, S. Sahni, Freed, "Fundamentals of Data Structures in C",2nd edition,2015.
3. Y. Langsam, M. J. Augenstein & A. M. Tanenbaum, Data Structures using C, Pearson Edu. Asia, 2004.
4. Data Structures – Lipshutz TMH

References:
https://www.geeksforgeeks.org/getting-started-with-arduino/
https://www.geeksforgeeks.org/raspberry-pi-a-computer-for-geeks/
https://www.geeksforgeeks.org/digital-storage-oscilloscope/
https://www.geeksforgeeks.org/temperature-sensor-types-of-sensor/
https://www.geeksforgeeks.org/ultrasonic-sensor-vs-ir-sensor/
https://www.geeksforgeeks.org/python-programming-language-tutorial/
https://www.geeksforgeeks.org/what-is-home-automation/

	MACHINE LEARNING WITH PYTHON 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

	JAVA PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objectives:

The learning objectives of this course are to:

- Identify Java language components and how they work together in applications
- Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- Learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- Understand how to design applications with threads in Java
- Understand how to use Java APIs for program development

UNIT I

Object Oriented Programming: Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables,DataTypes,TypeCasting,ScopeofVariableIdentifier,LiteralConstants,Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final,**Introduction to Operators**, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators. **Control Statements**: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator ?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT II

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded ConstructorMethods, NestedClasses, FinalClassandMethods, Passing ArgumentsbyValue and by Reference, Keyword this. **Methods:** Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT III

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Valuesin Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors. **Inheritance:** Introduction, Process of Inheritance, Types of Inheritances, UniversalSuperClass-Object Class, InhibitingInheritanceofClassUsing Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance. **Interfaces:** Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of

Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, RandomClass, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time inJava, Temporal Adjusters Class, Temporal Adjusters Class. **Exception Handling:** Introduction, Hierarchyof Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.
JavaI/OandFile: JavaI/OAPI, standard I/Ostreams, types, Byte streams, Characterstreams, Scanner class, Files in Java (Text Book 2)

UNITV

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.
MultithreadedProgramming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread-Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication-Suspending, Resuming, and Stopping of Threads. **JavaDatabaseConnectivity:** Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, Result Set Interface. **Java FX GUI:** Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)

TextBooks:
1) JAVAonestepahead, Anitha Seth, B.L.Juneja,Oxford.
2) Joy with JAVA,Fundamentals of ObjectOrientedProgramming,DebasisSamanta, Monalisa Sarma, Cambridge, 2023.
3) JAVA9forProgrammers,PaulDeitel,HarveyDeitel,4ᵗʰEdition,Pearson.

ReferencesBooks:
1) ThecompleteReferenceJava,11ᵗʰedition,HerbertSchildt,TMH
2) Introduction to Java programming, 7ᵗʰEdition, YDanielLiang, Pearson

Online Resources:
1) https://nptel.ac.in/courses/106/105/106105191/
2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0128804645476188 16347_shared/overview

	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course is to make student

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

UNIT-I

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

UNIT-II

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

UNIT– III

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

UNIT-IV

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

UNIT-V

File System: File System Interface: File concept, Access methods, Directory Structure; File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management; File-System Internals: File-System Mounting, Partitions and Mounting, File Sharing. **Protection:** Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix.

Text Books:
1. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018.
2. ModernOperating Systems,TanenbaumAS,4thEdition,Pearson,2016

Reference Books:
1. OperatingSystems-InternalsandDesignPrinciples,StallingsW,9thedition, Pearson, 2018
2. OperatingSystems:AConceptBasedApproach,D.MDhamdhere,3rdEdition, McGraw-Hill, 2013

Online Learning Resources:
1. https://nptel.ac.in/courses/106/106/106106144/
http://peterindia.net/OperatingSystems.html

		L	T	P	C
	DATA BASE MANAGEMENT SYSTEM	3	0	0	3

Course Objectives:

The main objectives of the course ist o

- Introduce database management systems and to give a good formal foundationon therelational model of data and usage of Relational Algebra
- Introducethe conceptsofbasic SQLasa universal Database language
- Demonstrate the principles behind systematic database design approaches by covering conceptual design,logical design through normalization
- Provide an overview of physicaldesign ofa database system, bydiscussing Database indexing techniques and storage techniques

UNIT-I

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Threetier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Entity Relationship Model: Introduction, Representation of entities, attributes, entityset, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

UNIT-II

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

UNIT-III

SQL: Basic SQLquerying (select and project) using where clause, arithmetic & logical operations, SQL functions (Date and Time, Numeric, String conversion). Creatingtables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable andnon-updatable), relational set operations.

UNIT-IV

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, conceptof functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF,2NF and 3NF), concept of surrogate key, Boyce-Codd normal form(BCNF), MVD, Fourth normal form (4NF), Fifth Normal Form (5NF).

UNIT-V

Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.
Introduction to Indexing Techniques: B+Trees, operations on B+Trees, Hash Based Indexing:

Text Books:

1) Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke,TMH (For Chapters 2, 3, 4)
2) Database SystemConcepts,5th edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 5)

ReferenceBooks:

1) Introduction to Database Systems, 8th edition, CJDate, Pearson.
2) Database Management System, 6thedition, Ramez Elmasri, Shamkant B. Navathe,Pearson
3) DatabasePrinciplesFundamentalsofDesignImplementationandManagement, CorlosCoronel, Steven Morris, Peter Robb, Cengage Learning.

Web-Resources:

1) https://nptel.ac.in/courses/106/105/106105175/
2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview

	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives:
- To understand the different types of networks
- To discuss the software and hardware components of a network
- To develop an understanding the principles of computer networks.
- To familiarize with OSI model and the functions of layered structure.
- To explain networking protocols, algorithms and design perspectives.

CourseOutcomes(CO): After completion of the course, students will be able to
- Identify the software and hardware components of a Computer network.(L1)
- Explain the functionality of each layer of a computer network.(L2)
- Identify and analyze flow control, congestion control, and routing issues.(L4)
- Analyze and interpret the functionality and effectiveness of the routing protocols. (L4)
- Choose the appropriate transport protocol based on the application requirements.(L3)

UNIT-I
Introduction: Types of Computer Networks, Broadband Access Networks, Mobile and Wireless Access Networks, Content Provider Networks, Transit networks, Enterprise Networks, Network technology from local to global, Personal Area Networks, Local Area Networks, Home Networks, Metropolitan Area Networks, Wide Area Networks, Internetworks, Network Protocols, Design Goals, Protocol Layering, Connections and Reliability, Service Primitives, The Relationship ofServices to Protocols ,Reference Models, The OSI Reference Model, The TCP/IP Reference Model, A Critique of the OSI Model and Protocols, A Critique of the TCP/IP Reference Model and Protocols.

UNIT-II
The Data Link Layer: Guided Transmission Media, Persistent Storage, Twisted Pairs, Coaxial Cable, Power Lines, Fiber Optics, Data Link Layer Design Issues, Services Provided To The Network Layer, Framing Error Control, Flow Control, Error Detection And Correction, Error-Correcting Codes, Error-Detecting Codes, Elementary Data Link Protocols, Initial Simplifying Assumptions Basic Transmission And Receipt, Simplex Link-Layer Protocols, Improving Efficiency, Bidirectional Transmission, Multiple Frames In Flight, Examples Of Full-Duplex, Sliding Window Protocols, The Channel Allocation Problem, Static Channel Allocation, Assumptions For Dynamic Channel Allocation, Multiple Access Protocols, Aloha, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited-Contention Protocols, Wireless LAN Protocols, Ethernet, Classic Ethernet Physical Layer, Classic Ethernet Mac Sublayer Protocol, Ethernet Performance, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, 10-Gigabit Ethernet,40- And 100-Gigabit Ethernet, Retrospective On Ethernet.

UNIT-III

The Network Layer: 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 In A Single Network, The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing Within a Network, Broadcast Routing, Multicast Routing, Anycast Routing, Traffic Management at The Network Layer, The Need for Traffic Management: Congestion, Approaches To Traffic Management, Internetworking, Internetworks: An Overview, How Networks differ, Connecting Heterogeneous Networks, Connecting Endpoints Across Heterogeneous Networks, Internetwork Routing: Routing Across Multiple Networks Supporting Different Packet Sizes: Packet Fragmentation, The Network Layer In The Internet, The IP Version 4 Protocol, IP Addresses, IP Version 6, Internet Control Protocols, Label Switching and MPLS, OSPF—An Interior Gateway Routing Protocol, BGP—The Exterior Gateway Routing Protocol, Internet Multicasting.

UNIT-IV

The Transport Layer: The Transport Service, Services Provided To The Upper Layers, Transport Service Primitives, Berkeley Sockets, An Example Of Socket Programming: An Internet File Server, Elements Of Transport Protocols, Addressing, Connection Establishment, Connection Release, Error Control And Flow Control, Multiplexing, Crash Recovery, Congestion Control, Desirable Band width Allocation, Regulating The Sending Rate, Wireless Issues, The Internet Transport Protocols: UDP, Introduction To UDP, Remote Procedure Call, Real-Time Transport Protocols, The Internet Transport Protocols: TCP, Introduction To TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release.

UNIT-V

TheApplicationLayer: Electronic Mail, Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery, The World Wide Web, Architectural Overview, Static Web Objects, Dynamic Web Pages and Web Applications, HTTP and HTTPS, Web Privacy, Content Delivery, Content and Internet Traffic, Server Farms and Web Proxies, Content Delivery Networks, Peer-To-Peer Networks, Evolution of The Internet.

Textbook:

1.AndrewTanenbaum,FeamsterWetherall,ComputerNetworks,6thEdition,Global Edition.

ReferenceBooks:

1. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, McGraw Hill Publication, 2017.
2. JamesF.Kurose,Keith W.Ross,"Computer Networking: A Top-Down Approach",6th edition, Pearson, 2019.
3. YouluZheng,ShakilAkthar,"NetworksforComputer ScientistsandEngineers",Oxford Publishers, 2016.

Online Learning Resources:

https://nptel.ac.in/courses/106105183/25
http://www.nptelvideos.in/2012/11/computer-networks.html
https://nptel.ac.in/courses/106105183/