

AUTONOMOUS

# SYLLABUS

VII & VIII Semesters

B.E in Computer Science & Engineering

2023

MITE



Invent Solutions

**MANGALORE INSTITUTE OF  
TECHNOLOGY & ENGINEERING**



# MANGALORE INSTITUTE OF TECHNOLOGY & ENGINEERING

(A Unit of Rajalaxmi Education Trust<sup>®</sup>, 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, Theoretical and Pragmatic; ALL at the same time**”*

## Department Vision

*“To establish as a **Center of Excellence in Education and Research in the field of Computer Science & Engineering** for transforming the students into **Competent Professionals**”*

## Department Mission

- *Provide strong theoretical and practical background in Computer Science & Engineering and allied fields of Engineering.*
- *Provide excellent state of the art infrastructure and competent man power to facilitate the need based technical education to the students with ethical and social values.*
- *Encourage students to involve in Co-curricular and extracurricular activities.*
- *Promote Research and Innovation activities among the staff and students.*

## Program Educational Objectives (PEOs)

### Graduates of Computer Science and Engineering program will

- *Design, develop and maintain reliable software systems to satisfy the needs of customers.*
- *Do research and development to meet the challenges of changing technologies.*
- *Work in teams to fulfill the societal and industrial needs.*

## Program Specific Outcomes (PSOs)

### The graduates of the Computer Science and Engineering department will be able to

- *Design, develop, test and maintain the software systems that fulfill the needs of the industry and society*
- *Apply the concept of networking, data storage and computation to solve the real world problems*

**LIST OF COURSES**

<b>VII/VIII Semester</b>			
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Semester</b>
<b>PROFESSIONAL CORE COURSES</b>			
1	23CSPC401	Deep Learning	VII
2	23CSPC402	Big Data Analytics	VII
<b>PROFESSIONAL ELECTIVE COURSES</b>			
3	23CSPE411	High Performance Computing	VII
4	23CSPE412	Social Network	VII
5	23CSPE413	Generative AI	VII
6	23CSPE42X	MOOCs (NPTEL/SWAYAM)	VIII
<b>OPEN ELECTIVE COURSES</b>			
7	23CSOE411	IoT for Automation	VII
8	23CSOE412	Data Visualization and Analytics	VII
9	23CSOE413	Software testing	VII
<b>SKILL ENHANCEMENT COURSES</b>			
10	23CSSE409	Project Phase-II	VII
11	23CSSE431	Internship	VIII
12	23CSSE432	Publication / Patenting	VIII
<b>HUMANITIES &amp; SOCIAL SCIENCE COURSES</b>			
13	23HMCC421	Constitution of India & Professional Ethics	VII



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## VII Semester (2023 Scheme): Computer Science & Engineering

Sl. No	Course Code	Course Title	Category	Teaching Dept.	Teaching Hours /Week			Exam Marks			Duration of Exam (SEE) in Hrs	Credits
					L	T	P	CIE	SEE	Total		
1	23CSPC401	Deep Learning	Professional Core Course	CSE Allied Branches	3	0	2	50	50	100	3	4
2	23CSPC402	Big Data Analytics	Professional Core Course	CSE Allied Branches	3	0	2	50	50	100	3	4
3	23CSPE41X	Professional Elective –III*	Discipline Specific Elective Course	CSE Allied Branches	3	0	0	50	50	100	3	3
4	23CSOE41X	Open Elective –III**	Open Elective Course	Concerned Department	3	0	0	50	50	100	3	3
5	23CSSE409	Project Phase-II	Skill Enhancement Course	CSE Allied Branches	-	-	12	100	100	200	-	6
6	23HMCC421	Constitution of India & Professional Ethics	Humanities & Social Sciences	Humanities/Any Engineering Department	1	0	0	100	-	100	-	1
<b>Total</b>											<b>21</b>	

### \* Professional Elective -III Course(s):

Sl. No.	Course Code	Course Title
1	23CSPE411	High Performance Computing
2	23CSPE412	Social Network
3	23CSPE413	Generative AI

### \*\*Open Elective -III Course(s):

Sl. No.	Course Code	Course Title
1	23CSOE411	IoT for Automation
2	23CSOE412	Data Visualization and Analytics
3	23CSOE413	Software testing



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## VIII Semester (2023 Scheme): Computer Science & Engineering

Sl. No.	Course Code	Course Title	Category	Teaching Dept.	Teaching Hours /Week			Examination (Marks)			Duration of Exam (SEE) in Hrs	Credits
					L	T	P	CIE	SEE	Total		
1	23CSPE42X	MOOCs* (NPTEL/SWAYAM) 8/12 WEEKS	Professional Elective Course	CSE Allied Branches	-	-	-	-	-	100	-	2
2	23CSSE431	Internship	Skill Enhancement Course	CSE Allied Branches	-			100	100	200	3	12
3	23CSSE432	Publication / Patenting	Skill Enhancement Course	CSE Allied Branches	-	-	-	100	-	100	-	2
<b>Total Credits</b>											<b>16</b>	

\* 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.



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## **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.

## **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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<b>Deep Learning</b>			
Semester	<b>VII</b>	CIE Marks	<b>50</b>
Course Code	<b>23CSPC401</b>	SEE Marks	<b>50</b>
Teaching Hrs./Week (L:T: P)	<b>3:0:2</b>	Exam Hrs.	<b>03</b>
Total Hrs.	<b>64(40+24)</b>	Credits	<b>03</b>
<p><b>Course Learning Objectives:</b> This course is designed to</p> <ul style="list-style-type: none"> <li>• Introduce the fundamental concepts and significance of deep learning.</li> <li>• Impart knowledge on training and optimization techniques.</li> <li>• Provide insights into generalization and performance improvement methods.</li> <li>• Familiarize the deep learning architectures such as Convolutional Neural Network (CNN) and Recurrent Neural Network (RNN).</li> <li>• Familiarize the principles of deep reinforcement learning.</li> </ul>			
<b>Module 1: Fundamentals of Deep Learning</b>			<b>No. of Hrs: 8+4</b>
Introduction, Deep Learning Challenges, Training Deep Neural Networks, Backpropagation, Setup and Initialization issues, The vanishing and Exploding Gradient Problems, Gradient descent Strategies, Batch Normalization.			
<b>Laboratory Component</b>			
<ol style="list-style-type: none"> <li>1. Programming exercises using Keras to implement a simple Artificial Neural Network (ANN) for classification and visualize training loss and accuracy.</li> <li>2. Programming exercises comparing different optimizers such as SGD and Adam and observing convergence behavior.</li> </ol>			
<b>Text Book 2: 1.1,1.3,1.4,1.5,1.6</b>			
<b>Text Book 1: 3.1,3.2,3.3,3.4,3.5.1-3.5.6,3.6</b>			
<b>Module 2: Generalization in Deep Learning</b>			<b>No. of Hrs.: 8+4</b>
Introduction, The Bias-Variance Trade off, Generalization Issues in Model Tuning and evaluation, Penalty-based Regularization, Ensemble Methods, Early Stopping.			
<b>Laboratory Component</b>			
<ol style="list-style-type: none"> <li>1. Programming exercises demonstrating overfitting and applying L2 regularization to improve model generalization.</li> <li>2. Programming exercises implementing dropout and early stopping techniques and comparing training and validation performance.</li> </ol>			
<b>Text Book 1: 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10</b>			
<b>Module 3: Convolutional Neural Networks</b>			<b>No. of Hrs.: 8+4</b>
Introduction, Basic structure of a Convolutional Network, Training a Convolutional Network, Case Studies of Convolutional Architecture: VGG, ResNet, Visualization and Unsupervised learning, Application of Convolutional networks.			
<b>Laboratory Component</b>			
<ol style="list-style-type: none"> <li>1. Programming exercises designing and training a Convolutional Neural Network (CNN) for image classification using the MNIST dataset.</li> </ol>			

2. Programming exercises performing hyperparameter tuning of CNN models (such as number of filters, kernel size, learning rate, batch size and activation functions) and analyzing its impact on classification accuracy.

**Text Book 1: 8.1,8.2,8.3.,8.4.3,8.4.4,8.4.5,8.5,8.6**

**Module 4: Recurrent Neural Network**

**No. of Hrs.: 8+6**

Introduction, Architecture of RNN, Challenges of training RNN ,Long Short Term Memory (LSTM), Gated Recurrent Units(GRU), Applications of RNN.

**Laboratory Component**

1. Programming exercises implementing an LSTM network for simple sequence prediction.
2. Programming exercises implementing GRU and comparing its performance with LSTM for sequence data.

**Text Book 1: 7.1,7.2,7.3,7.4,7.5,7.6,7.7.2,7.7.6,7.7.8,7.7.9**

**Module 5: Deep Reinforcement Learning**

**No. of Hrs: 8+6**

Introduction, Stateless Algorithms: Multi armed Bandits, Basic Framework of Reinforcement Learning, Bootstrapping for Value Function Learning, Policy Gradient Methods, Monte Carlo Tree Search.

**Laboratory Component**

1. Programming exercises simulating a multi-armed bandit problem using epsilon-greedy strategy and analyzing reward behavior.
2. Programming exercises implementing a Q-learning algorithm for solving a reinforcement learning environment.

**Text Book 1:9.1,9.2,9.3,9.4,9.5,9.6,9.7.2.2**

**Course Outcomes:**

At the end of the course the students will be able to

**CO1:** Explain deep learning concepts, training processes, optimization challenges, and techniques such as backpropagation and batch normalization.

**CO2:** Apply generalization and regularization techniques to improve performance and robustness of deep learning models.

**CO3:** Apply CNN and RNN models to solve image-based and sequential data problems.

**CO4:** Apply deep reinforcement learning principles to model decision-making tasks in dynamic environments.

**Textbook:**

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.

<b>Big Data Analytics</b>			
Semester	<b>VII</b>	CIE Marks	<b>50</b>
Course Code	<b>23CSPC402</b>	SEE Marks	<b>50</b>
Teaching Hrs/Week (L:T: P)	<b>3:0:2</b>	Exam Hrs	<b>3</b>
Total Hrs	<b>64(40+24)</b>	Credits	<b>4</b>
<p><b>Course Learning Objectives:</b> This course is designed to</p> <ol style="list-style-type: none"> <li>1. Provide knowledge on characteristics of big data</li> <li>2. Impart knowledge on Hadoop framework and MapReduce programming model</li> <li>3. Familiarize MongoDB, Cassandra, Hive ,Pig and Spark used in big data analytics</li> <li>4. Provide knowledge on big data analytics using machine learning techniques</li> </ol>			
<b>Module 1: Introduction to Big Data Analytics</b>			<b>No. of Hrs: 8</b>
<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, Terminologies used in Big data Environments, NoSQL and Hadoop.</p> <p><b>Text book 1: 1.1,2.1 to 2.5, 2.10, 3.2, 3.5, 3.8, 3.12, 4.1, 4.2</b></p>			
<b>Module 2 : Hadoop and MapReduce</b>			<b>No. of Hrs: 8 +6</b>
<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><b>Text book 1: 5.1 to 5.8, 5.10 to 5.12, 8.1 to 8.8</b></p> <p><b>Laboratory Components:</b></p> <ol style="list-style-type: none"> <li>1. Install Hadoop and Implement the following file management tasks in Hadoop:             <ol style="list-style-type: none"> <li>i. Adding files and directories</li> <li>ii. Retrieving files</li> <li>iii. Deleting files and directories.</li> </ol> </li> <li>2. Develop a Map Reduce program that mines weather data and displays appropriate messages indicating the weather conditions of the day.</li> <li>3. Develop a MapReduce program to find the tags associated with each movie by analyzing movie lens data.</li> </ol>			
<b>Module 3: MongoDB and Cassandra for Big Data</b>			<b>No. of Hrs: 8+6</b>

Concept of MongoDB, Features, RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.

Features of Cassandra, CQL Data types, CRUD, Collections, Alter Commands, Import and export.

**Text book 1: 6.1 to 6.5, 7.2,7.3,7.6,7.7,7.10,7.11**

**Laboratory Components:**

1. Implement Functions: Count – Sort – Limit – Skip – Aggregate using MongoDB.
2. Implement CRUD operations using Cassandra.

**Module 4: Hive and Pig**

**No. of Hrs: 8+6**

Hive Architecture, Hive data types, Hive file formats, Hive Query Language (HQL), RC File implementation, User Defined Function (UDF).

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.

**Text book 1: 9.1 to 9.6, 9.8, 10.1 to 10.15, 10.22**

**Laboratory Components:**

1. Write Pig Latin scripts to sort, group, join, project, and filter the data.
2. Use Hive to create, alter, and drop databases, tables, views, functions, and indexes.

**Module 5: Spark, Text and Web Content Analytics**

**No. of Hrs: 8+6**

Spark: Introduction, Features, Software Stack, Introduction to Data Analysis with Spark. Text Mining, Web Mining, Web Usage Analytics, Page Rank, Structure of Web and Analyzing a Web Graph.

**Text book 2: 5.1 to 5.3, 9.1 to 9.4**

**Laboratory Components:**

1. Implement a word count program in Hadoop and Spark.
2. Use CDH (Cloudera Distribution for Hadoop) and HUE (Hadoop User Interface) to analyze data and generate reports for sample datasets.

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

1. Explain big data concepts, Hadoop ecosystem, NoSQL databases, Hive, Pig, Spark, and web mining techniques for analyzing and managing large-scale data.
2. Apply Hadoop concepts using HDFS and YARN to process large datasets and implement MapReduce techniques for tasks such as searching, sorting, and compression.
3. Apply NoSQL database concepts by using MongoDB and Cassandra to manage data, and CRUD operations for effective data storage and retrieval.
4. Apply Hive and Pig tools on Hadoop to manage and analyze large datasets using related data types, operators, and user-defined functions.
5. Apply Spark for data analysis and utilize web and text mining techniques to analyze web data and usage patterns.

**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, Wajid Khattak, 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. Pig Tutorial :<https://www.kaggle.com/datasets/grouplens/movielens-20m-dataset>
2. Big Data: <https://www.youtube.com/watch?v=bAyrObl7TYE&list=PLEiEAq2VkUUJqp1k-g5W1mo37urJQOdCZ>
3. Hadoop Installation: <https://www.youtube.com/watch?v=VmO0QgPCbZY&list=PL E iEAq2VkUUJqp1k-g5W1mo37urJQOdCZ&index=4>

<b>High Performance Computing</b>			
Semester	<b>VII</b>	CIE Marks	<b>50</b>
Course Code	<b>23CSPE411</b>	SEE Marks	<b>50</b>
Teaching Hrs/ Week (L:T: P)	<b>3:0:0</b>	Exam Hrs	<b>03</b>
Total Hrs	<b>42</b>	Credits	<b>03</b>
<p><b>Course Learning Outcomes:</b> This course is designed to</p> <ol style="list-style-type: none"> <li>1. Impart knowledge on High Performance Computing (HPC) fundamentals, architectures, and the societal impact of supercomputing.</li> <li>2. Familiarize data-level and thread-level parallelism across modern HPC architectures.</li> <li>3. Familiarize cluster computing.</li> <li>4. Facilitate design and implementation of parallel algorithms for scalable HPC applications.</li> </ol>			
<b>Module 1: Introduction</b>			<b>No. of Hrs: 8</b>
<p>High performance Computing System, Impact of HPC on science, Society and security, HPC evolution: Flynn’s Classification, Parallel /Vector Computer. Performance metrics: Clock rate and CPI, Performance factor, system attributes, MIPS rate, Floating point operations per seconds, Throughput rate. Shared-memory Multiprocessors: uniform memory access (UMA), model, nonuniform-memory-access (NUMA) model, cache-only-memory access (COMA) model. Distributed-memory Multiprocessors</p> <p>Text Book 1: 1.1.4, 1.2. Text Book 2: 1.1.3,1.1.4,1.2.1, 1.2.2</p>			
<b>Module 2: Data-Level Parallelism in Vector, SIMD, and GPU Architectures</b>			<b>No. of Hrs: 9</b>
<p>Introduction, Vector Architecture, SIMD Instruction Set Extensions for Multimedia, Graphics Processing Units, Detecting and Enhancing Loop-Level Parallelism.</p> <p>Text Book 3: 4.1 to 4.5</p>			
<b>Module 3: Thread-Level Parallelism</b>			<b>No. of Hrs: 9</b>
<p>Introduction, Centralized Shared-Memory Architectures, Performance of Symmetric Shared-Memory Multiprocessors, Distributed Shared-Memory and Directory-Based Coherence, Synchronization, Models of Memory Consistency.</p> <p><b>Text Book 3: 5.1 to 5.6</b></p>			
<b>Module 4: Cluster Computing for HPC</b>			<b>No. of Hrs: 8</b>
<p>Clustering for Massive Parallelism, Computer Clusters and MPP Architectures, Design Principles of Computer Clusters, Cluster Job and Resource Management.</p> <p>Text Book 4: 2.1(2.1.4 is not included) to 2.4</p>			
<b>Module 5: Parallel Algorithms</b>			<b>No. of Hrs: 8</b>
<p>Parallel algorithms: Introduction, Fork-join, Divide and conquer, Manager-worker, Embarrassingly parallel, Halo exchange, Permutation: Cannon’s Algorithm, Task Dataflow: Breadth first search.</p>			

Text Book 1:9.1,9.2,9.3,9.4,9.5,9.6,9.7,9.8

### Course Outcomes:

At the ends of the course students will be able to

- CO1:** Illustrate HPC architectures, parallelism models, performance monitoring techniques, and fundamental parallel algorithm design concepts.
- CO2:** Apply data-level and thread-level parallelism techniques for vector, SIMD, GPU, and shared-memory architectures.
- CO3:** Apply Cluster Computing for HPC
- CO4:** Apply parallel algorithmic patterns to design scalable and efficient solutions for high-performance computing problems.

### Text Books:

1. Thomas Sterling, Matthew Anderson, Macie Brodowicz, High Performance Computing: Modern Systems and Practices, 1<sup>st</sup> Edition, Morgan Kaufmann publications,2018
2. K. Hwang and F. A. Briggs, Computer Architecture and Parallel Processing. New York, NY, USA: McGraw-Hill, 1985.
3. Patterson, D. A., & Hennessy, J. L. Computer Organization and Design: The Hardware/Software Interface (5th ed.). Morgan Kaufmann, Elsevier, 2014
4. Kai Hwang, Jack Dongarra, Geoffrey C. Fox, Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Morgan Kaufmann(Elsevier),2012.

### Reference Books:

1. Vadim Levchenko, High Performance Computing, 1<sup>st</sup> edition, Excelic Press, USA,2020
2. Georg Hager, Gerhald Wellein, Introduction tp High Performance Computing for Scientists and Engineers, 1<sup>st</sup> edition, CRC press, USA, 2019

<b>Social Networks</b>			
Semester	<b>VII</b>	CIE Marks	<b>50</b>
Course Code	<b>23CSPE412</b>	SEE Marks	<b>50</b>
Teaching Hrs./Week (L: T: P)	<b>3:0:0</b>	Exam Hrs.	<b>03</b>
Total Hrs.	<b>42</b>	Credits	<b>03</b>
<p><b>Course Learning Objectives:</b> This course is designed to</p> <ol style="list-style-type: none"> <li>1. Provide knowledge of semantic web and social networks.</li> <li>2. Familiarize with knowledge representation, modelling and aggregation of social network data.</li> <li>3. Impart knowledge on developing social semantic applications.</li> <li>4. Provide knowledge on privacy in online social networks.</li> <li>5. Provide knowledge on visualization and analytics of social networks.</li> </ol>			
<b>Module 1 Introduction to Semantic Web and Social Networks analysis</b>		<b>No. of Hrs.: 8</b>	
<p><b>Emergence of the Social Web ( web 1.0, web 2.0, web 3.0):</b> Limitations of the Current Web, Semantic Solution, Development of the semantic web.</p> <p><b>Social network analysis:</b> Network analysis, Development of Social Network Analysis, Key Concepts and measures in Network Analysis.</p>			
<b>Text Book 1:1.1 to 1.4, 2.1 to 2.3</b>			
<b>Module 2: Knowledge Representation, Modelling and aggregation of social network data</b>		<b>No. of Hrs.: 9</b>	
<p>Ontologies and their role in the semantic web: ontology-based knowledge representation, ontologies and ontology languages for the semantic web: Resource Description Framework (RDF) and RDF schema, Web Ontology Language (OWL), UML, comparison of OWL &amp; UML.</p> <p>State-of-the-art Techniques in Network Data Representation, Ontological Representation of Social Individuals, Ontological Representation of Social Relationships, Aggregating and reasoning with social network Data.</p>			
<b>Text Book 1: 4.1 to 4.3, 5.1 to 5.4</b>			
<b>Module 3: Developing social-semantic applications</b>		<b>No. of Hrs.: 9</b>	
<p>Building semantic web applications with social network features, Flink: the social networks of the semantic web community, open academia: distributed, semantic-based publication management. Evaluation of web-based social networks: data collection, preparing the data, optimizing goodness of fit, comparison across methods and networks, predicting the goodness of fit, evaluation through analysis, case studies on Facebook.</p>			
<b>Text Book 1: 6.1 to 6.3,7.1 to 7.3</b>			
<b>Module 4: Privacy in Social Networks</b>		<b>No. of Hrs.: 8</b>	
<p>Introduction, Privacy breaches: identity disclosure, social link disclosure, attribute disclosure, affiliation link disclosure, Privacy definitions for publishing data: k -anonymity, l-diversity and t-closeness, Differential privacy, Privacy preserving mechanisms: social</p>			

networks, affiliation networks.	
<b>Text Book 2:chapter 10</b>	
<b>Module 5: Visualization and analytics of Social Networks</b>	<b>No. of Hrs.: 8</b>
Introduction, Taxonomy of Visualization: Structural Visualization, Semantic and Temporal Visualization, Statistical Visualization, Convergence of Visualization, Interaction and Analytics: Structural and Semantic Filtering with Ontologies, Centrality-based Visual Discovery and Exploration	
<b>Text Book 2: 11.1 to 11.3</b>	
<p><b>Course Outcomes:</b></p> <p>At the end of the course the students will be able to</p> <p>CO1: Describe the evolution of semantic web and social network analysis.</p> <p>CO2: Apply ontology-based knowledge representation for semantic web applications.</p> <p>CO3: Apply strategies to evaluate web-based social network extraction.</p> <p>CO4: Identify and mitigate privacy challenges in social networks.</p> <p>CO5: Apply various visualization techniques for social network data.</p>	
<p><b>Textbooks:</b></p> <p>1.Social networks and the semantic web by Peter Mika, Springer,2022</p> <p>2.Social Network Data Analytics by Charu C Aggrawal, springer,2011</p>	
<p><b>Reference Books:</b></p> <p>1. Security and Privacy in Social Networks by Yaniv Altshuler et al, springer</p>	
<p><b>Weblinks:</b></p> <p>Privacy and security in social media: <a href="https://onlinecourses.nptel.ac.in/noc23_cs13">https://onlinecourses.nptel.ac.in/noc23_cs13</a></p>	

<b>Generative AI</b>			
Semester	<b>VII</b>	CIE Marks	<b>50</b>
Course Code	<b>23CSPE413</b>	SEE Marks	<b>50</b>
Teaching Hrs/Week (L: T: P)	<b>3:0:0</b>	Exam Hrs	<b>3</b>
Total Hrs	<b>42</b>	Credits	<b>3</b>
<p><b>Course Learning Outcomes:</b>            This course is designed to</p> <ol style="list-style-type: none"> <li>1. Provide knowledge of generative modeling concepts and applications.</li> <li>2. Provide knowledge of Variational Autoencoders and Generative Adversarial Networks (GANs) for stable, sequence-based data generation.</li> <li>3. Impart knowledge in using Autoregressive and Normalizing Flow models for generating data from learned distributions.</li> <li>4. Impart knowledge of diffusion and world models to create realistic data and simulate environments for learning agents.</li> <li>5. Provide knowledge of transformers-GPT and other models for generating text and training large language models.</li> </ol>			
<b>Module 1 Generative Modeling</b>			<b>No. of Hrs.: 8</b>
<p>Introduction to Generative Modeling, Generative Vs. Discriminative Modeling, Generative Modeling Framework, and Representation Learning.            Characteristics of Generative Models, Advantages, Disadvantages and Challenges in Generative Models, Applications of Generative Models.</p> <p><b>Text Book 1: Chapter 1.</b>  <b>Text Book 2: Chapter 3.3, 4.3</b></p>			
<b>Module 2 Variational Autoencoders and GANs</b>			<b>No. of Hrs.: 9</b>
<p><b>Autoencoders:</b> Autoencoder Architecture, Encoders, Decoders, Joining the Encoders to the Decoder, Reconstructing Images, <b>Variational Autoencoders (VAEs):</b> The Loss Function, and Generating New Images from Latent distributions.  <b>Generative Adversarial Networks (GANs):</b> Introduction of GANs, Deep Convolutional GAN(DCGAN), Wasserstein GAN with Gradient Penalty (WGAN-GP) for stability, and Conditional GAN(CGAN).</p> <p><b>Text Book 1: Chapter 3, 4.</b></p>			
<b>Module 3 Large Language Models</b>			<b>No. of Hrs: 8</b>
<p><b>Evolution of Language Models:</b> Statistical Language Models (SLM), Neural Language Models (NLM), Pre-trained Language Models (PLM), Large Language Models (LLM), <b>LLMs:</b> Key Techniques for LLMs, Types of LLMs, Tasks of LLMs, LLM Frameworks, LLMs Applications, and Challenges in LLMs.</p> <p><b>Text Book-2: 5.2, 5.4, 5.5.</b></p>			
<b>Module 4 Diffusion Models</b>			<b>No. of Hrs: 9</b>

**Diffusion Models:** Introduction, Denoising Diffusion Models (DDM): The Flowers Dataset, The Forward Diffusion Process, The Reparameterization Trick, Diffusion Schedules, The Reverse Diffusion Process, The U-Net Denoising Model, Training the Diffusion Model, Training the Diffusion Model, Sampling from the Denoising Diffusion Model, Analysis of the Diffusion Model.

**Text Book-1: Chapter 8.**

Module 5	Applications	No. of Hrs: 8
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**Transformers:** GPT (Generative Pre-trained Transformer): Attention mechanisms, Queries, Keys and Values, Multihead Attention, Causal Masking, The Transformer Block, Positional Encoding, Training and Analysis of GPT.

**Advanced GANs – ProGAN, StyleGAN, Other Important GANs:** Self-Attention GAN, BigGAN, VQ-GAN, ViT VQ-GAN.

**Text Book-1: Chapter 9, 10**

**Course Outcomes:**

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

**CO1:** Describe the mechanisms through which generative models produce new data, examine their advantages and limitations, and summarize the principles for their responsible use.

**CO2:** Apply Autoencoders, Variational Autoencoders (VAEs), and Generative Adversarial Network (GAN) architectures to design models for image reconstruction and image generation.

**CO3:** Describe the fundamentals of Large Language Models (LLMs) and outline the key techniques used in their development and application.

**CO4:** Apply GANs and diffusion models for creating new and realistic data.

**CO5:** Apply Transformer models, advanced GANs, and world models to solve structured problems in intelligent systems.

**Textbooks:**

1. Generative Deep Learning Teaching Machines to Paint, Write, Compose, and Play – David Foster – 2<sup>nd</sup> Edition.
2. Rajan Gupta, Sanju Tiwari, Poonam Chaudhary by Generative AI: Techniques, Models and Applications (Springer, 2025)

**Reference Books:**

1. Deep Learning by Ian Goodfellow, Yoshua Bengio, and Aaron Courville.
2. Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow by Aurelien Geron
3. Hands-On Large Language Models: Language Understanding and Genera

**Web links:**

1. Generative AI: <https://www.youtube.com/watch?v=Pq8lW5y8JpA>

<b>IoT for Automation</b>			
Semester	<b>VII</b>	CIE Marks	<b>50</b>
Course Code	<b>23CSOE411</b>	SEE Marks	<b>50</b>
Teaching Hrs/Week (L:T: P)	<b>3:0:0</b>	Exam Hrs	<b>3</b>
Total Hrs	<b>42</b>	Credits	<b>3</b>
<p><b>Course Learning Objectives:</b> This course is designed to</p> <ol style="list-style-type: none"> <li>1. Provide knowledge on the evolution of industrial automation, from traditional control systems to modern IoT-enabled Systems.</li> <li>2. Impart knowledge on Local Automation Clouds, including their properties, establishment and applications.</li> <li>3. Impart knowledge on IoT application automation systems to address industrial and societal challenges.</li> </ol>			
<b>Module 1: Local Automation Clouds</b>		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><b>The Arrow Head Framework architecture:</b> Important definitions, Documentation structure, The mandatory core systems, Automation support core systems.</p> <p><b>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)</b></p>			
<b>Module 2: Arrowhead Framework core systems and services</b>		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><b>Text Book :Chapter 4.2.1, 4.2.2, 4.2.3, 4.3.1, 4.3.2, 4.3.3</b></p>			
<b>Module 3: Engineering of IoT Automation Systems</b>		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><b>Text Book :Chapter 6.1, 6.3, 6.4, 6.5.2, 6.5.3, 6.5.4</b></p>			
<b>Module 4: Application System Design Energy Optimization</b>		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><b>Text Book :Chapter 7</b></p>			
<b>Module 5: Complex Systems Management, Automation and Security</b>		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><b>Text Book :Chapter 9.4, 9.5, 9.6, 9.7, 9.8; Chapter 10.2, 10.3, 10.5</b></p>			
<b>Course Outcomes:</b> At the end of the course, the student will be able to			

- CO1.** Describe the concept, architecture, and properties of Local Automation Clouds, including latency, security, scalability, and the Arrowhead Framework for industrial automation.
- CO2.** Apply Arrowhead core systems to enable service discovery, orchestration, authorization, and inter-cloud communication in IoT automation systems.
- CO3.** Describe the component-based engineering methodologies used to design, deploy, and configure safe and secure IoT automation systems for large-scale and dynamic environments.
- CO4.** Describe energy-optimized application systems, including virtual energy markets and context-aware automation solutions.
- CO5.** 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. <https://www.youtube.com/watch?v=HmbUJEShA-8>
2. <https://www.youtube.com/watch?v=eidD14dXW8s>
3. [https://www.udemy.com/course/iot-internet-of-things-automation-withesp8266/?srsltid=AfmBOoqqKDLk\\_fKye1CPIO9QjctFfgHOf1F\\_Zkmtze8uNRUvmq\\_9s1-3](https://www.udemy.com/course/iot-internet-of-things-automation-withesp8266/?srsltid=AfmBOoqqKDLk_fKye1CPIO9QjctFfgHOf1F_Zkmtze8uNRUvmq_9s1-3)
4. [https://onlinecourses.nptel.ac.in/noc20\\_cs69/preview](https://onlinecourses.nptel.ac.in/noc20_cs69/preview)

<b>Data Visualization &amp; Analytics</b>			
Semester	<b>VII</b>	CIE Marks	<b>50</b>
Course Code	<b>23CSOE412</b>	SEE Marks	<b>50</b>
Teaching Hrs/Week (L:T: P)	<b>3:0:0</b>	Exam Hrs	<b>3</b>
Total Hrs	<b>42</b>	Credits	<b>3</b>
<p><b>Course Learning Objectives:</b> This course is designed to</p> <ol style="list-style-type: none"> <li><b>Impart</b> knowledge on exploratory versus explanatory analysis, focusing on the need of effective storytelling for targeted audience.</li> <li><b>Familiarize</b> various approaches of Aesthetics in data visualization for enhancing the interpretability of data</li> <li><b>Provide</b> knowledge on various plots &amp; graph approaches for visualizing the data proportion, distribution &amp; trends in data for better interpretation.</li> <li><b>Provide</b> insights on data visualization approaches for effective interpretation of geospatial &amp; probabilistic data.</li> </ol>			
<b>Module 1: Introduction</b>		<b>No. of Hrs: 09</b>	
<p><b>Importance of context :</b> Exploratory vs. explanatory analysis, Defining : Who - Identifying Audience, What- Audience Expectation, How - Presenting mechanism, The 3-Mintue Story, Big Idea, Storyboarding            Handling Clutter : Cognitive Load, Clutter, Gestalt Principles :Proximity, Similarity, Enclosure, Closure, Contineuty, Connection, Lack of Visual Order : Alignment, White Spaces, Decluttring Example  <b>Text Book 1: Chapter 1, 3</b></p>			
<b>Module 2 : Aesthetics in Data Visualization</b>		<b>No. of Hrs: 08</b>	
<p>Introduction, <b>Visualizing Data:</b> Aesthetics and Types of Data, Scales Map Data Values onto Aesthetics, <b>Coordinate Systems and Axes:</b> Cartesian Coordinates, Nonlinear Axes, Coordinate Systems with Curved Axes, <b>Color Scales:</b> Color as a Tool to Distinguish, Color to Represent Data Values, Color as a Tool to Highlight, <b>plots and charts :</b> Bar Graph, Grouped &amp; Stacked Bar Graph, Heatmap  <b>Text Book 2:</b> Chapter 1,2,3,4,6</p>			
<b>Module 3 : Visualizing Distributions</b>		<b>No. of Hrs: 09</b>	
<p><b>Visualizing Distributions:</b> Single Distribution, Multiple Distrubution, <b>Cumulative Distribution Functions:</b> Empirical Cumulative Distribution Functions, Highly Skewed Distribution, Quantile-Quantile Plots, <b>Visualizing Many Distributions:</b> boxplots, violin plots, Strip Charts, sina plots, ridgeline plot, <b>Visualizing Proportions:</b> Pie Chart, side-by-side bars, Stacked Bars, Stacked Densities, Relative Proportions  <b>Text Book 2:</b> Chapter 7,8,9,10</p>			
<b>Module 4 : Visualizing Proportions &amp; Trends</b>		<b>No. of Hrs: 08</b>	

**Visualizing Nested Proportions:** Nested Proportions Issues, Mosaic Plots, Treemaps, Nested Pies, Parallel Sets, **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, Detrending 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

1. Explain the concepts of exploratory and explanatory analysis & discuss the need of storytelling for targeted guidance
2. 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:**

1. Cole Nussbaumer Knaflic, “Storytelling with Data: A Data Visualization Guide for Business Professionals” Wiley Publisher, 2015
2. Claus O. Wilke, “Fundamentals of Data Visualization”, O’Reilly Media, 2019

**Reference Books:**

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 link**

1. Storytelling based on Data:  
<https://www.youtube.com/channel/UCjhGILWNlOxJdR2NTCBMIA>
2. Data to visualization various graphs : <https://www.data-to-viz.com/>

<b>Software Testing</b>			
Semester	<b>VII</b>	CIE Marks	<b>50</b>
Course Code	<b>23CSOE413</b>	SEE Marks	<b>50</b>
Teaching Hrs/Week (L:T: P)	<b>3:0:0</b>	Exam Hrs	<b>03</b>
Total Hrs	<b>42</b>	Credits	<b>03</b>
<p><b>Course Learning Objectives:</b> This course is designed to</p> <ol style="list-style-type: none"> <li>1. Impart knowledge on basics of software testing.</li> <li>2. Impart knowledge on different types of software testing.</li> <li>3. Provide knowledge on building test cases for a given application.</li> <li>4. Provide knowledge on effective test planning.</li> <li>5. Impart knowledge on automated testing process and Selenium tool.</li> </ol>			
<b>Module 1: Basics of Software Testing</b>		<b>No. of Hrs: 8</b>	
<p>Introduction to software testing, Approaches to testing, Principles of Testing, Salient Features of good testing, Test Policy &amp; Planning, Challenges in testing, Cost Aspect of testing, Testing Process.</p> <p><b>Textbook 1: Ch3 (3.3, 3.4, 3.12, 3.13, 3.14, 3.16, 3.20, 3.23, 3.31)</b></p>			
<b>Module 2: Functional and Non-Functional Testing</b>		<b>No. of Hrs: 9</b>	
<p>Boundary value analysis, Test cases for the Triangle problem, Equivalence class testing, Equivalence class test cases for the Triangle problem, Security testing, Performance testing, Recovery testing, Installation testing.</p> <p><b>Textbook 2: Ch5 (5.1, 5.2) Ch6 (6.1, 6.2) Textbook 1: Ch11 (11.5, 11.6, 11.7, 11.8)</b></p>			
<b>Module 3: Structural Testing</b>		<b>No. of Hrs: 9</b>	
<p>Program Graphs, DD paths, Basis path testing, Guidelines and observations, Definition-Use testing, Slice based testing, Program slicing tools.</p> <p><b>Textbook 2: Ch8 (8.1, 8.2, 8.4, 8.5) Ch9 (9.1, 9.2, 9.3)</b></p>			
<b>Module 4: Test planning and Test cases</b>		<b>No. of Hrs: 8</b>	
<p>Content of test policy, Content of test strategy, Test plan, Test plan template, Building test data and test cases, Test scenario, test cases, Template for test cases, Test management software.</p> <p><b>Textbook 1: Ch14 (14.3, 14.5, 14.6, 14.7, 14.10, 14.15, 14.16, 14.17, 14.19, 14.21)</b></p>			
<b>Module 5: Selenium - Testing tool</b>		<b>No. of Hrs: 8</b>	
<p>Test Automation, Test Automation environment, Getting Started with Selenium IDE, Installing Selenium-IDE, Recording a script with IDE, Save the test case, Create Selenium Test Suite, Format of Selenium Test, Selenium Test Case writing in HTML, Applying CSS to Selenium Test Cases.</p> <p><b>Textbook 3: Ch1, Ch2, Ch6, Ch9</b></p>			

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

1. Describe the basic concepts of software testing.
2. Articulate various types of software testing techniques, their advantages, disadvantages and significance of testing in software development process.
3. Write effective test cases for the given software systems.
4. Develop elaborate testing plans for the hypothetical project.
5. Test software systems using Selenium and create testing reports.

**Textbooks:**

1. M G Limaye, “Software Testing Principles, Techniques and Tools”, Tata McGraw Hill, 2012.
2. Paul C. Jorgensen, “Software Testing, A Craftsman’s Approach”, 4<sup>th</sup> Edition, Auerbach Publications, 2014.
3. Ashish Mishra and Aditya Garg, “A Practitioner’s Guide to Test Automation using Selenium”, Tata McGraw Hill, 2012.

**Reference Books:**

1. Elfriede Dustin, “Effective Software Testing” Pearson Education, 2007.
2. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008.
3. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" – Second Edition 2018.

**Activities/Assignments:**

1. Develop a Mini Project with documentation of suitable test-cases and their results to perform automation testing of any E-commerce or social media web page using Selenium.

**Web links:**

1. Software Testing Course, IIT, Kharagpur  
<https://nptel.ac.in/courses/106/105/106105150/>
2. Software Testing Course, NPTEL [https://onlinecourses.nptel.ac.in/noc19\\_cs71/preview](https://onlinecourses.nptel.ac.in/noc19_cs71/preview)
3. Software Testing Course, IIT, Madras  
<https://www.youtube.com/watch?v=OGImfxO2TEU&t=10s>
4. Lecture series on Software Testing <https://www.youtube.com/watch?v=Q50ZyydS7pI>

<b>PROJECT PHASE – II</b>			
Semester	VII	CIE Marks	100
Course Code	23CSSE409	SEE Marks	100
Hours/Week (L: T: P)	0:0:12	Exam Hrs	03
Total Hrs	-	Credits	06
<b>Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To enable students to execute, validate, and communicate the engineering solution to the identified problem conceptualized in Project Phase – I</li> <li>2. To motivate students to extend their project work toward research publications, patent filing, funding proposals, or technology transfer, where applicable.</li> </ol>			

**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:

<b>Review - 1</b>	
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
<b>Total</b>	<b>40 Marks</b>

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

<b>Presentation</b>	
Presentation	20 Marks
Team work	10 Marks
Total	<b>30 Marks</b>

<b>Grand Total</b>	<b>100 Marks</b>
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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:

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

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

- CO1.** Execute the problem identified using the methodology proposed through systematic design, development, experimentation, and/or simulation, leading to a functional solution or validated outcome.
- CO2.** Translate theoretical concepts into practical implementation while considering constraints such as feasibility, cost, sustainability, safety, ethics, and societal relevance.
- CO3.** Exhibit the resourcefulness to act independently as well as collaboratively within a team in overcoming technical challenges encountered during project execution.
- CO4.** Plan tasks effectively, manage time and resources, meet defined milestones, and adhere to deadlines, reflecting professional engineering practice.
- CO5.** Prepare a comprehensive project report that clearly documents design decisions, implementation details, experimental results, analysis, and conclusions using standard technical writing practices.
- CO6.** Confidently present the project work through reviews, demonstrations, seminars, and viva-voce examinations, addressing questions from peers, faculty, and examiners.

<b>Constitution of India and Professional Ethics</b>			
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
<b>Course Learning Objectives:</b>			
This course is designed to			
<ol style="list-style-type: none"> <li>1. Introduce the foundational principles and features of the Indian Constitution</li> <li>2. Familiarize the Fundamental Rights and Directive Principles.</li> <li>3. Provide an understanding of Union and State government policies and Electoral Process.</li> <li>4. Develop awareness on Sustainable development goals, energy conservation and climate change</li> <li>5. Inculcate Ethical responsibilities and Code of Conduct.</li> </ol>			
<b>Module 1: Introduction to the Indian Constitution</b>			<b>No. of Hrs:2</b>
Definition and Significance of the Constitution, Making of the Constitution, Constituent Assembly, Preamble, Salient features of the Indian Constitution, Amendments, Schedules and Citizenship.			
<b>Module 2: Fundamental Rights and Duties</b>			<b>No. of Hrs:4</b>
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.			
<b>Module 3: Union and State Government Structure</b>			<b>No. of Hrs:3</b>
<b>Union Govt: Union Legislature-</b> Parliament-Lok Sabha and Rajya Sabha, Sessions of Parliament, Parliamentary System, Parliamentary Committees, Important Parliamentary Terminologies.			
<b>Union Executive</b> – President, Prime Minister, Union Cabinet, Union Council of Ministers.			
<b>Union Judiciary</b> -Supreme Court of India, Judicial Review and Judicial Activism.			
<b>State Govt: State Legislature-</b> State Legislative Assembly, State Legislative council,			
<b>State Executive-</b> Governor, Chief Minister, State Cabinet, State Council of Ministers,			
<b>State Judiciary-</b> High Court and Subordinate Courts.			
<b>Elections:</b> Election Commission of India, Process and Laws. <b>Emergency Provisions</b>			
<b>Module 4: Ethics and Sustainable Development</b>			<b>No. of Hrs:2</b>
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.			
<b>Module 5: Professional Ethics for Engineers</b>			<b>No. of Hrs:2</b>

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:

**CO1: State** the preamble and the basic features of the Indian Constitution.

**CO2: Explain** the Fundamental Rights, Directive Principles of State Policy and their relevance in contemporary Indian society.

**CO3: Compare** the functioning of the Union and State legislature, Executive and Judiciary

**CO4: Classify** Ethical, Virtues and explain sustainable development goals and climate change.

**CO5: 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.

### Weblinks:

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=qAlolKgDPrA>

INTERNSHIP			
Semester	VIII	CIE Marks	100
Course Code	23CSSE431	SEE Marks	100
Hours/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:

- i. **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.
- ii. **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.
- iii. **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.

- iv. **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.

- 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:**

- SEE for Internship will be conducted by two examiners (one internal examiner and the other an external examiner) appointed by the Controller of Examinations.
- Students must present their Internship work to the examiners.
- 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:**

- Internship Daily Report
- Final Internship Report
- Internship Completion Certificate

**Evaluation for CIE:**

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

<b>Review – 1 &amp; 2 (Internal Internship Evaluation Committee)</b>	
Internship Daily Report	10 Marks
Deliverables and Outcomes	10 Marks
Presentation Skills	05 Marks
<b>Review – 1 Total</b>	<b>25 Marks</b>
<b>Review – 2 Total</b>	<b>25 Marks</b>
<b>Review – 1 &amp; 2 (External Internship Evaluation Committee)</b>	
Technical Knowledge	10 Marks

Work Ethic	05 Marks
Deliverables and Outcomes	05 Marks
Ability to Learn, Adapt & Critical Thinking	05 Marks
<b>Review – 1 Total</b>	<b>25 Marks</b>
<b>Review – 2 Total</b>	<b>25 Marks</b>
<b>Grand Total</b>	<b>100 Marks</b>

### Evaluation for SEE:

Total of 100 SEE marks is distributed as follows:

<b>SEE (Internal &amp; External Examiners)</b>	
Internship Report	70 Marks
Final Presentation	30 Marks
<b>Grand Total</b>	<b>100 Marks</b>

### 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.

<b>PUBLICATION / PATENTING</b>			
Semester	VIII	CIE Marks	100
Course Code	23CSSE432	SEE Marks	-
Hours/Week (L: T: P)	-	Exam Hrs.	-
Total Hrs.	-	Credit	02

**Objectives: This course is designed to**

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:**

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:
  - a. Accurately representing experimental results
  - b. Providing evidence for validated outcomes / effective performance
  - c. Explicit mention of novelty / innovation
3. The evaluation shall be carried out based on the following three major components:
 

Component 1: Literature Review & Manuscript / Patent Drafting

  - a. Comprehensive literature survey and identification of research gap
  - b. Structuring of research paper / patent document
  - c. Technical depth, methodology, and clarity of presentation
  - d. Patentability analysis (in case of patent track)

Component 2: Submission / Filing

- a. Submission of manuscript to a reputed Scopus / SCI / WoS indexed journal
- OR
- Filing of a patent application with appropriate authority
- b. Submission proof (acknowledgement / application number) is mandatory

Component 3: Publication / Patent Outcome

- Publication of article in Scopus / SCI / WoS indexed journal
- OR
- Publication of patent

4. Marks shall be awarded proportionately based on:
  - a. Paper publication status (accepted / published)

b. Patent filing / publication status

5. 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:
  - a. Conversion of project work into quality manuscript / patent
  - b. Quality of manuscript / patent drafting
  - c. Readiness for submission / publication
8. The HOD shall constitute publication/patenting 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. Coordinator shall be member - Convener
  - c. 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)

**Deliverables:**

1. Literature Review Report / Patentability Report
  - a. Representation of problem identification
  - b. Representation of gap analysis
  - c. Survey of recent literature / prior art
2. Manuscript / Patent Draft  
Structured manuscript (Abstract, Introduction, Methodology, Results, References)  
OR  
Patent Draft (Title, Abstract, Claims, Description, Drawings)
3. Submission Proof  
Journal submission acknowledgement / Patent filing receipt
4. 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
2.	a. Submission & Acceptance of manuscript (Scopus / SCI / WoS) OR b. Filing a Patent Application	30
3.	a. Publication of Article (Scopus / SCI / WoS) OR b. Publication of Patent	20
	<b>Total</b>	<b>100</b>

**Course Outcomes:**

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

- CO1.** Systematically document 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.