

AUTONOMOUS

SYLLABUS

VII & VIII Semesters

B.E in CS&E(Artificial Intelligence and
Machine Learning)

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, Theoretical and Pragmatic; ALL at the same time**”*

Department Vision

“To create well groomed, technically competent and skilled professionals who can become part of industry and undertake quality research at global level to meet societal needs.”

Department Mission

- *Provide state of art infrastructure, tools and facilities to make students competent and achieve excellence in education and research.*
- *Provide a strong theoretical and practical knowledge across the CS&E(AI&ML) discipline with an emphasis on AI based research and software development.*
- *Inculcate strong ethical values, professional behavior and leadership abilities through various curricular, co-curricular training and development activities*

Program Educational Objectives (PEOs)

After successful completion of the program, the graduates will be

- *Graduates will follow logical, practical and research-oriented approach for solving the real world problems by providing AI based solutions.*
- *Graduates will work independently as well as in multidisciplinary teams at workplace.*
- *Graduates will setup start-up and become successful entrepreneurs.*

Program Specific Outcomes (PSOs)

At the end of the program, CS&E (AI&ML) graduates will be

- *Train machine learning models to address real life challenging problems using acquired AI knowledge.*
- *Develop applications using ML techniques related to the field of medical, agriculture, defence, education and various scientific explorations.*



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LIST OF COURSES

VII/VIII Semester Courses			
Sl. No.	Course Code	Course Title	Sem
PROFESSIONAL CORE COURSES			
1	23CIPC401	Large Language Modeling	VII
2	23CIPC402	Deep Learning	VII
PROFESSIONAL ELECTIVE COURSES			
3	23CIPE411	Cloud Computing	VII
4	23CIPE412	Nature Inspired Computing	VII
5	23CIPE413	Computer Vision	VII
6	23CIPE42X	MOOC's (NPTEL/SWAYAM)	VIII
OPEN ELECTIVE COURSES			
7	23CIOE411	IoT for Automation	VII
8	23CIOE412	Data Visualization and Analytics	VII
9	23CIOE413	Software Testing	VII
SKILL ENHANCEMENT COURSES			
10	23CISE409	Project Phase -II	VII
11	23CISE431	Internship	VIII
12	23CISE432	Publication / Patenting	VIII
HUMANITIES & SOCIAL SCIENCE COURSE			
13	23HMCC421	Constitution of India & Professional Ethics	VII



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VII Semester (2023 Scheme): Computer Science & Engineering (Artificial Intelligence & Machine Learning)

Sl. No	Course Code	Course Title	Category	Teaching Dept.	Teaching Hours /Week			Examination Marks			Duration of Exam in Hrs	Credits
					L	T	P	CIE	SEE	Total		
1	23CIPC401	Large Language Model	Professional Core Course	CS&E(AIML)	3	0	2	50	50	100	3	4
2	23CIPC402	Deep Learning	Professional Core Course	CS&E(AIML)	3	0	2	50	50	100	3	4
3	23CIPE41X	Professional Elective –III*	Discipline Specific Electives	CS&E(AIML)	3	0	0	50	50	100	3	3
4	23CIOE41X	Open Elective – III**	Discipline Specific Electives	CS&E(AIML)	3	0	0	50	50	100	3	3
5	23CISE409	Project Phase-II	Skill Enhancement	CS&E(AIML)	-	-	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 Credits											21	

*Professional Elective Course –III :

Sl. No.	Course Code	Course Title
1	23CIPE411	Cloud Computing
2	23CIPE412	Nature Inspired Computing
3	23CIPE413	Computer Vision

Sl. No.	Course Code	Course Title
1	23CIOE411	IoT for Automation
2	23CIOE412	Data Visualization & Analytics
3	23CIOE413	Software Testing



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VIII Semester (2023 Scheme): Computer Science & Engineering (Artificial Intelligence & Machine Learning)

Sl. No	Course Code	Course Title	Category	Teaching Dept.	Teaching Hours /Week			Examination Marks			Duration of Exam in Hrs	Credits
					L	T	P	CIE	SEE	Total		
1	23CISE42X	MOOCs* (NPTEL/SWAYAM) 8/12 WEEKS	Professional Elective	CS&E(AIML)	-	-	-	-	-	100	-	2
2	23CISE431	Internship	Skill Enhancement	CS&E(AIML)	-			100	100	200	3	12
3	23SECC432	Publication / Patenting	Skill Enhancement	CS&E(AIML)	-	-	-	100	-	100	-	2
Total Credits											16	

Massive Open Online Courses*

Sl. No.	Course Code	Course Title
1	23CIPE421	Edge Computing
2	23CIPE422	Introduction to Soft Computing
3	23CIPE423	Wireless Ad Hoc Networks

Offered during AY 2025-26 (Even Semester)

**Evaluated either by the MOOC platform or by 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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VII Semester & VIII Semester

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3.	23CIPE411	Cloud Computing	7
4.	23CIPE412	Nature Inspired Computing	9
5.	23CIPE413	Computer Vision	11
6.	23CIOE411	IoT for Automation	13
7.	23CIOE412	Data Visualization and Analytics	15
8.	23CIOE413	Software Testing	17
9.	23CISE409	Project Phase –II	19
10.	23HMCC421	Constitution of India & Professional Ethics	22
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Large Language Modeling			
Semester	VII	CIE Marks	50
Course Code	23CIPC401	SEE Marks	50
Teaching Hrs/Week (L:T:P)	3:0:2	Exam Hrs	03
Total Hrs	40 + 24	Credits	04
<p>Course Learning Objectives: This course is designed to</p> <ol style="list-style-type: none"> Provide knowledge on basic concepts of Large Language Models (LLMs). Impart knowledge on token embeddings and cluster modeling techniques for text classification. Familiarize with the concepts of prompt engineering, RAG and multimodal AI techniques for LLM applications. 			
Module 1: An Introduction to Large Language Models			No. of Hrs: 08+4
<p>Language AI, Language Representation: Bag-of-Words, Dense Vector Embeddings, Types of Embedding, Encoding and Decoding Context with Attention, Self-attention, Representational : Encoder-Only Model, Decoder-Only Models, LLM Training Paradigm and its Applications, Societal and Ethical Consideration.</p> <p>Token & Embeddings: Introduction, LLM Tokenization, Token to LLM, Word Versus Subword Versus Character Versus Byte Tokens, BPE, Tokenizer Properties</p> <p>Lab Components:</p> <p>1. Implement different tokenization techniques for a given text dataset. Compare word, subword, character, and byte tokenization methods and analyze the number of tokens generated by each method.</p> <p>Text Book 1 – Chapter 1(Page No: 3 to 28) Chapter 2 :(Pages:37 to 54)</p>			
Module 2: Embeddings and Transformer Fundamentals			No. of Hrs: 08+6



Token Embedding, Word Embeddings, Embeddings for Recommendation Systems.
 Overview of Transformer Models: I/O of a Trained Transformer LLM, The Components of the Forward Pass, Sampling/Decoding, Parallel Token Processing, Inside the Transformer Block ,
 Improvements to the Transformer Architecture: Efficient Attention in Transformers, Positional Embeddings.

Lab Components:

1. Implement Bag-of-Words and dense vector embedding techniques for a given text corpus. Compare the representations.
2. Develop a recommendation system using embedding-based features. Convert users and items into embeddings, compute similarity, and generate top-k personalized recommendations. Evaluate using precision, recall or MAP.
3. Implement a simple self-attention mechanism using the Hugging Face Transformers library to demonstrate how a transformer model captures contextual relationships between words in a sentence.

Text Book 1 – Chapter 2(Pages:57 to 70), Chapter 3(Pages:73 to 105)

Module 3: Text Analysis Techniques	No. of Hrs: 8+6
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Text Classification: Representation Models, Model Selection, Task-Specific Model, Embedding-Based Classification, Generative Models, Text Clustering Pipeline: Embedding Documents, Embedding Dimensionality Reduction, Clustering Reduced Embeddings, Cluster Inspection, Topic Modeling: BERTopic, Special Block Addition, Text Generation Lego Block.

Lab Component:

1. Considering suitable example corpus, Develop a text classification system by converting documents into embedding vectors and analyze the performance.
2. Considering suitable example, Implement a text clustering pipeline by converting documents into embedding vectors, reducing the dimensionality.

Text Book 1 – Chapter:4(Pages :111 to 134), Chapter 5:(Pages 137 to 163)

Module 4: Prompt Engineering and LLM Application Frameworks	No. of Hrs: 8+4
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Prompt Engineering Basics, Advanced Prompt Engineering Concepts, Generative Model Reasoning, Output Verification, Quantized Models with Langchain, LangChain Chains: Single and Multiple prompts chains, LLM Memory, LLM Agents.

Lab Component:

1. Design and test different prompt engineering techniques such as zero-shot, few-shot, and chain-of-thought prompting with suitable example and compare the responses.

Text Book 1 – Chapters:6 (Pages:167 to 197), Chapter 7(Pages:199 to 223)

Module 5: Retrieval-Augmented Generation (RAG) and Multimodal Extensions

**No. of Hrs:
08+4**

Overview of Semantic Search and RAG, Semantic Search with Language Models: Dense Retrievals, Reranking, Retrieval Evaluation Metrics, Retrieval augmented Search(RAG) Basics, Grounded Generation with LLMs, Knowledge Base Integration in RAG Systems, Evaluation of RAG Systems, Multimodal Concepts: Embedding Models, Multimodal Text Generation

Lab Components:

1. Develop a simple Retrieval-Augmented Generation (RAG) system that retrieves relevant documents from a knowledge base and generates context-aware responses.

Text Book 1 – Chapters:8 (Pages:225 to 257), Chapter 9:(Pages :259 to 285)

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

1. Explain the fundamental concepts of tokenization, embeddings, transformers and attention mechanisms in Large Language Models,
2. Illustrate the concepts of tokenization, embeddings, transformers and attention mechanisms in LLM
3. Describe effective prompt-design strategies and LangChain techniques to build text-based GPT applications.
4. Apply prompt-engineering and LangChain techniques with memory and agent-based reasoning to build a basic text-based GPT .
5. Explain retrieval-augmented and multimodal generation methods to enhance the performance of language models

Textbook:

1. Alammr, J. and Grootendorst, M., 2024. *Hands-On Large Language Models: Language Understanding and Generation*. O’Reilly Media.

Reference Books:

1. Raieli, S. and Iuculano, G., 2025. *Building AI Agents with LLMs, RAG, and Knowledge Graphs*. Packt Publishing
2. Bommasani, R., et al., 2023. *Foundations and Trends in Large Language Models*. MIT Press.

Web links:

1. https://www.youtube.com/watch?v=zBj4eWZFBzs&utm_source=chatgpt.com



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Deep Learning			
Semester	VII	CIE Marks	50
Course Code	23CIPC402	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. Familiarize with the conceptual and mathematical foundations of linear neural networks, multilayer perceptrons, and deep neural network models. 2. Impart the knowledge and skills required to design and implement modern deep learning architectures. 3. Provide practical exposure to applying deep learning techniques in advanced computer vision tasks such as image classification, object detection, and semantic segmentation. 4. Impart knowledge on building, training, and evaluating deep learning and generative models using appropriate optimization techniques. 			
Module 1: Linear & MultiLayer Neural Networks			No. of Hrs: 8+6
<p>Linear Neural Network : Softmax Regression based classification, Classification Dataset, Implementation of Softmax Regression from Scratch, Implementation of Softmax Regression using High Level APIs, Multilayer Neural Network: Implementation of Multilayer Perceptrons from Scratch, Implementation of Multilayer Perceptrons using High Level APIs, Weight Decay, Dropout, Numerical Stability and Initialization, Environment and distribution shift.</p> <p>Lab Experiments :</p> <ol style="list-style-type: none"> 1. Implement Linear Neural Network based Classification using softmax regression for any example dataset and Analyze the performance of the model by adjusting various hyperparameters. 2. Implement Multilayer Neural Network based Classification using softmax regression for any example dataset and Analyze the performance of the model by adjusting various hyperparameters. <p>Text Book 1: Chapter 2.1,2.3, 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.4.5, 3.4.7, 3.5, 3.6, 3.7, 4.2, 4.3, 4.5, 4.6, 4.8, 4.9.</p>			
Module 2: Modern Convolution Neural Network Architectures			No. of Hrs: 8+4

<p>Deep Learning Computation : Layers and Block, Parameter Management, Deferred Initialization, Custom Layers, File I/O, GPU, Deep Convolutional Neural Networks : Alex Net, Networks Using Blocks(VGG), Network in Network (NiN), Networks with Parallel Concatenations (GoogLeNet), Batch Normalization, Residual Networks (ResNet), Densely Connected Networks (DenseNet).</p> <p>Lab Experiments :</p> <ol style="list-style-type: none"> 1. Comparative Analysis of AlexNet, VGG, and GoogLeNet Architectures for Image Classification. 2. Comparative Analysis of ResNet and DenseNet Architectures for Image Classification. <p>Text Book 1: Chapter 5.1 to 5.6, 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7.</p>	
Module 3: Recurrent Neural Networks	No. of Hrs: 8+4
<p>Sequence Models, Recurrent Neural Networks, Gated Recurrent Units (GRU), Long Short-Term Memory (LSTM), Deep Recurrent neural networks, Bidirectional Recurrent neural networks, Encoder-Decoder Architecture, Sequence to Sequence, Attention, Sequence to Sequence Attention</p> <p>Lab Experiments :</p> <ol style="list-style-type: none"> 1. Implement and compare RNN, LSTM, and GRU models for a sequence learning task, and analyze their training and inference computational cost. <p>Text Book 1: Chapter 8.1, 8.4, 9.1, 9.2, 9.3, 9.4, 9.6, 9.7, 10.1, 10.2</p>	
Module 4 : Optimization Algorithms & GAN	No. of Hrs: 8+4
<p>Optimization Algorithms : Optimization in Deep Learning, Momentum, Adagrad, RMStop, Adadelata, Adam, Generative Adversarial Networks : Overview, Deep Convolutional Generative Adversarial Networks.</p> <p>Lab Experiments :</p> <ol style="list-style-type: none"> 1. Implement Adagrad, RMSProp, and Adadelata optimization algorithms on a neural network model and analyze their convergence behavior during training. 2. Implement Generative Adversarial Networks (GANs) for example dataset and Analyze the performance of the model using hyperparameter adjustments. <p>Text Book 1: Chapter 11.1, 11.6 to 11.10, 17.1, 17.2</p>	
Module 5: Deep Learning Models for Computer Vision	No. of Hrs: 8+6

Image Augmentation, Fine-Tuning, Object Detection and Bounding Boxes, Anchor Boxes, Multiscale Object Detection, The Object Detection Dataset, Single Shot Multi box Detection (SSD), Region-based CNNs(R-CNNs), Semantic Segmentation, Dataset, Transposed Convolution, FCN for Semantic Segmentation, Neural Style Transfer.

Lab Experiments :

1. Implement Object Detection for example dataset using SSD & Analyze the performance of the model using hyperparameter adjustments.
2. Implement Semantic Segmentation for example dataset using FCN and Analyze the performance of the model using hyperparameter adjustments.

Text Book 1: Chapter 13.1 to 13.12

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

1. **Illustrate** the fundamental concepts and architectures of linear, multilayer, convolutional, and used in deep learning.
2. **Describe** the learning paradigms of sequence models, recurrent neural networks and generative models for representation learning and performance optimization.
3. **Explain** deep learning architectures for advanced computer vision tasks including image classification, object detection, and semantic segmentation.
4. **Apply** linear, multilayer, deep convolution architecture and sequence-based recurrent neural network models using effective optimization techniques for real-world applications.
5. **Apply** various deep learning techniques for object detection, semantic segmentation & style transfer based compute vision applications.

Textbooks:

1. Aston Zhang, Zachary C. Lipton, Mu Li and Alexander J.Smola “Dive Into Deep Learning”, 2020

Reference Books:

1. Simon J.D. Prince, “Understanding Deep Learning”, MIT Press, 2023.
2. Rowel Atienza, “Advanced Deep Learning with TensorFlow 2 and Keras”, 2nd Edition, PACT Publisher, 2020.

Web link

1. Interactive deep learning book with code, math, and discussions: <https://d2l.ai/>
2. Understanding Deep Learning Video Lectures : <https://udlbook.github.io/udlbook/>



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Cloud Computing			
Semester	VII	CIE Marks	50
Course Code	23CIPE411	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"> Provide knowledge on working of distributed system models, scalable Internet computing, and cloud systems. Familiarize virtualization concepts and its application in data center automation. Provide insights on various cloud computing architecture and service models. Impart knowledge on cloud security concepts and cloud programming environments, 			
Module 1: Distributed System Foundations			No. of Hrs: 8
Distributed System Models and Enabling Technologies: Scalable Computing Over the Internet, Technologies for Network Based Systems, System Models for Distributed and Cloud Computing, Software Environments for Distributed Systems and Clouds, Performance, Security and Energy Efficiency. Textbook 1: Chapter 1: 1.1 to 1.5			
Module 2: Virtualization			No. of Hrs: 8
Virtual Machines and Virtualization of Clusters and Data Centers: Implementation Levels of Virtualization, Virtualization Structure/Tools and Mechanisms, Virtualization of CPU/Memory and I/O devices, Virtual Clusters and Resource Management, Virtualization for Data Center Automation. Textbook 1: Chapter 3: 3.1 to 3.5			
Module 3: Cloud Platform Architecture			No. of Hrs: 9
Cloud Platform Architecture over Virtualized Datacenters: Cloud Computing and Service Models, Data Center Design and Interconnection Networks, Architectural Design of Computer and Storage Clouds, Public Cloud Platforms: GAE, AWS and Azure, Inter-Cloud Resource Management. Textbook 1: Chapter 4: 4.1 to 4.5			
Module 4: Cloud Security			No. of Hrs: 8
Cloud Security: Top concern for cloud users, Risks, Privacy Impact Assessment, Cloud Data Encryption, Security of Database Services, OS security, VM Security, Security Risks Posed by Shared Images and Management OS, XOAR, A Trusted Hypervisor, Mobile Devices and Cloud Security. Textbook 2: Chapter 11: 11.1 to 11.3, 11.5 to 11.8, 11.10 to 11.14			
Module 5: Cloud Programming and Software Environments			No. of Hrs: 9



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Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, Parallel and Distributed Computing Paradigms, Programming Support for Google App Engine, Programming on Amazon AWS and Microsoft, Emerging Cloud Software Environments.

Textbook 1: Chapter 6: 6.1 to 6.5

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

1. **Explain** distributed system models, enabling technologies, virtualization concepts, and cloud computing architectures.
2. **Apply** virtualization techniques for CPU, memory, and I/O devices to design and manage virtual clusters and data center resources.
3. **Describe** cloud security mechanisms and risk assessment strategies in cloud environments.
4. **Illustrate** the process of building cloud-based applications using appropriate programming models and tools in cloud computing environments.

Textbooks:

1. Kai Hwang, Geoffrey C. Fox, and Jack J. Dongarra, Distributed and Cloud Computing, Morgan Kaufmann, Elsevier, 2012.
2. Dan C. Marinescu, “Cloud Computing Theory and Practice”, Morgan Kaufmann, Elsevier, 2013

Reference Books:

1. Rajkumar Buyya, Christian Vecchiola, and Thamrai Selvi, Mastering Cloud Computing, McGraw Hill Education, 2013.
2. Toby Velte, Anthony Velte, Cloud Computing: A Practical Approach, McGraw-Hill Osborne Media, 2010.
3. APA: Dotson, C. (2024). Practical Cloud Security: A Guide for Secure Design and Deployment (2nd ed.). O'Reilly Media

Web links:

1. NPTEL Course : <https://nptel.ac.in/courses/106105167>
2. Google Cloud Computing Foundations Certificate : <https://www.skills.google/paths/36>



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NATURE INSPIRED COMPUTING			
Semester	VII	CIE Marks	50
Course Code	23CIPE412	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"> Familiarize the optimization problems and the limitations of classical methods. Provide an in-depth understanding of evolutionary and swarm intelligence-based metaheuristics approaches. Impart the knowledge on various applications of nature-inspired algorithms to solve complex engineering problems. 			
Module 1: Introduction to Optimization and Classical Methods			No. of Hrs: 08
<p>Introduction and Fundamentals of Optimization, Types of Optimization Problems, Examples of Optimization, Formulation of Optimization Problem, Classification of Optimization Algorithms. Classical Optimization Methods: Introduction and Mathematical Model of Optimization.</p> <p>Textbook 1: Chapters 1.2-1.6, 2.2</p>			
Module 2: Evolutionary Algorithms			No. of Hrs: 08
<p>Genetic Algorithm: Basics of Genetic Algorithm, Genetic Operators, Schema Theory, and Prisoner's Dilemma Problem. Genetic Programming (GP): Basics of Genetic Programming, Data Structures for Genetic Programming, Binary Tree Traversals, and GP Operators. Genetic Programming Algorithm and Pseudocode, Variants of the GP Algorithm</p> <p>Textbook 1: Chapters 4.2, 4.3, 4.7, 4.8, 5.2-5.8</p>			
Module 3: Classical Swarm Intelligence Algorithms			No. of Hrs: 08
<p>Particle Swarm Optimization: Swarm Behavior, Particle Swarm Optimization Algorithm. Differential Evolution: Mutation and Crossover mechanisms, and Variants of the DE Algorithm. Ant Colony Optimization: Ant Colony Characteristics, and application to the Traveling Salesman Problem. Bee Colony Optimization: Honey Bee Foraging Behavior, Bee Colony Optimization Algorithm and Pseudocode.</p> <p>Textbook 1: Chapters 6.2-6.3, 7.2-7.3, 8.2, 8.3.1, 9.2-9.3</p>			
Module 4: Advanced Swarm Intelligence Algorithms			No. of Hrs: 09
<p>Fish School Search : Fish School Behavior, Fish School Search Optimization. Cuckoo Search : Cuckoo Bird Behavior, and the integration of Levy Flights, Cuckoo Search Optimization. Firefly Algorithm: Firefly Behavior and Characteristics, Firefly-Inspired Optimization. Bat Algorithm: Behavior of Bats in Nature, Bat Optimization Algorithm</p> <p>Text Book 1: Chapters 10.2-10.3, 11.2-11.4, 12.2-12.3, 13.2</p>			
Module 5: Advanced Swarm Heuristics and Applications			No. of Hrs: 09

Biological Pollination and Social Hierarchy: Flower Pollination Optimization, Gray Wolf Characteristics, and Gray Wolf Optimization
Emerging Metaheuristics: Elephant Herding Optimization, Crow Search Algorithm, and Raven Roosting Optimization Algorithm.
Implementation and Benchmarking: Benchmark Test Functions and Real-world Applications in Network Routing, Job Scheduling problem, and Feature Reduction problem.
Text Book 1: Chapters 14.2-14.3, 15.2-15.3, 16.2-16.3, 17.3, 18.2-18.3, 19.

Course Outcomes: At the end of the course, the student will be able to
CO1: Explain the transition from classical deterministic optimization methods to stochastic nature-inspired paradigms.
CO2: Explain the principles of intelligence inspired by natural and social behaviors and their application in swarm-based optimization algorithms.
CO3: Discuss the exploration and exploitation strategies used in metaheuristic algorithms to efficiently search complex solution spaces.
CO4: Apply evolutionary computation operators to solve discrete and combinatorial optimization problems.
CO5: Apply swarm-based metaheuristic algorithms to optimize real-world engineering and image processing problems.

Textbooks:

1. Vasuki, A. *Nature-Inspired Optimization Algorithms*. 1st ed., CRC Press, 2020

Reference Books:

1. Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies, Dario Floreano and Claudio Mattiussi, MIT Press, 2008.
2. Introduction to Evolutionary Computing, A.E. Eiben and J.E. Smith, Springer, 2nd Edition, 2015

Web link

1. NPTEL - Introduction to Soft Computing: <https://nptel.ac.in/courses/106105173/>
2. Virtual Lab on Soft Computing: <https://vlab.co.in/>
3. MIT Open Course Ware - Bio-Inspired Robotics & AI: <https://ocw.mit.edu/>



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COMPUTER VISION			
Semester	VII	CIE Marks	50
Course Code	23CIPE413	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"> Provide an understanding of image acquisition, digital camera mechanics, and basic image filtering techniques. Impart knowledge on frequency domain analysis and multi-resolution processing using wavelets and pyramids. Introduce mathematical models for image degradation, restoration, and classical segmentation strategies. Provide knowledge on modern recognition frameworks, including object detection, and various levels of image segmentation Familiarize the traditional pattern recognition techniques. 			
Module 1: Introduction and Image Formation			No. of Hrs: 08
<p>Introduction to computer vision, Human vs Machine vision, Application Areas, Image Formation: Photometric Image Formation, Digital Image Formation, Image Representation, Image Processing: Enhancement, Filtering, Restoration, Segmentation, Point Operators. Text Book 1: Chapter 1.1, 1.2, 2.2, 2.3, 3.1, 3.2</p>			
Module 2: Linear Filtering and Transforms			No. of Hrs: 08
<p>Linear Filtering: 2D Convolution, 2D Correlation, Fourier Transforms, Pyramids and Geometric Transformations and Applications. Textbook 1: Chapter 3.3–3.6</p>			
Module 3: Restoration and Segmentation			No. of Hrs: 09
<p>Image Restoration and Reconstruction: A Model of Image Degradation and Restoration Process; Restoration in the Presence of Noise Only; Periodic Noise Reduction by Frequency Domain Filtering. Image Segmentation: Fundamentals; Point, Line, and Edge Detection; Thresholding; Segmentation by Region Growing and Region Splitting and Merging Textbook 2: Chapter 5.1–5.4, 10.1–10.3.2, 10.4</p>			
Module 4: Image Recognition			No. of Hrs: 09
<p>Instance Recognition, Image Classification: Feature-Based Methods; Deep Network–Based Methods; Applications: Visual Similarity Search, Face Recognition. Object Detection: Face Detection, Pedestrian Detection, General Object Detection. Semantic Segmentation: Applications: Medical Image Segmentation, Instance Segmentation, Panoptic Segmentation: Applications: Intelligent Photo Editing, Pose Estimation. Textbook 1: Chapter 6.1-6.4</p>			
Module 5: Pattern Recognition			No. of Hrs: 08

Patterns and Pattern Classes; Recognition Based on Decision-Theoretic Methods: Minimum Distance Classifier, Pattern Matching by Correlation, Optimum Statistical Classifiers; **Pattern Classification by Structural Methods:** Matching Shape Numbers.

Textbook 2: 12.1–12.2.2, 12.3.1

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

CO1: **Explain** the fundamentals of computer vision, image formation, image representation, and linear filtering techniques, including spatial and frequency domain transforms, for basic image analysis tasks.

CO2: **Describe** classical and modern image recognition and pattern recognition concepts, including feature-based methods, deep learning–based recognition, object detection, segmentation, and decision-theoretic classification techniques.

CO3: **Apply** image processing techniques such as filtering, restoration, and segmentation to solve practical problems in image enhancement, noise reduction, and region-based analysis.

CO4: **Apply** suitable image recognition and pattern recognition methods for real-world applications such as face recognition, object detection, medical image segmentation, and pattern classification.

Textbooks:

1. Richard Szeliski, Computer Vision: Algorithms and Applications, 2nd Edition, 2022, Springer.
2. Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, Digital Image Processing, Pearson, 4th edition, 2019

Reference Books:

1. David Forsyth and Jean Ponce, Computer Vision: A Modern Approach, 2nd Edition, Pearson, 2015.
2. Reinhard Klette, Concise Computer Vision - An Introduction into Theory and Algorithms, Springer, 2014.

Web link

1. Virtual Labs: <https://cse19-iiith.vlabs.ac.in/>
2. NPTEL Digital Image Processing: https://onlinecourses.nptel.ac.in/noc21_ee78/preview
3. Introduction to Machine Vision: <https://www.youtube.com/watch?v=tY2gcZObpfU>



IoT for Automation			
Semester	VII	CIE Marks	50
Course Code	23CIOE411	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 Local Automation Clouds, including their properties, establishment and applications. 3. Impart knowledge on IoT application automation systems to address 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			

- 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_fKye1CPIO9QjctFfgHOfIF_Zkmtze8uNRUvmq_9s1-3
4. https://onlinecourses.nptel.ac.in/noc20_cs69/preview



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Data Visualization & Analytics			
Semester	VII	CIE Marks	50
Course Code	23CIOE412	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, Story Boarding</p> <p>Handling Clutter : Cognitive Load, Clutter, Gestalt Principles :Proximity, Similarity, Enclosure, Closure, Continuity, Connection, Lack of Visual Order : Alignment, White Spaces, Decluttering Examples.</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 Distributions, 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, 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.</p>	
<p>Text Book 2: Chapter 11,12,13,14</p>	
<p>Module 5 : Visualizing Geospatial & Uncertainty data</p>	<p>No. of Hrs: 08</p>
<p>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</p>	
<p>Text Book 2: Chapter 15,16</p>	
<p>Course Outcomes: At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> 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 	
<p>Textbooks:</p> <ol style="list-style-type: none"> 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 	
<p>Reference Books:</p> <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. 	
<p>Web link</p> <ol style="list-style-type: none"> 1. Youtube Channel on Storytelling based on Data https://www.youtube.com/channel/UCjhGiILWNloXJdR2NTCBMIA 2. Data to visualization various graphs : https://www.data-to-viz.com/ 	

Software Testing			
Semester	VII	CIE Marks	50
Course Code	23CIOE413	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 basics of software testing. 2. Impart knowledge on different types of software testing. 3. Provide knowledge on building test cases for a given application. 4. Provide knowledge on effective test planning. 5. Impart knowledge on automated testing process and Selenium tool. 			
Module 1: Basics of Software Testing			No. of Hrs: 8
<p>Introduction to software testing, Approaches to testing, Principles of Testing, Salient Features of good testing, Test Policy & Planning, Challenges in testing, Cost Aspect of testing, Testing Process.</p> <p>Textbook 1: Chapter 3 (3.3, 3.4, 3.12, 3.13, 3.14, 3.16, 3.20, 3.23, 3.31)</p>			
Module 2: Functional and Non-Functional Testing			No. of Hrs: 9
<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>Textbook 2: Chapter 5 (5.1, 5.2) Ch6 (6.1, 6.2) Textbook 1: Ch11 (11.5, 11.6, 11.7, 11.8)</p>			
Module 3: Structural Testing			No. of Hrs: 9
<p>Program Graphs, DD paths, Basis path testing, Guidelines and observations, Definition-Use testing, Slice based testing, Program slicing tools.</p> <p>Textbook 2: Chapter 8 (8.1, 8.2, 8.4, 8.5) Ch9 (9.1, 9.2, 9.3)</p>			
Module 4: Test planning and Test cases			No. of Hrs: 8
<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>Textbook 1: Chapter 14 (14.3, 14.5, 14.6, 14.7, 14.10, 14.15, 14.16, 14.17, 14.19, 14.21)</p>			
Module 5: Selenium - Testing tool			No. of Hrs: 8
<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>Textbook 3: Chapter 1, Chapter 2, Chapter 6, Chapter 9</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”, 4th 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
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>



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Project Phase – II			
Semester	VII	CIE Marks	100
Course Code	23CISE409	SEE Marks	100
Hrs/Week (L: T: P)	0:0:12	Exam Hrs.	3
		Credits	6

Objectives: This course is designed to

1. Enable students to execute, validate, and communicate the engineering solution to the identified problem conceptualized in Project Phase – I
2. 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:
 - HOD or one of the HODs in case of an interdisciplinary project, shall be the Chairman of the committee
 - Project Coordinator shall be member - Convener
 - Project 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)
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.



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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	



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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. 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

Confidently present the project work through reviews, demonstrations, seminars, and viva-voce examinations, addressing questions from peers, faculty, and examiners



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Constitution of India and 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
Course Learning Objectives:			
This course is designed to			
<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 Indian Constitution, Amendments, Schedules and Citizenship.			
Module 2: Fundamental Rights and Duties			No. of Hrs:4
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. Emergency Provisions</p>			



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Module 4: Ethics and Sustainable Development	No. of Hrs:2
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.	
<p>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.</p>	
<p>TEXT BOOKS</p> <ol style="list-style-type: none"> 1. Raja Ram, M., (2015), <i>Constitution of India & Professional Ethics</i>, (3rd Edition), New Age International Publishers. 2. Dr. Tharanath, Santhosh Prabhu & Suma Suresh Kogilgeri,(2018), <i>Constitution of India & Professional Ethics</i>, Pristine Publishing House. 3. Sharma Brij Kishore, (2011), <i>Introduction to the Constitution of India</i>, (8th Edition), PHI Learning Pvt. Ltd. 4. Charles E Harris, Michael S. Pritchard & Michael J. Rabins (2018), <i>Engineering Ethics: Concepts and Cases</i>, (1st Edition), IEEE / Cengage. 5. Iqbal, Jaquir, (2013), <i>SDG – Sustainable Urban Development: Challenges, Achievements & Opportunities</i>, (1st Edition), Global Vision Publishing House. 	
<p>Weblinks:</p> <ol style="list-style-type: none"> 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=vXvlSXlmyM 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	23CISE431	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.



- 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:

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	23CISE432	SEE Marks	-
Hrs/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
	Total	100

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.