

AUTONOMOUS

SYLLABUS

VII & VIII Semesters

B.E in Computer Science & Engineering (IoT
& Cyber Security with Blockchain Technology)

2023

MITE



Invent Solutions

MANGALORE INSTITUTE OF
TECHNOLOGY & ENGINEERING



MANGALORE INSTITUTE OF TECHNOLOGY & ENGINEERING

(A Unit of Rajalaxmi Education Trust®, Mangalore)

Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE, New Delhi

Accredited by NAAC with A+ Grade & ISO 9001:2015 Certified Institution

Institute Vision

*“To attain perfection in providing **Globally Competitive Quality Education** to all our Students and also benefit the global community by using our strength in **Research and Development**”*

Institute Mission

*“To establish world class educational institutions in their respective domains, which shall be **Centers of Excellence** in their stated and implied sense. To achieve this objective we dedicate ourselves to meet the challenges of becoming **Visionary and Realistic, Sensitive and Demanding, Innovative and Practical, and Theoretical and Pragmatic; ALL at the same time**”*

Department Vision

“Envision becoming a premier department in providing high-quality technical education in IoT, Cyber security, and Blockchain technologies to students, enabling them with industry-relevant skills, critical thinking, and a hands-on approach to tackle real-world challenges in socially responsible and sustainable ways and engage in quality research”

Department Mission

- *To deliver a comprehensive and quality education that equips students with the skills and knowledge needed to excel in IoT, Cyber Security, and Blockchain.*
- *To provide a conducive and pleasant learning ecosystem that promotes research and Innovation activities among the staff and students.*
- *To collaborate with industry, government, and the community to address real-world challenges and contribute to the betterment of society.*
- *Inculcate teamwork, strong ethical values, and lifelong learning skills among students with a sense of societal responsibilities*

Program Educational Objectives (PEOs)

Graduates of the CSE (IoT & Cyber Security with Blockchain Technology) program will be able to

- *Apply their knowledge and skills to succeed in their careers, continue life-long learning, pursue higher education at a reputed institution, and develop their professional knowledge.*
- *Provide innovative solutions, communicate effectively using modern tools, and work productively & ethically in multidisciplinary teams by embracing global challenges with leadership skills.*
- *Design and integrate hardware and software systems through cutting-edge technologies and open-source platforms in IoT, Cyber Security, and Blockchain technologies to provide reliable techno-commercially feasible software solutions for societal and industrial problems.*
- *Achieve excellence in the IT profession by becoming leaders, researchers, entrepreneurs, and catalysts for social change through a high-quality education grounded in mathematics, engineering, and fundamental science principles.*

Program Specific Outcomes (PSOs)

The graduates of the CSE (IoT & Cyber Security with Blockchain Technology) program will be able to

- *Identify Cyber Security vulnerabilities and threats and develop strategies to mitigate these risks, with a focus on Blockchain technologies.*
- *Develop, integrate and optimize IoT solutions across diverse domains, enhancing the efficiency and reliability of interconnected devices and systems.*



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LIST OF COURSES

VII/VIII Semester Courses			
Sl. No.	Course Code	Course Title	Semester
PROFESSIONAL CORE COURSES			
1	23ICPC401	IOT Architecture and Platforms	VII
2	23ICPC402	Cryptocurrency	VII
PROFESSIONAL ELECTIVE COURSES			
3	23ICPE411	Deep Learning	VII
4	23ICPE412	Security & Privacy in IoT	VII
5	23ICPE413	Big Data Analytics	VII
6	23ICPE42X	MOOCs (NPTEL/SWAYAM)	VIII
OPEN ELECTIVE COURSES			
7	23ICOE411	IoT for Automation	VII
8	23ICOE412	Data Visualization and Analytics	VII
9	23ICOE413	Enterprise Cyber Security Governance and Compliance	VII
SKILL ENHANCEMENT COURSE			
10	23ICSE409	Project Phase - II	VII
11	23ICSE431	Internship	VIII
12	23ICSE432	Publication / Patenting	VIII
HUMANITIES & SOCIALSCIENCE COURSE			
13	23HMCC421	Constitution of India & Professional Ethics	VII



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VII Semester (2023 Scheme): CSE (IoT & Cyber Security including Blockchain Technology)

Sl. No	Course Code	Course Title	Category	Teaching Dept.	Teaching Hrs/Week			Exam (Marks)			Duration of Exam(SEE) in Hrs	Credits
					L	T	P	CIE	SEE	Total		
1	23ICPC401	IOT Architecture and Platforms	Professional Course	IOT	3	0	2	50	50	100	3	4
2	23ICPC402	Cryptocurrency	Professional Course	IOT	3	0	2	50	50	100	3	4
3	23ICPE41X	Professional Elective-III*	Discipline Specific Elective Course	IOT	3	0	0	50	50	100	3	3
4	23ICOE41X	Open Elective –III**	Open Electives	IOT	3	0	0	50	50	100	3	3
5	23ICSE409	Project Phase - II	Skill Enhancement	IOT	-	-	12	100	100	200	-	6
6	23HMCC421	Constitution of India & Professional Ethics	Humanities & Social Sciences	Humanities/ Any Department	1	0	0	100	-	100	-	1
Total											21	

*Professional Elective Course -III

Sl. No.	Course Code	Course Title
1	23ICPE411	Deep Learning
2	23ICPE412	Security & Privacy in IoT
3	23ICPE413	Big Data Analytics

**Open Elective Course-III

Sl. No.	Course Code	Course Title
1	23ICOE411	IoT for Automation
2	23ICOE412	Data Visualization and Analytics
3	23ICOE413	Enterprise Cyber Security Governance and Compliance



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VIII Semester (2023 Scheme): CSE (IoT & Cyber Security including Blockchain Technology)

Sl. No	Course Code	Course Title	Category	Teaching Dept.	Teaching Hrs/Week			Exam(Marks)			Duration of Exam(SEE) in Hrs.	Credits
					L	T	P	CIE	SEE	Total		
1	23ICPE42X	MOOCs* (NPTEL/SWAYAM) 8/12 Weeks	Professional Elective	IoT	-	-	-	-	-	100	-	2
2	23ICSE431	Internship	Skill Enhancement	IoT	-			100	100	200	3	12
3	23SECC432	Publication/Patenting	Skill Enhancement	IoT	-	-	-	100	-	100	-	2
Total											16	

* **Massive Open Online Courses (MOOCs)** - Identified by the BoS of the department

Guidelines for MOOCs

To promote self-paced, flexible, and industry-relevant learning, a Two-Credit Online professional elective course is introduced in the VIII semester curriculum for all Bachelor of Engineering (B.E.) programs. Students are required to complete an approved online course as per the following guidelines:

1. Registration and Course Completion:

Students must complete any one of the *Board of Studies (BOS)* approved online courses by registering for an 8-week or 12-week course offered through recognized platforms such as NPTEL or SWAYAM. Registration can be done during semester VI or semester VII.

2. Credit Conversion:

The score obtained in the proctored examination conducted by the respective online platform shall be formally converted into course credits as per institute norms.



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3. Provision for students failing to clear the Online Course

If a student fails to successfully complete the selected online course within two consecutive attempts before the commencement of Semester VIII, they must register for an elective course offered by the respective department. This elective will be delivered in online mode by the department.

4. Assessment Pattern for the alternate elective:

- a. All assignments for the alternate elective course must be submitted online.
- b. The Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE) shall be conducted in offline mode.
- c. Students must physically appear for these examinations at the institute.



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VII & VIII Semesters

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IoT Architecture and Platforms			
Semester	VII	CIE Marks	50
Course Code	23ICPC401	SEE Marks	50
Teaching Hrs/Week (L:T: P)	3:0:2	Exam Hrs.	3
Total Hrs.	40+24	Credits	4
<p>Course Learning Objectives: This course is designed to</p> <ol style="list-style-type: none"> 1. Provide knowledge on physical & logical design of IoT and system management using NETCONF-YANG 2. Provide knowledge about various IoT Architectures. 3. Impart knowledge on various skills to design IoT systems using Python for logical design and interface with physical IoT devices like Raspberry Pi. 4. Impart knowledge on real-world applications and case studies of IoT across diverse domains. 			
Module 1:IoT Levels and Domain Specific System Architecture			No. of Hrs: 8+6
<p>IoT levels (Levels 1-6), Home automation, Smart cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Lifestyle.</p> <p>IoT System Management with NETCONF-YANG: Need for IoT Systems Management, Simple Network Management Protocol (SNMP), Network Operator Requirements, NETCONF, YANG, IoT Systems Management with NETCONF-YANG.</p> <p>Text Book 1: Chapter 1.5.1 to 1.5.6, Chapter 2.2 to 2.10, Chapter 4.1 to 4.6</p> <p>Laboratory Components:</p> <ol style="list-style-type: none"> 1. Installation and Configuration of NETCONF–YANG Environment. <ol style="list-style-type: none"> a. Install NETCONF client b. Connect to a NETCONF-enabled device or simulator. 2. Configure IoT Device using Custom YANG Model. 			
Module 2: IoT State of the art Architecture and Reference models			No. of Hrs: 8+6
<p>IoT Architecture State of the art: ETSI M2M high-level architecture, ETSI M2M service capabilities, ETSI M2M resource management, Internet Engineering Task Force architecture fragments, Open Geospatial Consortium architecture.</p> <p>Architecture Reference Model: Introduction, Reference Model and Architecture, IoT Reference Model: IoT Domain Model.</p> <p>Text Book 2: Chapter 6.2.1.1, 6.2.1.2, 6.2.1.4, 6.2.3, 6.2.4, Chapter 7.1 ,7.2, 7.3.1</p> <p>Laboratory Components:</p> <ol style="list-style-type: none"> 1. Set up a Raspberry Pi-based IoT development environment. 2. Set up a Raspberry Pi GPIOs and Program the same using Python. 			
Module 3: IoT Reference Architecture			No. of Hrs: 8+4
<p>IoT Reference Model: Information Model, Functional Model, Communication Model, Safety, Privacy, Trust, and Security Model</p> <p>IoT Reference Architecture Introduction, Functional View, Information View, Deployment and Operational View.</p> <p>Text Book 2: Chapter 7.3.2, 7.3.3, 7.3.4, 7.3.5, Chapter 8.1 to 8.4</p> <p>Laboratory Components:</p> <ol style="list-style-type: none"> 1. Design and implementation of temperature and humidity monitoring system using DHT sensor and Raspberry Pi. 2. Development of a weather reporting system using Raspberry Pi and Python for real-time environmental monitoring. 			



Module 4: IoT Design Methodology and Platforms	No. of Hrs: 8+4
Introduction, IoT Design Methodology, Case Study on IoT System for Weather Monitoring, Motivation for Using Python, Python Packages of Interest for IoT. Text Book 1: Chapter 5, Chapter 6.11 Laboratory Components: <ol style="list-style-type: none">1. Design and implementation of home intrusion detection system using PIR sensor and Raspberry Pi.2. Implementation of air pollution monitoring system using gas sensor and Raspberry Pi.	
Module 5: IoT Design Applications	No. of Hrs: 8+4
Introduction, Home Automation: Smart Lighting, Home Intrusion Detection; Cities: Smart Parking; Environment: Weather Monitoring System, Weather Reporting Bot, Air Pollution Monitoring, Forest Fire Detection, Agriculture: Smart Irrigation; Productivity Applications: IOT Printer. Text Book 1: Chapter 9 Laboratory Components: <ol style="list-style-type: none">1. Development of smart parking detection system using ultrasonic sensor and Raspberry Pi.2. Implementation of IoT-based printer control system using Raspberry Pi and Python.	
Course Outcomes: At the end of the course, the student will be able to <ol style="list-style-type: none">1. Describe the core design components of IoT systems and the role of NETCONF-YANG in managing IoT devices and networks.2. Describe the various concepts of IoT reference model and IoT reference architecture.3. Apply IoT design methodologies to design IoT systems using Python and Raspberry Pi to interact with sensors and actuators4. Build IoT solutions for various real-world scenarios.	
Textbooks: <ol style="list-style-type: none">1. Arshdeep Bahga, Vijay Madiseti “Internet of Things: A Hands-on Approach”, Universities Press (India) Publications.2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2015.	
Reference Books: <ol style="list-style-type: none">1. S. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 9789386873743).2. Raj Kamal, “Internet of Things”, Second Edition, McGraw Hill India, 2022.	
Web Links: <ol style="list-style-type: none">1. IoT Platform System Design: https://www.youtube.com/watch?v=bdCdKdfDf7o2. Open Source Technologies: https://www.youtube.com/watch?v=cSIcqxvgChQ3. IoT Platform Development: https://www.youtube.com/watch?v=xMkWCvICC4Y4. NPTEL : https://onlinecourses.nptel.ac.in/noc22_cs53/preview	



Cryptocurrency			
Semester	VII	CIE Marks	50
Course Code	23ICPC402	SEE Marks	50
Teaching Hrs/Week (L: T: P)	3:0:2	Exam Hrs.	3
Total Hrs.	40+24	Credits	4
<p>Course Learning Objectives: This course is designed to</p> <ol style="list-style-type: none"> 1. Impart the concepts of the Cryptocurrency 2. Provide knowledge on Bitcoin fundamentals and configuring the nodes. 3. Outline how Bitcoin wallets are created and how transactions are structured and decoded within the protocol. 4. Provide a comprehensive overview of Bitcoin’s peer-to-peer architecture, including its core components, network operations, mining processes, and consensus mechanisms. 5. Applying the concepts of smart contracts, token and wallet creation in Blockchain. 			
Module 1: Introduction to Cryptocurrency and Bitcoin			No. of Hrs: 8+6
<p>Physical and digital money, FIAT currency and intrinsic value. Interbank payments, E-Money Wallets. Cryptocurrency: Definition, Introduction to Bitcoin, Ethereum and Digital tokens. Bitcoin: Underlying components. Bitcoin Uses, Users, History of Bitcoin. Bitcoin wallet, Choosing a Bitcoin Wallet: Types of Bitcoin wallets, Full node versus Lightweight client, Bitcoin Addresses, Getting the Bitcoin for the first time. Sending and Receiving Bitcoin. How Bitcoin Works: Overview, Transactions, and Bitcoin transactions: Transaction Inputs and Outputs, Transaction Chains, Making Change, Common Transaction Forms. Constructing a Transaction: Getting the Right Inputs, Creating the Outputs, Adding the Transaction to the Blockchain. Bitcoin mining, Mining transactions in Blocks, Spending the transactions.</p> <p>Textbook 1: Chapter 1 ,Text Book 2 : Chapter 1,2</p> <p>Laboratory Components:</p> <ol style="list-style-type: none"> 1. Write a program to generate public and private keys using OpenSSL. 2. Develop and test smart contract on local Blockchain 			
Module 2 : Bitcoin System development and addresses			No. of Hrs: 8+6
<p>Bitcoin Development Environment, Compiling Bitcoin Core from the Source Code: Selecting a Bitcoin Core Release, Configuring the Bitcoin Core Build, and Building the Bitcoin Core Executables. Running a Bitcoin Core Node, Configuring the Bitcoin Core Node. Bitcoin Core Application Programming Interface (API): Getting Information on the Bitcoin Core Client Status, Exploring and Decoding Transactions, Exploring Blocks, Using Bitcoin Core’s Programmatic Interface. Alternative Clients, Libraries, and Toolkits. Bitcoin Addresses: Base58 and Base58Check Encoding, Key Formats. Implementing Keys and Addresses in Python, Advanced Keys and Addresses: Pay-to-Script Hash (P2SH) and Multisig Addresses, Vanity Addresses, Paper Wallets.</p> <p>Text Book 2: Chapter 3,4</p> <p>Laboratory Components:</p> <ol style="list-style-type: none"> 1. Design and develop Cryptocurrency for multiple users using python. 2. Write a smart contract using a solidity program to perform the balance transfer from contract to other accounts 			



Module 3: Wallet Technology and Transactions	No. of Hrs: 8+4
<p>Wallet Technology Overview: Nondeterministic (Random) Wallets, Deterministic (Seeded) Wallets, Seeds and Mnemonic Codes (BIP-39), Wallet Best Practices, Using a Bitcoin Wallet. Wallet Technology Details: Creating an HD Wallet from the Seed, Using an Extended Public Key on a Web Store.</p> <p>Transactions- Introduction, Transactions in Detail: Transactions—Behind the Scenes. Transaction Outputs and Inputs: Transaction Outputs, Transaction Inputs, Transaction Fees, Adding Fees to Transactions. Transaction Scripts and Script Language: Turing Incompleteness, Stateless Verification, Script Construction (Lock + Unlock), Pay-to-Public-Key-Hash (P2PKH), How Digital Signatures Work, Verifying the Signature, Signature Hash Types (SIGHASH), ECDSA Math, The Importance of Randomness in Signatures. Bitcoin Addresses, Balances, and Other Abstractions.</p> <p>Text Book 2:Chapter 5,6</p> <p>Laboratory Components:</p> <ol style="list-style-type: none">1. Write a program to perform token Creation and Management on Ethereum2. Setup Metamask in the System and Create a wallet in the Metamask with Test Network	
Module 4: Advanced Transactions and the Bitcoin Network	No. of Hrs: 8+4
<p>Advanced Transactions and Scripting: Introduction, Multisignature, Pay-to-Script-Hash (P2SH), P2SH Addresses, Benefits of P2SH, Redeem Script and Validation. Data Recording Output (RETURN). Time locks, Scripts with Flow Control (Conditional Clauses), Complex Script Example.</p> <p>The Bitcoin Network- Peer-to-Peer Network Architecture, Node Types and Roles, The Extended Bitcoin Network, Bitcoin Relay Networks, Network Discovery, Full Nodes, Exchanging “Inventory”, Simplified Payment Verification (SPV) Nodes, Bloom Filters: Working. How SPV Nodes Use Bloom Filters, SPV Nodes and Privacy, Encrypted and Authenticated Connections, Transaction Pools.</p> <p>Text Book 2:Chapter 7,8</p> <p>Laboratory Components:</p> <ol style="list-style-type: none">1. Create multiple accounts in Metamask and perform the balance transfer between the accounts and describe the transaction specification2. Create and deploy a python program to measure the maximum hashing capacity (Hash Rate) of a local CPU using Python	
Module 5: Bitcoin Mining and Consensus	No. of Hrs: 8+4
<p>Bitcoin’s Test Blockchain: Testnet, Segnet, Regtest.</p> <p>Mining and Consensus: Introduction, Bitcoin Economics and Currency Creation, Decentralized Consensus, Independent Verification of Transactions, Mining Nodes, Aggregating Transactions into Blocks, Constructing the Block Header, Mining the Block, Successfully Mining the Block, Validating a New Block, Assembling and Selecting Chains of Blocks, Mining and the Hashing Race, Consensus Attacks, Changing the Consensus Rules, Soft Fork Signaling with Block Version, Consensus Software Development.</p> <p>Text Book 2:Chapter 9, 10</p> <p>Laboratory Components:</p> <ol style="list-style-type: none">1. Decode a Transaction Hash: Take a random transaction ID (TXID) from a block explorer and identify the Input address, Output address, Transaction Fee (Use appropriate API’s if needed)2. Deploy a Self-Executing Smart Contract via the Remix IDE Environment.(use Remix VM (Cancun))	



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

1. Describe the basic concepts of Cryptocurrency with bitcoin as a use case.
2. Describe the Bitcoin development environment, concept of keys and addresses used in Bitcoin.
3. Perform transactions and interactions on Blockchain test network.
4. Build, test and deploy basic smart contracts.
5. Use mining algorithms for adding the blocks.

Textbooks:

1. Antony Lewis “The Basics of Bitcoins and Blockchain: An Introduction to Cryptocurrencies and the Technology that Powers Them” ,Mango Publishing, 2018
2. Andreas M. Antonopoulos, Mastering Bitcoin, O Reilly, 2nd Edition, 2017

Reference Books:

1. Andreas M. Antonopoulos & David A. Harding, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies” (3rd Ed., 2024), O’Reilly Media.
2. Arvind Narayanan, Joseph Bonneau “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction” (2016), Princeton University Press.
3. Saifedean Ammous “The Bitcoin Standard: The Decentralized Alternative to Central Banking (2018)”John Wiley & Sons Publishers

Web Links:

1. Blockchain Applications: <https://www.youtube.com/@WhiteboardCrypto>
2. Basics of wallets, security, and the history of Bitcoin: <https://www.youtube.com/@99Bitcoins>
3. Math behind Bitcoin : <https://www.youtube.com/watch?v=bBC-nXj3Ng4>



Deep Learning			
Semester	VII	CIE Marks	50
Course Code	23ICPE411	SEE Marks	50
Teaching Hrs/Week (L:T: P)	3:0:0	Exam Hrs.	03
Total Hrs.	42	Credits	03
<p>Course Learning Objectives: This course is designed to</p> <ol style="list-style-type: none"> 1. Introduce the fundamental concepts and significance of deep learning. 2. Impart knowledge on training and optimization techniques. 3. Provide insights into generalization and performance improvement methods. 4. Familiarize the deep learning architectures such as Convolutional Neural Networks (CNN) and Recurrent Neural Network (RNN). 5. Familiarize the principles of deep reinforcement learning. 			
Module 1: Fundamentals of Deep Learning			No. of Hrs: 8
<p>Introduction, Deep Learning Challenges, Training Deep Neural Networks, Backpropagation, Setup and Initialization issues, The vanishing and Exploding Gradient Problems, Gradient descent Strategies, Batch Normalization.</p> <p>Text Book 2: 1.1,1.3,1.4,1.5,1.6</p> <p>Text Book 1: 3.1,3.2,3.3,3.4,3.5,3.6</p>			
Module 2: Generalization in Deep Learning			No. of Hrs: 9
<p>Introduction, The Bias-Variance Trade off, Generalization Issues in Model Tuning and evaluation, Penalty-based Regularization, Ensemble Methods, Early Stopping, Unsupervised Pre-training, Continuation and curriculum learning, Parameter Sharing, Regularization in Unsupervised Application.</p> <p>Text Book 1: 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10</p>			
Module 3: Convolutional Neural Networks			No. of Hrs: 8
<p>Introduction, Basic structure of a Convolutional Network, Training a Convolutional Network, Case Studies of Convolutional Architecture, Visualization and Unsupervised learning, Application of Convolutional networks</p> <p>Text Book 1: 8.1,8.2,8.3,8.4.3,8.4.4,8.4.5,8.5,8.6</p>			
Module 4: Recurrent Neural Network			No. of Hrs: 9
<p>Introduction, Architecture of RNN, Challenges of training RNN ,Long Short Term Memory (LSTM), Gated Recurrent Units(GRU), Applications of RNN.</p> <p>Text Book 1: 7.1,7.2,7.3,7.4,7.5,7.6,7.7</p>			
Module 5: Deep Reinforcement Learning			No. of Hrs: 8
<p>Introduction, Stateless Algorithms: Multi armed Bandits, Basic Framework of Reinforcement Learning, Bootstrapping for Value Function Learning, Policy Gradient Methods, Monte Carlo Tree Search,</p> <p>Text Book 1:9.1,9.2,9.3,9.4,9.5,9.6,9.7.2.2</p>			



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

1. Explain deep learning concepts, training processes, optimization challenges, and techniques such as backpropagation and batch normalization.
2. Apply generalization and regularization techniques to improve performance and robustness of deep learning models.
3. Apply CNN and RNN models to solve image-based and sequential data problems.
4. Apply deep reinforcement learning principles to model decision-making tasks in dynamic environments.

Textbooks:

1. Charu C. Aggarwal, Neural Networks and Deep Learning, Springer International Publishing, 2018.
2. M. Arif Wani, Farooq Ahmad Bhat, Saduf Afzal, Asif Iqbal Khan, Advances in Deep Learning, Springer, 2020.

Reference Books:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2017.
2. François Chollet, Deep Learning with Python, Manning Publications, 2018.

Web Links:

1. Deep Learning Full Course: https://youtu.be/d2kxUVwWWwU?si=6jXLgoEVJH DU_WHN
2. Edureka-Full course of Deep Learning:
https://www.youtube.com/live/NtUqYEWdGoQ?si=QNuF_MhrcLWMsIv9
3. NPTEL – Deep Learning: https://youtu.be/aPfkYu_qiF4?si=ac2gcfBW-5YHYqul



Security and Privacy in IOT			
Semester	VII	CIE Marks	50
Course Code	23ICPE412	SEE Marks	50
Teaching Hrs/Week (L: T: P)	3:0:0	Exam Hrs.	03
Total Hrs.	42	Credits	03
<p>Course Learning Objectives: This course is designed to</p> <ol style="list-style-type: none"> 1. Impart knowledge on network resilience and formal methods for IoT system security. 2. Familiarize malware propagation and the control schemes in IoT Systems. 3. Provide knowledge on privacy-enhancing algorithms and secure key management in trusted IoT systems. 4. Provide knowledge of secure authentication and key agreement for specialized IoT environments. 			
Module 1: Attack and defence in IoT			No. of Hrs: 8
<p>Introduction to Attacks, Network resilience and Topological defence Scheme, Sequential Defence scheme. Location certificate-based scheme, System Modelling and verification. Attack vectors based on Smart home systems, Smart home systems defending attack. Analysis for attack scenarios. Text book 1: Chapter 2, Chapter 3, Chapter 5</p>			
Module 2: Malware propagation and control in IoT			No. of Hrs: 8
<p>Malware schemes in IoT, Malware Models: Impulse free Model, Impulse-reaction Model, Malware dynamics: SI model. Text book 1: Chapter 4</p>			
Module 3: Privacy Preservation and Data Dissemination			No. of Hrs: 8
<p>Network model, Threat model, Privacy scope, Uncertainty and information states, Evaluation Criteria, Special privacy graph (SPG) Data Dissemination, Methods for enhancing privacy and availability: Colouring algorithm, message replication. Validation by experiment. Text book 1: Chapter 6</p>			
Module 4: Trust Models for the IoT			No. of Hrs: 8
<p>Secure key storages, Trust model concepts, Public key infrastructures architecture Components, Design considerations of digital certificates, Public key infrastructure for IoT. Textbook 1: Chapter 10</p>			
Module 5: Authentication and computational security in IoT			No. of Hrs: 8
<p>Fundamentals of authentication: Entity Authentication and Message Authentication in Vehicular Adhoc Network (VNAET), Key agreement and management in Wireless body Area Network (WBAN), Characteristics of complex systems. Computational tools for complex systems. Text book 1: Chapter 13, Chapter 14</p>			



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

1. Describe the security challenges, privacy requirements, and threat models that in IoT systems.
2. Analyse malware propagation behaviour in IoT networks using the Susceptible–Infected (SI) model.
3. Identify vulnerabilities and attacks across IoT Systems.
4. Apply various authentication techniques for real-world IoT applications.

Text book:

1. Privacy in Internet of Things (IoTs) Models, Algorithms, and Implementations. Edited by Fei Hu

Reference book:

1. William Stallings – Cryptography and Network Security: Principles and Practice. 6th Edition

Web Links:

1. NPTEL – IoT Security: <https://archive.nptel.ac.in/courses/106/105/106105166/>
2. Introduction to IoT Security: <https://www.youtube.com/watch?v=OBrNzbOSwWs>



Big Data Analytics			
Semester	VII	CIE Marks	50
Course Code	23CSPC402	SEE Marks	50
Teaching Hrs/Week (L:T: P)	3:0:0	Exam Hrs.	3
Total Hrs.	42	Credits	3
<p>Course Learning Objectives: This course is designed to</p> <ol style="list-style-type: none"> 1. Provide knowledge on characteristics of big data 2. Impart knowledge on Hadoop framework and Map Reduce programming model 3. Familiarize MongoDB, Cassandra, Hive ,Pig and Spark used in big data analytics 4. Provide knowledge on big data analytics using machine learning techniques 			
Module 1:Introduction to Big Data Analytics			No. of Hrs: 8
<p>Classification of Digital data, Characteristics of Data, Challenges with big data, Typical data warehouse.</p> <p>Classification of Analytics, Importance of Big Data Analytics, and Terminologies used in Big data Environments, NoSQL and Hadoop.</p> <p>Text book 1: 1.1,2.1 to 2.5,2.10,3.2,3.5,3.8,3.12,4.1,4.2</p>			
Module 2:Hadoop and MapReduce			No. of Hrs: 8
<p>Introduction, RDBMS (Relational Database Management Systems) Vs Hadoop, Hadoop Components, Use case of Hadoop, Hadoop Distributed File System (HDFS), Processing data with Hadoop, Managing resources and applications with Hadoop YARN (Yet Another Resource Negotiator).</p> <p>MapReduce: Mapper, Reducer, Combiner, Partitioner, Using MapReduce for Searching, Sorting and Compression.</p> <p>Text book 1: 5.1 to 5.8, 5.10 to 5.12, 8.1 to 8.8</p>			
Module 3:MongoDB and Cassandra for Big Data			No. of Hrs: 9
<p>Concept of MongoDB, Features, RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.</p> <p>Features of Cassandra, CQL Data types, CRUD, Collections, Alter Commands, Import and export.</p> <p>Text book 1: 6.1 to 6.5, 7.2, 7.3, 7.6, 7.7, 7.10, 7.11</p>			
Module 4: Hive and Pig			No. of Hrs: 9
<p>Hive Architecture, Hive data types, Hive file formats, Hive Query Language (HQL), RC File implementation, User Defined Function (UDF).</p> <p>Pig Features, Pig on Hadoop, Use case for Pig, Pig Latin Commands, Data types in Pig, Running Pig, Execution Modes of Pig, HDFS Commands in Pig, Relational Operators, Eval Function, Complex Data Types, Piggy Bank, User Defined Function, Pig Vs Hive.</p> <p>Text book 1: 9.1 to 9.6, 9.8, 10.1 to 10.15, 10.22</p>			
Module 5: Spark, Text and Web Content Analytics			No. of Hrs: 8
<p>Spark: Introduction, Features, Software Stack, Introduction to Data Analysis with Spark.</p> <p>Text Mining, Web Mining, Web Usage Analytics, Page Rank, Structure of Web and Analyzing a Web Graph.</p> <p>Text book 2: 5.1 to 5.3, 9.1 to 9.4</p>			



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

1. Identify and list various Big Data concepts, tools and applications.
2. Develop programs using HADOOP framework.
3. Apply MapReduce programming model to process the big data along with Hadoop tools.
4. Implement data processing and querying using NoSQL, MogoDB, and Cassandra tools.
5. Apply machine-learning techniques to analyze large-scale datasets and web graphs using Spark, text mining, web mining, and PageRank.

Textbooks:

1. Seema Acharya and Subhashini Chellappan, “Big data and Analytics”, Wiley India Publishers, 2nd Edition, 2019.
2. Rajkamal and Preeti Saxena, “Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning” , McGraw Hill Publication, 2019

Reference Books:

1. Adam Shook and Donald Mine, “MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems” - O’Reilly 2012
2. Tom White, “Hadoop: The Definitive Guide” 4th Edition, O’reilly Media, 2015.
3. Thomas Erl, WajidKhattak, and Paul Buhler, Big Data Fundamentals: Concepts, Drivers & Techniques, Pearson India Education Service Pvt. Ltd., 1st Edition, 2016
4. John D. Kelleher, Brian Mac Namee, Aoife D’Arcy -Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, MIT Press 2020, 2nd Edition

Web Links:

1. Training and Testing Dataset:<https://www.kaggle.com/datasets/grouplens/movielens-20m-dataset>
2. What Is Big Data: <https://www.youtube.com/watch?v=bAyrObl7TYE&list=PLEiEAq2VkJUJqp1k-g5W1mo37urJQOdCZ>
3. Hadoop: <https://www.youtube.com/watch?v=VmO0QgPCbZY&list=PLEiEAq2VkJUJqp1k-g5W1mo37urJQOdCZ&index=4>
4. Pig Tutorial: <https://www.youtube.com/watch?v=GG-VRm6XnNk>

Activity based Assignment:

1. Install Hadoop and Implement the following file management tasks in Hadoop: Adding files and directories Retrieving files Deleting files and directories.
2. Develop a MapReduce program to implement Matrix Multiplication.
3. Develop a Map Reduce program that mines weather data and displays appropriate messages indicating the weather conditions of the day.
4. Develop a MapReduce program to find the tags associated with each movie by analyzing movie lens data.
5. Implement Functions: Count – Sort – Limit – Skip – Aggregate using MongoDB.
6. Implement CRUD operations using Cassandra.
7. Write Pig Latin scripts to sort, group, join, project, and filter the data.
8. Use Hive to create, alter, and drop databases, tables, views, functions, and indexes.
9. Implement a word count program in Hadoop and Spark.
10. Use CDH (Cloudera Distribution for Hadoop) and HUE (Hadoop User Interface) to analyze data and generate reports for sample datasets.



IoT for Automation			
Semester	VII	CIE Marks	50
Course Code	23ICOE411	SEE Marks	50
Teaching Hrs/Week (L:T: P)	3:0:0	Exam Hrs.	3
Total Hrs.	42	Credits	3
<p>Course Learning Objectives: This course is designed to</p> <ol style="list-style-type: none"> 1. Provide knowledge on the evolution of industrial automation, from traditional control systems to modern IoT-enabled Systems. 2. Impart knowledge on foundational concepts of Local Automation Clouds, including their properties, establishment and applications. 3. Impart knowledge on various application automation systems to address complex industrial and societal challenges. 			
Module 1: Local Automation Clouds			No. of Hrs: 9
<p>The Local Cloud Concept, Local Cloud Properties, Local Cloud Establishment, Automation Support, Automation Application Engineering in Local Clouds, Latency in Local Clouds, Security in Local Clouds, SoS Scalability.</p> <p>The Arrow Head Framework architecture: Important definitions, Documentation structure, The mandatory core systems, Automation support core systems.</p> <p>Text Book: Chapter 2, Chapter 3.2, 3.3, 3.4.1 (3.4.1.1 to 3.4.1.3), 3.4.2 (3.4.2.1 to 3.4.2.9)</p>			
Module 2: Arrowhead Framework core systems and services			No. of Hrs: 9
<p>Service Registry system, Authorization system, Orchestration system, Plant Description system, Configuration system, System Discovery and Device Discovery services.</p> <p>Text Book :Chapter 4.2.1, 4.2.2, 4.2.3, 4.3.1, 4.3.2, 4.3.3</p>			
Module 3: Engineering of IoT Automation Systems			No. of Hrs: 8
<p>Introduction, Component-based Engineering Methodology, Safety and Security Engineering of IoT Automation Systems, Swift Deployment and Configuration, PLC device monitoring, Replacement of device.</p> <p>Text Book :Chapter 6.1, 6.3, 6.4, 6.5.2, 6.5.3, 6.5.4</p>			
Module 4: Application System Design Energy Optimization			No. of Hrs: 8
<p>Introduction, Market as an Energy Optimizing Method, Optimizations Based on a Virtual Market of Energy, Energy Optimization on Lifts, Context Aware Streets, Optimization of Municipal Service Systems.</p> <p>Text Book :Chapter 7</p>			
Module 5: Complex Systems Management, Automation and Security			No. of Hrs: 8
<p>Electric Vehicles and Recharge Infrastructure, Arrowhead SOA EM Solution, Systems and Services, Arrowhead EM Services and Related Automation Aspects, Co-simulation Platform. Smart Maintenance Use Case, Authentication and Certification Service, Safety and Security Analysis for Identifying System Vulnerabilities.</p> <p>Text Book :Chapter 9.4, 9.5, 9.6, 9.7, 9.8; Chapter 10.2, 10.3, 10.5</p>			



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

1. Describe the concept, architecture, and properties of Local Automation Clouds, including latency, security, scalability, and the Arrowhead Framework for industrial automation.
2. Apply Arrowhead core systems to enable service discovery, orchestration, authorization, and inter-cloud communication in IoT automation systems.
3. Describe the component-based engineering methodologies used to design, deploy, and configure safe and secure IoT automation systems for large-scale and dynamic environments.
4. Describe energy-optimized application systems, including virtual energy markets and context-aware automation solutions.
5. Apply systems management and security automation techniques to real-world use cases such as EV infrastructure and smart maintenance systems.

Textbooks:

1. Jerker Delsing, “IoT Automation: Arrowhead Framework”, CRC Press, Taylor & Francis Group.

Reference Books:

1. The Internet of Things in the Industrial Sector, Mahmood, Zaigham (Ed.) (Springer Publication).
2. Industrial Internet of Things: Cyber manufacturing System, Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer Publication).

Web Links:

1. Industrial Internet of Things: <https://www.youtube.com/watch?v=HmbUJEShA-8>
2. IoT Home Automation Project Tutorial : <https://www.youtube.com/watch?v=eidD14dXW8s>
3. Udemy: https://www.udemy.com/course/iot-internet-of-things-automation-witresp8266/?srsltid=AfmBOoqqKDLk_fKye1CPIO9QjctFfgHOf1F_Zkmtze8uNRUvmq_9s1-3
4. NPTEL: https://onlinecourses.nptel.ac.in/noc20_cs69/preview



Data Visualization & Analytics			
Semester	VII	CIE Marks	50
Course Code	23ICOE412	SEE Marks	50
Teaching Hrs/Week (L:T: P)	3:0:0	Exam Hrs.	3
Total Hrs.	42	Credits	3
<p>Course Learning Objectives: This course is designed to</p> <ol style="list-style-type: none"> 1. Impart knowledge on exploratory versus explanatory analysis, focusing on the need of effective storytelling for targeted audience. 2. Familiarize various approaches of Aesthetics in data visualization for enhancing the interpretability of data 3. Provide knowledge on various plots & graph approaches for visualizing the data proportion, distribution & trends in data for better interpretation. 4. Provide insights on data visualization approaches for effective interpretation of geospatial & probabilistic data. 			
Module 1: Introduction			No. of Hrs: 09
<p>Importance of context : Exploratory vs. explanatory analysis, Defining : Who - Identifying Audience, What- Audience Expectation, How - Presenting mechanism, The 3-Mintue Story, Big Idea, StoryBoarding</p> <p>Handling Clutter : Cognitive Load, Clutter, Gestalt Principles :Proximity, Similarity, Enclosure, Closure, Contineuty, Connection, Lack of Visual Order : Alignment, White Spaces, Decluttering Example</p> <p>Text Book 1: Chapter 1, 3</p>			
Module 2 : Aesthetics in Data Visualization			No. of Hrs: 08
<p>Introduction, Visualizing Data: Aesthetics and Types of Data, Scales Map Data Values onto Aesthetics, Coordinate Systems and Axes: Cartesian Coordinates, Nonlinear Axes, Coordinate Systems with Curved Axes, Color Scales: Color as a Tool to Distinguish, Color to Represent Data Values, Color as a Tool to Highlight, plots and charts : Bar Graph, Grouped & Stacked Bar Graph, Heatmap</p> <p>Text Book 2: Chapter 1,2,3,4,6</p>			
Module 3 : Visualizing Distributions			No. of Hrs: 09
<p>Visualizing Distributions: Single Distribution, Multiple Distrubution, Cumulative Distribution Functions: Empirical Cumulative Distribution Functions, Highly Skewed Distribution, Quantile-Quantile Plots, Visualizing Many Distributions: boxplots, violin plots, Strip Charts, sina plots, ridgeline plot, Visualizing Proportions: Pie Chart, side-by-side bars, Stacked Bars, Stacked Densities, Relative Proportions</p> <p>Text Book 2: Chapter 7,8,9,10</p>			
Module 4 : Visualizing Proportions & Trends			No. of Hrs: 08
<p>Visualizing Nested Proportions: Nested Proportions Issues, Mosaic Plots, Treemaps, Nested Pies, Parallel Sets, And Visualizing Associations: Scatterplots, Correlograms, Dimension Reduction, Paired Data, Visualizing Time Series: Individual Time Series, Multiple Time Series and Dose–Response Curves, Visualizing Trends: Smoothing, Showing Trends with a Defined Functional Form,</p>			



Deterrending and Time-Series Decomposition. Text Book 2: Chapter 11,12,13,14	
Module 5 : Visualizing Geospatial & Uncertainty data	No. of Hrs: 08
Visualizing Geospatial Data: Projections, Layers, Choropleth Mapping, Cartograms Visualizing Uncertainty: Framing Probabilities as Frequencies, Visualizing the Uncertainty of Point Estimates, Visualizing the Uncertainty of Curve Fits, Hypothetical Outcome Plots Text Book 2: Chapter 15,16	
Course Outcomes: At the end of the course, the student will be able to <ol style="list-style-type: none">1. Explain the concepts of exploratory and explanatory analysis & discuss the need of storytelling for targeted guidance2. Identify various clutters in data visualization and discuss various approaches for incorporating Aesthetics in Data Visualization.3. Illustrate the significance of various plots & graph approaches used in visualizing distribution, proportion, trends in data.4. Explain the approaches used for visualizing geospatial data & uncertainty probabilistic data for effective interpretation.5. Compare & discuss the pros & cons of various approaches used for data visualization	
Textbooks: <ol style="list-style-type: none">1. Cole Nussbaumer Knaflic, “Storytelling with Data: A Data Visualization Guide for Business Professionals” Wiley Publisher, 20152. Claus O. Wilke, “Fundamentals of Data Visualization”, O’Reilly Media, 2019	
Reference Books: <ol style="list-style-type: none">1. Effective Data Storytelling: How to Drive Change with Data, Narrative and Visuals, WILEY Publisher, 2020.2. Data Visualization: Exploring and Explaining with Data with MindTap, Cengage Learning India Pvt. Ltd, 2022.	
Web Links: <ol style="list-style-type: none">1. YouTube Channel on Storytelling based on Data https://www.youtube.com/channel/UCjhGILWNlOxJdR2NTCBMIA2. Data to visualization various graphs : https://www.data-to-viz.com/	



Enterprise Cybersecurity Governance and Compliance			
Semester	VI	CIE Marks	50
Course Code	23ICPE411	SEE Marks	50
Teaching Hrs/Week(L:T:P)	3:0:0	Exam Hrs.	3
Total Hrs.	42	Credits	3
<p>Course Learning Objectives: This course is designed to</p> <ol style="list-style-type: none"> 1. Provide knowledge on GRC concepts and their application in strategic Cyber Security planning. 2. Familiarize risk management life cycle, NIST frameworks, and best practices used for risk management. 3. Impart knowledge on Cyber Security Metrics, frameworks, and risk assessment methodologies. 4. Provide knowledge on cybersecurity controls, architectures, and risk mitigation strategies used for securing organizational assets. 5. Impart knowledge on emerging cybersecurity technologies, such as cloud security, AI-driven solutions, and quantum computing. 			
Module1:Governance, Risk, and Compliance Fundamentals			No. of Hrs: 8
<p>Introduction: Governance, Risk Management, and Compliance: Understanding GRC and its intersection. GRC frameworks, standards, tools, and culture. Role of GRC in strategic planning.</p> <p>Cybersecurity Program and Project Management: Fundamentals of program and project management. Agile project management in cybersecurity. Communication and collaboration in cybersecurity projects.</p> <p>Chapter 1 and 4</p>			
Module2: Risk Management and NIST Frameworks			No. of Hrs:8
<p>Risk Management: Understanding risk management life cycle. Third party risk management and compliance expectations. Monitoring, reporting, and risk approvals.</p> <p>NIST Risk Management Framework (RMF): Steps in the NIST RMF authorization process. Integrating NIST RMF into organizational risk management. Challenges and best practices in implementing RMF.</p> <p>Chapter 7 and 8</p>			
Module3: Metrics, Assessments, and Cybersecurity Frameworks			No. of Hrs: 9
<p>Cybersecurity Metrics: Key Performance Indicators (KPIs) and Key Risk Indicators (KRIs) in cybersecurity. Role of metrics in decision-making, compliance, and strategy.</p> <p>Risk Assessments: Conducting cybersecurity risk assessments. NIST, FFIEC approaches, and best practices.</p> <p>Cybersecurity Frameworks: ISO/IEC27001, COBIT, CMMC, and PCIDSS. Comparing and integrating multiple frameworks. Future trends in cybersecurity frameworks.</p> <p>Chapter 9, 10 and 12</p>			
Module4:Cybersecurity Controls and Architecture			No. of Hrs: 9
<p>NIST SP 80053: Overview and structure of NIST SP 80053 controls. Control families and their applications.</p>			



<p>Cybersecurity Architecture: Components and layers of cybersecurity architecture. Security reference models and adapting to emerging threats.</p> <p>Risk Mitigation: Basics of risk mitigation and security controls. Policies, user security controls, and physical security measures.</p> <p>Chapter 13, 25 and 26</p>	
<p>Module5: Emerging Trends in Cybersecurity</p>	<p>No. of Hrs:8</p>
<p>Cloud Security: Cloud computing services, challenges, and best practices. Security tools, techniques, and future trends in cloud security. Artificial Intelligence in Cybersecurity: AI powered cybersecurity solutions. CISO's AI preparation checklist and its role in cyber defense. Quantum Computing: Quantum cryptography and its impact on cybersecurity. Strategic and security implications of quantum computing.</p> <p>Chapter 27, 28 and 29</p>	
<p>Course Outcomes: At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> 1. Apply GRC frameworks to analyze organizational governance, risk management, and compliance requirements. 2. Apply the risk management life cycle to identify, assess, and treat organizational risks. 3. Utilize cybersecurity metrics, assessment techniques, and international standards such as ISO/IEC 27001 and COBIT to support effective cybersecurity decision-making. 4. Apply cybersecurity architectures and security controls to assess and mitigate risks, while addressing evolving cyber threats. 5. Integrate emerging cybersecurity technologies, such as, AI and quantum computing, into security frameworks to address future challenges. 	
<p>Textbook:</p> <ol style="list-style-type: none"> 1. J. Edwards and G. Weaver, The Cyber security Guide to Governance, Risk, and Compliance. Wiley, May 2024 	
<p>Reference Book:</p> <ol style="list-style-type: none"> 1. P. Trimand Y. - I. Lee, Cyber Security Management Governance, Risk and Compliance Framework, 1st ed. Routledge, 2014. 	
<p>Web Links:</p> <ol style="list-style-type: none"> 1. GRC Practical Approach: https://youtu.be/mq_vSLHm4r0?si=KHqANw6lSJrVrCZP 2. NIST Framework: https://youtu.be/q0tBR0Iv-kE?si=njZ7fZypsU2TCvIm 3. KPI and KRI : https://youtu.be/UkEhXbNOn9w?si=Fgo3Tgw0mYSsY0ix 4. Cyber Security Architecture: https://youtu.be/jq_LZ1RFPfU?si=5kBodeV_bowvIwKZ 	



Project Phase – II

Semester	VII	CIE Marks	100
Course Code	23ICSE409	SEE Marks	100
Hrs/Week (L: T: P)	0:0:12	Exam Hrs.	03
Total Hrs.	-	Credits	06

Objectives:

1. To enable students to execute, validate, and communicate the engineering solution to the identified problem conceptualized in Project Phase – I
2. To motivate students to extend their project work toward research publications, patent filing, funding proposals, or technology transfer, where applicable.

General Guidelines for CIE procedure:

1. The Department project coordinator will take the responsibility of monitoring all the activities related to the project execution.
2. The HOD shall constitute project evaluation/review committee(s) & the composition shall be as follows:
 - a. HOD or one of the HODs in case of an interdisciplinary project, shall be the Chairman of the committee
 - b. Project Coordinator shall be member - Convener
 - c. Project guide shall be the member
 - d. One/Two senior faculty members nominated by the HOD (may be from different departments in case of an interdisciplinary project jointly nominated by the HODs)
3. Project teams must implement the problem identified using the proposed methodology through systematic experimentation and/or simulation leading to a functional solution or validated outcome in consultation with their project guide.
4. Each project team shall maintain a project diary and record their project progress at regular interval of time. This shall carry signature of the students and the project guide.
5. Marks may be equally or proportionally distributed among team members based on contribution assessed by the guide and committee.
6. A student shall obtain minimum of 40% of the total CIE marks to gain eligibility for SEE

General Guidelines for SEE procedure:

1. The Department project coordinator will take the responsibility of all the requirements for successful conduction of the SEE.
2. SEE for project work will be conducted by two examiners (one internal examiner and the other an external examiner) appointed by the Controller of Examinations.
3. Project teams must present their projects that have been executed and completed with a functional solution or validated outcome during the SEE.
4. Each project team shall bring to the SEE a project report that shall carry signature of the students, project guide, HOD and the Principal. Plagiarism, data fabrication, or copying of work will result in stringent disciplinary action and /or penalties. (Note: Any disciplinary actions or penalties will be as per institutional policy.)
5. Marks may be equally or proportionally distributed among team members based on contribution assessed by the examiners.



6. A student shall obtain minimum of 40% of the total SEE marks to pass this course.

Deliverables:

1. Comprehensive Project Report comprising of:

- Abstract
- Introduction
- Literature Survey
- Problem Definition
- Proposed Methodology
- Design
- Implementation
- Results and discussion
- References
- Appendices

The project report shall be prepared in the prescribed format provided by the institute.

2. A plagiarism report shall be obtained from the Department of Library. Acceptable similarity threshold is generally below 20%, and hence, the plagiarized content shall not exceed 20%. Similarity above 20% will require resubmission after proper revisions.

Review and Evaluation for CIE:

1. There shall be two reviews and a presentation. Total of 100 CIE marks is distributed as follows:

Review - 1	
Phase wise execution of proposed solution	20 Marks
Use of modern tools for proposed solution	10 Marks
Contribution as an individual and team member	10 Marks
Total	40 Marks

Review - 2	
Complete Implementation and Demonstration of Modules	15 Marks
Report Quality & Formatting	15 Marks
Total	30 Marks

Presentation	
Presentation	20 Marks
Team work	10 Marks
Total	30 Marks
Grand Total	100 Marks

2. First review shall be conducted after one month from the start of the semester.

3. Every department shall develop rubrics to assess performance of the students based on the above given parameters.



Evaluation for SEE:

1. There shall be a presentation for SEE. Total of 100 SEE marks is distributed as follows:

SEE	
Execution of proposed solution	40 Marks
Evaluation of Project Report	30 Marks
Project presentation & Question and Answer	30 Marks
Total	100 Marks

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

1. Execute the problem identified using the methodology proposed through systematic design, development, experimentation, and/or simulation, leading to a functional solution or validated outcome.
2. Translate theoretical concepts into practical implementation while considering constraints such as feasibility, cost, sustainability, safety, ethics, and societal relevance.
3. Exhibit the resourcefulness to act independently as well as collaboratively within a team in overcoming technical challenges encountered during project execution.
4. Plan tasks effectively, manage time and resources, meet defined milestones, and adhere to deadlines, reflecting professional engineering practice.
5. Prepare a comprehensive project report that clearly documents design decisions, implementation details, experimental results, analysis, and conclusions using standard technical writing practices.
6. Confidently present the project work through reviews, demonstrations, seminars, and viva-voce examinations, addressing questions from peers, faculty, and examiners.



Constitution of India & Professional Ethics			
Semester	VII	CIE Marks	100
Course Code	23HMCC421	SEE Marks	-
Teaching Hrs/Week (L:T:P)	1:0:0	Exam Hrs.	-
Total Hrs.	13	Credits	01
<p>Course Learning Objectives: This course is designed to</p> <ol style="list-style-type: none"> 1. Introduce the foundational principles and features of the Indian Constitution 2. Familiarize the Fundamental Rights and Directive Principles. 3. Provide an understanding of Union and State government policies and Electoral Process. 4. Develop awareness on Sustainable development goals, energy conservation and climate change. 5. Inculcate Ethical responsibilities and Code of Conduct. 			
Module 1: Introduction to the Indian Constitution			No. of Hrs:2
Definition and Significance of the Constitution, Making of the Constitution, Constituent Assembly, Preamble, Salient features of the India Constitution, Amendments, other Provisions and Citizenship.			
Module 2: Fundamental Rights and Duties			No. of Hrs:3
Fundamental Rights: Right to Equality, Right to Freedom, Right to Life & Personal Liberty, Right against Arbitrary arrest and Preventive Detention, Right against Exploitation, Right to Religion, Cultural & Educational Rights and Right to Constitutional Remedies, Restrictions and Limitations, Directive Principles of State Policy and its relevance in the society, Fundamental Duties of Citizens.			
Module 3: Union and State Government Structure			No. of Hrs:3
<p>Union Govt: Union Legislature- Parliament-Lok Sabha and Rajya Sabha, Sessions of Parliament, Parliamentary System, Parliamentary Committees, Important Parliamentary Terminologies.</p> <p>Union Executive- President, Prime Minister, Union Cabinet, Union Council of Ministers.</p> <p>Union Judiciary-Supreme Court of India, Judicial Review and Judicial Activism.</p> <p>State Govt: State Legislature- State Legislative Assembly, State Legislative council,</p> <p>State Executive- Governor, Chief Minister, State Cabinet, State Council of Ministers,</p> <p>State Judiciary- High Court and Subordinate Courts.</p> <p>Elections: Election Commission of India, Process and Laws.</p>			
Module 4: Ethics and Sustainable Development			No. of Hrs:3
Ethics: Values and types, Honesty, Trust, Integrity and Reliability in Engineering, Sustainable development goals, energy conservation, sustainable developments, Environmental Ethics: climate change and ethical responsibility.			
Module 5: Professional Ethics for Engineers			No. of Hrs:2
Scope & Aims, Code of Ethics, Professional responsibility, Accountability, Research Ethics, Clash of Ethics (example with respect to technology), Conflicts of Interest, Risks, Safety, Liability and Corporate Social Responsibility.			



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

1. State the preamble and the basic features of the Indian Constitution.
2. Explain the Fundamental Rights, Directive Principles of State Policy and their relevance in contemporary Indian society.
3. Compare the functioning of the Union and State legislature, Executive and Judiciary
4. Classify Ethical, Virtues and explain sustainable development goals and climate change.
5. Outline the Aims, Code of Ethics, and principles of Corporate Social Responsibility.

Text Books

1. Raja Ram, M., (2015), Constitution of India & Professional Ethics,(3rd Edition),New Age International Publishers.
2. Dr.Tharanath, Santhosh Prabhu & Suma Suresh Kogilgeri,(2018),Constitution of India & Professional Ethics, Pristine Publishing House.
3. Sharma Brij Kishore, (2011), Introduction to the Constitution of India, (8th Edition), PHI Learning Pvt. Ltd.
4. Charles E Harris, Michael S. Pritchard & Michael J. Rabins (2018), Engineering Ethics: Concepts and Cases), (1st Edition), IEEE / Cengage.
5. Iqbal,Jaquir, (2013), SDG – Sustainable Urban Development: Challenges, Achievements & Opportunities, (1st Edition), Global Vision Publishing House.

Web Links:

1. Making of the Indian Constitution - <https://www.youtube.com/watch?v=Z5nQ4xea9ts>
2. Parts, Articles and Schedules of the Indian Constitution - <https://www.youtube.com/shorts/TJRdYarLPYI>
3. The Indian Constitution - <https://www.youtube.com/watch?v=vXvLSXlmkyM>
4. Professional Engineering Ethics - <https://www.youtube.com/watch?v=SVz6Q7EoBJM>
5. Sustainable Development Goals- <https://www.youtube.com/watch?v=qAIolKgDPrA>



INTERNSHIP

Semester	VIII	CIE Marks	100
Course Code	23ICSE431	SEE Marks	100
Hrs/Week (L: T: P)	-	Exam Hrs.	03
Total Hrs.	-	Credit	12

Objectives: This course is designed to

1. Bridge the gap between academic learning and real-world engineering practice.
2. Provide hands-on experience in industry, research and incubation environments.
3. Develop technical, analytical, and professional skills.
4. Expose students to organizational structure, workflow, and workplace ethics.
5. Enhance employability, innovation, and lifelong learning capabilities

Preamble:

Internship refers to the position of a student as trainee or a temporary (or unconfirmed) employee, who works in an organization, with or without pay/stipend, in order to gain work experience or satisfy requirements for a qualification. It is a structured, supervised professional experience in an industry, research organization, or incubation centers.

Internships play a vital role in bridging the gap between theoretical education and professional practice. In general, engineering internships serve as a crucial component of professional education by providing experiential learning, industry readiness, and holistic skill development, ultimately producing competent engineers or entrepreneurs. Apart from these, it develops professional ethics, work culture awareness and communication skills.

Types of Internships:

Following are the types of internships:

- Industry Internship:** Carried out in the engineering industry, companies, manufacturing units, startups, business, IT industry. The topic involved may be technical, managerial, production-related tasks, live projects, or innovative activities.
- Research Internship:** Carried out at universities, research labs, or R&D departments or organizations. The internship involves literature review, data analysis, and experimental work leading to publications, prototypes, technical reports or innovations. The research internship may induce students to plan for higher studies or academic careers.
- Entrepreneurship Internship:** Undertaken in association with start-ups, or entrepreneurship cells or launching own idea in Preincubation/Incubation centers. The internship offers exposure to business planning, prototype, product development, and promotes innovation, risk-taking, and entrepreneurial mindset.
- Post-Placement Internship:** Refers to the internship offered to students after they receive a confirmed job offer (placement) from a company, but before formally joining as full-time employees. This internship (on-site, virtual, or hybrid) ensures that students are groomed to be professionally ready, technically competent, and culturally aligned with the organization even before official induction.



General Guidelines:

1. The official engagement period of 15-week for students selected/recruited by the company/organization only at their premises under the supervision of the company, shall only be considered as an internship.
2. The period of training and working of students who have been recruited as employees by organizations at the beginning of the 4th year of the program, shall also be treated as an internship.
3. The assigned faculty mentor/coordinator/guide should monitor the student's progress, and document offer letters, training reports, attendance, and evaluations for awarding academic credits.
4. All students undergoing an internship, should adhere to all the guidelines, reporting protocols, and evaluation procedures prescribed by the Institution and the company.
5. Students must submit the certificate of completion of an internship with the period of internship clearly mentioned, from the respective company/organization.

Procedure for CIE:

1. The Department Internship coordinator identified by the HOD will take the responsibility of monitoring all the activities related to the Internship.
2. The HOD shall constitute Internal Internship evaluation/review committee & the composition shall be as follows:
 - a. HOD shall be the Chairman of the committee
 - b. Internship Coordinator shall be member – Convener
 - c. Internal Internship Guide shall be member
 - d. Two senior faculty members nominated by the HOD shall be the members
3. The External Internship evaluation/review committee shall be composed of industry supervisor/external guide. For evaluation, the industry supervisor/external guide may join the review in online mode.
4. The internal evaluation shall be conducted by the departmental review committee based on the student's internship progress, documentation, and presentation which will comprise the student's daily report, focusing on the regularity, completeness, and clarity of the internship logbook/diary; the deliverables and outcomes, considering the quality of work, relevance, and achievement of the stated objectives; and the presentation skills, assessing clarity, communication effectiveness, and the ability to present the work in a structured and professional manner.
5. The external evaluation shall be carried out by the industry supervisor/external guide based on the student's performance at the workplace which will comprise the student's technical knowledge, assessment of the understanding and application of domain-specific concepts during the internship; work ethics, considering professionalism, punctuality, discipline, and adherence to organizational practices; deliverables and outcomes, evaluating the quality and completion of assigned tasks; and the ability to learn independently, adapt to new and emerging technologies, and exhibit critical thinking, reflecting the student's capacity for continuous learning, problem-solving, and adaptability in a professional environment.



Procedure for SEE:

7. SEE for Internship will be conducted by two examiners (one internal examiner and the other an external examiner) appointed by the Controller of Examinations.
8. Students must present their Internship work to the examiners.
9. Each student shall bring to the SEE, an Internship report which includes the Internship Completion Certificate from the organization. The report shall also carry signatures of the student, Internship guides (Internal & External), HOD and the Principal.

Deliverables:

1. Internship Daily Report
2. Final Internship Report
3. Internship Completion Certificate

Evaluation for CIE:

There shall be two reviews and a presentation. Total of 100 CIE marks is distributed as follows:

Review – 1 & 2 (Internal Internship Evaluation Committee)	
Internship Daily Report	10 Marks
Deliverables and Outcomes	10 Marks
Presentation Skills	05 Marks
Review – 1 Total	25 Marks
Review – 2 Total	25 Marks
Review – 1 & 2 (External Internship Evaluation Committee)	
Technical Knowledge	10 Marks
Work Ethic	05 Marks
Deliverables and Outcomes	05 Marks
Ability to Learn, Adapt & Critical Thinking	05 Marks
Review – 1 Total	25 Marks
Review – 2 Total	25 Marks
Grand Total	100 Marks

Evaluation for SEE:

Total of 100 SEE marks is distributed as follows:

SEE (Internal & External Examiners)	
Internship Report	70 Marks
Final Presentation	30 Marks
Grand Total	100 Marks



Course Outcomes:

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

CO1: Apply engineering knowledge to real-world industrial or societal problems.

CO2: Demonstrate technical competency in a professional environment.

CO3: Analyze and solve practical engineering problems using modern tools / techniques.

CO4: Communicate effectively through reports and presentations.

CO5: Exhibit professional ethics, teamwork, and adaptability.

CO6: Inculcate industry practices, workflows, and organizational behavior.



Publication / Patenting			
Semester	VIII	CIE Marks	100
Course Code	23ICSE432	SEE Marks	-
Hrs/Week (L: T: P)	-	Exam Hrs.	-
Total Hrs.	-	Credit	02
Objectives: This course is designed to <ol style="list-style-type: none">1. Enable students to systematically document literature review and research gaps.2. Train students in research paper writing and publication process.3. Provide knowledge of patentability search and drafting patent applications.4. Motivate students to publish research work or file patents.5. Inculcate ethical research practices.			
Procedure for CIE: <ol style="list-style-type: none">1. The project guide from Project Phase I / II shall continue as the research guide, ensuring continuity in converting the completed project work into a research publication or patent.2. Students shall derive research contributions from their completed project work, focusing on:<ol style="list-style-type: none">a. Accurately representing experimental resultsb. Providing evidence for validated outcomes / effective performancec. Explicit mention of novelty / innovation3. The evaluation shall be carried out based on the following three major components: Component 1: Literature Review & Manuscript / Patent Drafting<ol style="list-style-type: none">a. Comprehensive literature survey and identification of research gapb. Structuring of research paper / patent documentc. Technical depth, methodology, and clarity of presentationd. Patentability analysis (in case of patent track)Component 2: Submission / Filing<ol style="list-style-type: none">a. Submission of manuscript to a reputed SCI/WoS indexed journalOR Filing of a patent application with appropriate authority<ol style="list-style-type: none">b. Submission proof (acknowledgement / application number) is mandatoryComponent 3: Publication / Patent Outcome Publication of article in SCI/WoS indexed journal OR Publication of patent4. Marks shall be awarded proportionately based on:<ol style="list-style-type: none">a. Paper publication status (accepted / published)b. Patent filing / publication status5. Students must ensure originality and adherence to ethical practices, including proper citation and avoidance of plagiarism.6. A plagiarism report shall be submitted, with similarity generally not exceeding 10%, failing which revision and resubmission is required.7. Progress shall be monitored through periodic reviews by the departmental committee, focusing on:<ol style="list-style-type: none">a. Conversion of project work into quality manuscript / patentb. Quality of manuscript / patent draftingc. Readiness for submission / publication			



8. The HOD shall constitute publication/patenting evaluation/review committee(s) & the composition shall be as follows:
- HOD or one of the HODs in case of an interdisciplinary project, shall be the Chairman of the committee
 - Coordinator shall be member - Convener
 - Guide shall be the member
 - One/Two senior faculty members nominated by the HOD (may be from different departments in case of an interdisciplinary project jointly nominated by the HODs)

Deliverables:

- Literature Review Report / Patentability Report
 - Representation of problem identification
 - Representation of gap analysis
 - Survey of recent literature / prior art
- Manuscript / Patent Draft
Structured manuscript (Abstract, Introduction, Methodology, Results, References)
OR
Patent Draft (Title, Abstract, Claims, Description, Drawings)
- Submission Proof
Journal submission acknowledgement / Patent filing receipt
- Paper Publication / Patent Filing / Patent Publication Evidence

Evaluation for CIE:

Total of 100 CIE marks is distributed as follows:

Sl. No.	Description	Marks
1.	Literature Review, Research Paper Writing / Patentability Search, Drafting the Patent Application	50
3.	a. Submission & Acceptance of manuscript (SCI/WoS) OR b. Filing a Patent Application	30
4.	a. Publication of Article (SCI/WoS) OR b. Publication of Patent	20
Total		100

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

- CO1. Systematically documenting literature review and gaps in a specific domain.
- CO2. Prepare a structured research manuscript or patent document following standard guidelines.
- CO3. Perform patentability search and analyze prior art for innovation feasibility.
- CO4. Demonstrate the ability to submit research work to journals or file patent applications.
- CO5. Apply ethical practices in research, including plagiarism avoidance and proper citation.