



*An Autonomous College under VTU*

*DEPARTMENT OF CSE (AI&ML)*

**VII Semester  
Scheme and Syllabus**

**With effect from Academic Year 2025-26**

**VISION :**

To be at the frontier of Artificial Intelligence and Machine learning with a focus on innovation, industry needs and to produce global professionals contributing to society.

**MISSION :**

- 1. Provide a state-of-the-art curriculum and infrastructure** to deliver high- quality education in Artificial Intelligence and Machine Learning.
- 2. Promote high-quality research and higher education** through strong collaborations between industry and academia.
- 3. Inculcate professional ethics and encourage sustainable solutions** for addressing societal challenges.

**PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)**

Program Educational Objectives (PEOs) of the UG program in CSE (AI & ML) are as follows.

**PEO1:** Graduates of the program will pursue successful careers in the IT, Artificial Intelligence, and Machine Learning industries.

**PEO2:** Graduates will be equipped with the knowledge and skills required to excel in postgraduate education.

**PEO3:** Graduates of the program will design and implement computing solutions that address real-world challenges and societal demands.

## **PROGRAMME SPECIFIC OUTCOMES (PSOs)**

**PSO1:** Apply the the principles of cognitive computing, artificial intelligence, and machine learning to design and develop intelligent systems in the domain of AI & ML engineering.

**PSO2:** Exhibit strong computational knowledge, hands-on proficiency, and innovative thinking in the field of Artificial Intelligence and Machine Learning.

**PSO3:** Utilize modern technologies and approaches to effectively solve real-world problems in Machine Learning, Deep Learning, Computer Vision, and NLP.

### **List of POs as Defined by NBA in Annexure II.**

**PO1: Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop the solution of complex engineering problems.

**PO2: Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4).

**PO3: Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5).

**PO4: Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

**PO5: Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6).

**PO6: The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

**PO7: Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9).

**PO8: Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

**PO9: Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

**PO10: Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

**PO11: Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8).

# Nagarjuna College of Engineering and Technology

Department of CSE (AI&ML)

**Scheme of Teaching and Examinations 2025 - 26**

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2025-26)

## VII SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper and Setting Board (PSB)	Teaching Hours / Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PEC	22CIT741	Cyber Security	CSE Board	3	0	0	0	03	50	50	100	3
		22CIT742	Object Oriented Modeling And Design										
		22CIT743	Responsible AI										
2	IPCC	22CII71	Generative AI	CSE Board	3	0	2	0	05	50	50	100	4
3	PCC	22CIT72	Deep Reinforcement Learning	CSE Board	3	2	0	0	05	50	50	100	4
4	IPCC	22CII73	Blockchain & its Applications	CSE Board	3	0	2	0	05	50	50	100	4
5	Open Elective	22CIO751	R Programming	CSE Board	3	0	0	0	03	50	50	100	3
		22CIO752	Introduction to Computer Vision										
		22CIO753	Introduction to Natural Language Processing										
6	NC	22CIT76	Indian Knowledge System	CSE Board	1	0	0	0	01	100	00	100	0
7	Project Work Phase-II	22CIP77	Major Project Work Phase-II	CSE Board	0	0	12	0	12	100	100	200	6
<b>Total</b>									<b>34</b>	<b>450</b>	<b>350</b>	<b>800</b>	<b>24</b>

<b>CYBER SECURITY</b>					
<b>Course Code</b>	<b>L:T:P:S</b>	<b>Credits</b>	<b>Exam Marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
22CIT741	3:0:0:0	03	IAT:50 SEE:50	03 Hours	PEC
<b>Module - I</b>					
<p><b>Introduction to Cyber Security:</b> Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, Who are Cybercriminals?, Classification of Cybercrimes, How Criminals plan the attacks, Social Engineering, Cyberstalking, Botnets, Attack vector, IP spoofing, Methods of defense, Security Models. Risk management, Cyber Threats- Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.</p>					
<b>08 HOURS</b>					
<b>Module - II</b>					
<p><b>Cyber-crime:</b> Mobile and Wireless Devices- Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.</p>					
<b>08 HOURS</b>					
<b>Module - III</b>					
<p>Tools and Methods Used in Cyber crime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft).</p>					
<b>08 HOURS</b>					
<b>Module - IV</b>					
<p><b>Understanding Computer Forensics:</b> Introduction, Historical Background of Cyber Forensics, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Anti Forensics.</p>					
<b>08 HOURS</b>					
<b>Module - V</b>					
<p><b>Cybersecurity- Organizational Implications:</b> Introduction, Cost of Cybercrimes and IPR issues, Web Threats for organizations, Security and Privacy implications from Cloud Computing, Social Media marketing, Social Computing and the Associated Challenges for Organizations, Organizational guidelines, Incident Handling, <b>Cybersecurity Standards and Frameworks:</b> DFARS, ISO 22301, HIPAA, NIST CSF <b>Cybercrime and Cyberterrorism:</b> Intellectual Property in the Cyberspace, The Ethical Dimension of Cybercrimes, The Psychology, Mindset and Skills of Hackers and Cybercriminal, Sociology of Cybercriminals, Information warfare.</p>					
<b>08 HOURS</b>					

**Assessment Details (Both CIE / IAT and SEE):**

<b>Theory Component</b>	IAT-1 after completion 45 to 50% Syllabus	25 Marks
	IAT-2 after completion 95 to 100% Syllabus	25 Marks
	Average of two IATs	<b>25 Marks</b>
	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	<b>25 Marks</b>
<b>Grand Total of CIE Marks (min marks 20 / 50)</b>		<b>50 Marks</b>
SEE conducted for 100 and scaled down to 50 ( <b>min marks 18/50</b> )		<b>50 Marks</b>
CIE + SEE (min marks 40)		<b>100 Marks</b>

**Text Books:**

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives	Sunit Belapure and Nina Godbole	1st	WILEY INDIA,	2013
2.	Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives	B. B. Gupta, D. P. Agrawal, Haoxiang Wang	1st	CBS PUBLISHERS & DISTRIBUTORS PVT. LTD	2018

**Reference Books:**

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Cyber SecurityEssentials,	James Graham, Richard Howard and Ryan Otson,	1st	CRC Press.	2010
2.	Introduction to Cyber Security	Chwan-Hwa(john) Wu,J.David Irwin.	1st	CRC Press.	2013

**Course Outcomes**

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

<b>CO1</b>	Apply the concepts of cyber security, and cyber-crime.
<b>CO2</b>	Analyze threats and risks within the context of cyber security.
<b>CO3</b>	Design applications for cybercrime using appropriate cyber security methods.
<b>CO4</b>	Conduct experiments to implement cyber-attacks and its countermeasures.



## OBJECT ORIENTED MODELING AND DESIGN

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22CIT742	3:0:0:0	3	IAT:50 SEE:50	3	PEC

### Module - I

**Class Modeling:** Object and class concepts; Link and associations concepts; Generalization and inheritance.

Advanced Class Modeling: Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages.

**08 Hours**

### Module – II

State Modelling: Events, States, Transitions and Conditions; State diagrams; State diagram behaviour. Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency.

**08 Hours**

### Module – III

Interaction Modelling: Use case models; Sequence models; Activity models. Advanced interaction modelling: Use case relationships; Procedural sequence models; Special constructs for activity models. System Conception: Devising a system concept; elaborating a concept; preparing a problem statement

**08 Hours**

### Module – IV

Domain Analysis: Overview of analysis; Domain class model; Domain State Model; Domain Interaction Model; Iterating the analysis.

Application Analysis: Application interaction model; Application class model; Application State Model; Adding operations.

**08 Hours**

### Module – V

Design Patterns - Introduction to patterns, Pattern categories; Relationships between patterns; Pattern description. Communication Patterns: Forwarder-Receiver; Client-Dispatcher-Server; Publisher-Subscriber

**08 Hours**

### Assessment Details (Both CIE / IAT and SEE):

<b>Theory Component</b>	IAT-1 after completion 45 to 50% Syllabus	25 Marks
	IAT-2 after completion 95 to 100% Syllabus	25 Marks
	Average of two IATs	<b>25 Marks</b>
	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	<b>25 Marks</b>
<b>Grand Total of CIE Marks (min marks 20 / 50)</b>		<b>50 Marks</b>
SEE conducted for 100 and scaled down to 50 ( <b>min marks 18/50</b> )		<b>50 Marks</b>
CIE + SEE (min marks 40)		<b>100 Marks</b>

**Course outcomes:**

<b>CO1</b>	Apply the knowledge of class, State & Interaction Modelling using Unified Modelling Language to solve a given problem
<b>CO2</b>	Analyse a System for a given requirement using Unified Modelling language
<b>CO3</b>	Design a given system using high level strategy
<b>CO4</b>	Conduct practical experiment to solve a given problem using Unified Modelling language.

**Text Books:****Prescribed Text Book**

<b>Sl. No.</b>	<b>Book Title</b>	<b>Authors</b>	<b>Edition</b>	<b>Publisher</b>	<b>Year</b>
1	Object - Oriented Modeling and Design with UML	Michael Blaha, James Rumbaugh	2nd	Pearson Education	2007
2	Pattern-Oriented Software Architecture, A System of Patterns,	Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad,Michael Stal	1st	John Wiley and Sons	2007

**Reference Text Book**

<b>Sl. No.</b>	<b>Book Title</b>	<b>Authors</b>	<b>Edition</b>	<b>Publisher</b>	<b>Year</b>
1	Pattern-Oriented Software Architecture: A System of Patterns	Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal	1st	John Wiley and Sons	2006
2	Object-Oriented Analysis and Design with Applications	Grady Booch	3rd	Pearson Education	2007
3	Object-Oriented Analysis, Design and Implementation	Brahma Dathan, Sarnath Ramnath	1st	Universities Press	2009
4	UML 2 Toolkit	Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado	1st	Wiley-dreamtech India	2004

## CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3										
CO2		3									
CO3			3								
CO4				3	3					2	

RESPONSIBLE AI					
Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22CIT743	3:0:0:0	03	IAT:50 SEE:50	03 Hours	PEC
<p><b>Pre- Requisites:</b>  <b>Basic understanding of AI concepts:</b> Machine learning, data processing, model training, etc.  <b>Awareness of business and societal impact:</b> How AI decisions affect individuals, communities, and industries Use interpretable models to clarify decision-making processes.  <b>Monitoring Systems:</b> Continuously evaluate AI performance and impact post-deployment</p>					
<p><b>Course Objectives:</b>  Identify and Address Bias in AI Systems: Learn how to detect, measure, and mitigate biases in datasets and algorithms to ensure fairness and equity in AI applications.</p> <p>Implement Privacy-Preserving Techniques: Acquire skills to implement privacy-preserving techniques in AI, such as differential privacy and federated learning, and understand legal frameworks like GDPR that govern data privacy.</p> <p>Evaluate Societal Impact of AI Technologies: Analyze the broader societal impacts of AI technologies, including both the potential benefits and risks, especially in sectors like healthcare, education, and environmental science</p>					
<p><b>Teaching - Learning Process:</b>  These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.</p> <ol style="list-style-type: none"> <li>1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.</li> <li>2. Use of Video/Animation to explain functioning of various concepts.</li> <li>3. Encourage collaborative (Group Learning) Learning in the class.</li> <li>4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.</li> <li>5. Adopt Problem Based Learning (PBL), which fosters student's, Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.</li> <li>6. Introduce Topics in manifold representations.</li> <li>7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.</li> <li>8. Discuss how every concept can be applied to the real world - and when that's possible, it helps to improve the students' understanding.</li> </ol>					
<b>Module - I</b>					
Introduction: Ethical Theories and Frameworks, Building Ethics into machines. Philosophical foundations: Ethical frameworks, benefit and harm, power, automation					<b>08 HOURS</b>
<b>Module - II</b>					
Social bias and algorithmic fairness: Psychological foundations of bias; social bias and disparities in NLP data and models					

		<b>08 HOURS</b>			
<b>Module - III</b>					
Social bias in AI models. Hate speech: NLP for identifying and countering hate speech/toxicity/abuse		<b>08 HOURS</b>			
<b>Module - IV</b>					
Misinformation: NLP for fact-checking and fake news detection. Computational propaganda and political misinformation. Green AI, and other topics		<b>08 HOURS</b>			
<b>Module - V</b>					
Case studies : Recommendation systems , medical diagnosis , hiring / Education , computer vision and natural language processing		<b>08 HOURS</b>			
<b>Assessment Details (Both CIE / IAT and SEE):</b>					
<b>Theory Component</b>	IAT-1 after completion 45 to 50% Syllabus	25 Marks			
	IAT-2 after completion 95 to 100% Syllabus	25 Marks			
	Average of two IATs	<b>25 Marks</b>			
	CCE-1	25 Marks			
	CCE-2	25 Marks			
	Average of two CCEs	<b>25 Marks</b>			
<b>Grand Total of CIE Marks (min marks 20 / 50)</b>		<b>50 Marks</b>			
SEE conducted for 100 and scaled down to 50 (min marks 18/50)		<b>50 Marks</b>			
CIE + SEE (min marks 40)		<b>100 Marks</b>			
<b>Course Outcomes :</b>					
<b>At the end of the course the student will be able to :</b>					
CO1: Explain key ethical principles in AI development.					
CO2: Analyze bias and fairness in machine learning models.					
CO3: Apply privacy-preserving techniques in AI systems.					
CO4: Evaluate the societal impact of AI technologies.					
CO5: Design AI solutions that align with legal and ethical standard					
<b>Text Books:</b>					
<b>Prescribed Text Book</b>					
<b>Sl. No.</b>	<b>Book Title</b>	<b>Authors</b>	<b>Edition</b>	<b>Publisher</b>	<b>Year</b>
1.	Ethics of artificial intelligence	Liao , S.M	First	Oxford University Press	2020
2.	AI ethics	Coeckelbergh, Mark	Second	. Mit Press,	2020
3.	Moral machines: Teaching robots right from wrong	Wallach, W., & Allen, C.	Third	Oxford University Press	2018

**Reference Books:**

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Artificial you: AI and the future of your mind.	Schneider, Susan	second	Princeton University Press,	2019
2.	Interpretable machine learning	Christoph Molnar	First	Shroff publishers	2019

**E – Resources:**

1. Microsoft Responsible AI Toolbox: A suite of open-source tools to help assess, develop, and deploy AI responsibly. Includes dashboards for fairness, explainability, and error analysis.
2. Responsible AI Toolkit by TensorFlow: Offers guides and tools for integrating responsible AI practices into machine learning workflows, including fairness indicators and privacy tools.
3. Responsible AI Tools and Practices | Microsoft AI: A comprehensive hub with templates, standards, and toolkits for building trustworthy AI systems.
4. Google Cloud Skills Boost – Introduction to Responsible AI: A free microlearning course that explains Google's approach to responsible AI and its principles.
5. Centre for Responsible AI – IIT Madras: A research-driven resource with papers, code, and presentations focused on responsible AI in the Indian ecosystem.

**CO-PO Mapping:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	-	-	-	-	1	-	2	2	2
CO2	3	3	2	2	1	-	-	-	-	1	-	3	2	2
CO3	3	3	3	1	1	-	-	-	-	1	-	3	1	1
CO4	3	3	2	2	1	-	-	-	-	1	-	3	2	2
CO5	3	3	2	2	1	-	-	-	-	1	-	3	2	2

## GENERATIVE ARTIFICIAL INTELLIGENCE

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22CII71	3:0:2:0	04	100	03	Integrated

### Pre- Requisites:

Foundation of Machine learning and Deep Learning.

### Objectives:

This course will enable students to:

CLO1: Understand the principles and concepts behind generative AI models

CLO2: Explain the knowledge gained to implement generative models using Prompt design frameworks.

CLO3: Apply various Generative AI applications for increasing productivity.

CLO4: Develop Large Language Model-based Apps.

### Teaching - Learning Process:

Chalk & Board, PPT, Activity Based Learning.

### Module - I

**Introduction to Generative AI:** Introducing Generative AI, Domains of Generative AI, Text generation, Image Generation, Music Generation, Video Generation. **Representation of Text:** Basic Vector Models-One-Shot Vector representation of words. **Word Embedding:** Static word embedding, Word2Vec, CBOW Model, Skip Gram Model, FastText and GloVe Word Embedding, Visualizing embedding vectors (t-SNE), Applications of word embedding.

**08 HOURS**

### Module – II

**NLP Evolution and Transformers: Exploring NLPs and LLMs** - NLP evolution and the rise of transformers: The main drawbacks of RNNs and CNNs, NLP and the strengths of generative AI in LLMs. **Understanding LLMs:** GPT, other LLMs, Working of GPT models- Pre-training, Tokenization, Scaling, and Conditioning.

**08 HOURS**

### Module – III

**Hugging Face Transformers:** Features of the Hugging Face Platform, Components of Hugging Face. **Tasks Using the Hugging Face Library** - Gradio: An Introduction, Creating a Space on Hugging Face, Hugging Face Tasks – Summarization, Sentiment Analysis.

**08 HOURS**

### Module – IV

**LangChain for LLM Apps:** Limitations of LLMs, Mitigating LLM limitations, LLM app. Introduction to LangChain: Exploring key components of LangChain, Working mechanism of LangChain, Comparing LangChain with other frameworks, Exploring API model integrations, Building an application for customer service, Case study.

**08 HOURS**

## Module – V

**Building a Chatbot like ChatGPT:** Introduction to Chatbot, Understanding retrieval and vectors – Embeddings, Vector storage; Loading and retrieving in LangChain - Document loaders, Retrievers in LangChain - kNN retriever, PubMed retriever, Custom retrievers; Implementing a Chatbot.

**Introduction to Agentic AI:** Agentic AI Use cases, The Building Blocks of Agentic AI , Key Components: Perception, Reasoning, Planning, Learning, and Execution , Types and Categories of Agents .Applications Across Industries

**08 HOURS**

### LAB PROGRAMS

1. Explore pre-trained word vectors. Explore word relationships using vector arithmetic. Perform arithmetic operations and analyze results.

2. Use dimensionality reduction (e.g., PCA or t-SNE) to visualize word embedding's for Q 1. Select 10 words from a specific domain (e.g., sports, technology) and visualize their embedding's. Analyze clusters and relationships. Generate contextually rich outputs using embedding's. Write a program to generate 5 semantically similar words for a given input.

3. Train a custom Word2Vec model on a small dataset. Train embedding's on a domain-specific corpus (e.g., legal, medical) and analyze how embedding's capture domain-specific semantics.

4. Use word embedding's to improve prompts for Generative AI model. Retrieve similar words using word embedding's. Use the similar words to enrich a GenAI prompt. Use the AI model to generate responses for the original and enriched prompts. Compare the outputs in terms of detail and relevance.

5. Use word embedding's to create meaningful sentences for creative tasks. Retrieve similar words for a seed word. Create a sentence or story using these words as a starting point. Write a program that: Takes a seed word. Generates similar words. Constructs a short paragraph using these words.

6. Use a pre-trained Hugging Face model to analyze sentiment in text. Assume a real-world application, Load the sentiment analysis pipeline. Analyze the sentiment by giving sentences to input.

7. Summarize long texts using a pre-trained summarization model using Hugging face model. Load the summarization pipeline. Take a passage as input and obtain the summarized text.

8. Install Lang chain, cohere (for key), Lang chain-community. Get the api key (By logging into Cohere and obtaining the cohere key). Load a text document from your Google drive. Create a prompt template to display the output in a particular manner

9. Take the Institution name as input. Use Pydantic to define the schema for the desired output and create a custom output parser. Invoke the Chain and Fetch Results. Extract the below Institution related details from Wikipedia: The founder of the Institution. When it was founded. The current branches in the institution. How many employees are working in it. A brief 4-line summary of the institution.

10. Build a Chatbot for the Indian Penal Code. We'll start by downloading the official Indian Penal Code document, and then we'll create a Chatbot that can interact with it. Users will be able to ask questions about the Indian Penal Code and have a conversation with it.

## Assessment Details (Both CIE / IAT and SEE):

<b>Theory Component</b>	IAT-1 after completion 45 to 50% Syllabus	25 Marks
	IAT-2 after completion 95 to 100% Syllabus	25 Marks
	Average of two IATs	<b>25 Marks</b>
	<b>Total 25 Marks : Reduced to 15 Marks</b>	
	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	<b>25 Marks</b>
	<b>Total 25 Marks : Reduced to 10 Marks</b>	
<b>Lab Component</b>	Lab Record and execution of programs	<b>15 Marks</b>
	<b>Lab Test at the end of 15<sup>th</sup> week</b>	<b>10 Marks</b>
	<b>Total</b>	<b>25 Marks</b>
<b>Grand Total of IAT Marks</b>		<b>50 Marks</b>
Obtaining 40% of marks in both theory and lab component is essential for appearing for SEE		

## Course Outcomes :

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

CO1. Develop the ability to explore and analyze word embedding's, perform vector arithmetic to investigate word relationships, visualize embedding's using dimensionality reduction techniques

CO2. Apply different architectures used in large language models, such as transformers, and understand their advantages and limitations.

CO3. Utilize pre-trained Hugging Face models for real-world applications, including sentiment analysis and text summarization.

CO4. Exploring key components of LangChain and apply prompt engineering skills to real-world scenarios.

## Text Books:

1. Modern Generative AI with ChatGPT and OpenAI Models: Leverage the Capabilities of OpenAI's LLM for Productivity and Innovation with GPT3 and GPT4, by Valentina Alto, Packt Publishing Ltd, 2023.
2. T V Geetha, "Understanding Natural Language Processing", Pearson India Education Services Pvt. Ltd 2024.
3. Generative AI for Cloud Solutions: Architect modern AI LLMs in secure, scalable, and ethical cloud environments, by Paul Singh, Anurag Karuparti, Packt Publishing Ltd, 2024.
4. Introduction to Transformers for NLP With the Hugging Face Library and Models to Solve Problems, by Shashank Mohan Jain, Apress 2022.
5. Ben Auffarth. Generative AI with LangChain: Build Large Language Model (LLM) Apps with Python, ChatGPT, and Other LLMs, Packt, 2023.

## Reference Books:

1. David Foster. Generative Deep Learning, Second Edition, O'Reilly, 2023
2. James Phoenix, Mike Taylor. Prompt Engineering for Generative AI, O'Reilly, 2024
3. Denis Rothman. Transformers for Natural Language Processing and Computer Vision: Explore Generative AI and Large Language Models with Hugging Face, ChatGPT, GPT-4V, and DALL-E3, 3rd Edition, Packt Publications, 2024
4. Jakub Langr, Vladimir Bok. GANs in Action, Manning, 2019
5. Tanmoy Chakraborty. Introduction to Large Language Models Generative AI for Text, 2024, Wiley



DEEP REINFORCEMENT LEARNING					
Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22CII72	3:0:0:0	03	SEE : 50 & IAT : 50	03 Hours	IPCC
<p><b>Pre- Requisites:</b>  Understanding of Machine Learning, Theoretical and practical knowledge of Deep Learning, Proficiency in Linear Algebra, Probability and Statistics, Proficiency in Python Programming.</p>					
<p><b>Course Objectives:</b>  This course will enable students to:</p> <ul style="list-style-type: none"> <li>• Understand the statistical learning techniques and the importance and challenges of learning agents</li> <li>• Formalize problems as Markov Decision Processes</li> <li>• Understand value functions</li> <li>• Understand how to implement dynamic programming as an efficient solution approach to an industrial control problem</li> </ul> <p>Start using Reinforcement Learning for real problems</p>					
<p><b>Teaching - Learning Process:</b>  Chalk &amp; Talk</p>					
<b>Module - I</b>					
<p><b>Introduction to Reinforcement Learning:</b> Reinforcement Learning, Terms used, Approaches to implement reinforcement learning, Examples, Elements of Reinforcement Learning, Limitations and Scope, An Extended Example: Tic-Tac-Toe.  <b>Multiarm Bandits:</b> An n-Armed Bandit Problem, Action-Value Methods, Tracking a Non stationary Problem, Upper confidence -Bound area selection, Gradient Bandits.</p> <p style="text-align: right;"><b>08 Hours</b></p> <p>Teaching Learning Methodology: Chalk &amp; Talk</p> <p>Tutorial Plan</p> <ol style="list-style-type: none"> <li>1. Implement a 2-player Tic-Tac-Toe game (agent vs agent or agent vs rule-based player).</li> <li>2. Multi-armed bandit problem</li> </ol>					
<b>Module - II</b>					
<p><b>Finite Markov Decision Processes:</b> The Agent–Environment Interface, Goals and Rewards, Returns, Unified Notation for Episodic and Continuing Tasks, The Markov Property, Markov Decision Processes, Optimal Value Functions.  <b>Dynamic Programming:</b> Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Asynchronous Dynamic Programming.</p> <p style="text-align: right;"><b>08 Hours</b></p> <p><b>Teaching Learning Methodology:</b> Chalk &amp; Talk</p> <p><b>Tutorial Plan</b></p> <ol style="list-style-type: none"> <li>1. Simulate GridWorld</li> <li>2. Perform Policy Evaluation and Improvement</li> </ol>					
<b>Module - III</b>					
<p><b>Monte Carlo Methods:</b> Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Off-policy Prediction via Importance Sampling, Off-Policy Monte Carlo Control.  <b>Temporal-Difference Learning:</b> TD Prediction, Advantages of TD Prediction Methods, Optimality of TD(0), Sarsa: On-Policy TD Control, Q-Learning: Off-Policy TD Control.</p> <p style="text-align: right;"><b>08 Hours</b></p>					

**Teaching Learning Methodology:** Chalk & Talk,

**Tutorial Plan**

1. Solve FrozenLake using Monte Carlo
2. Implement SARSA and Q-learning in Open AI.

**Module - IV**

**Eligibility Traces:** n-Step TD Prediction, The Forward View of TD( $\lambda$ ), The Backward View of TD( $\lambda$ ), Sarsa( $\lambda$ ), Watkins's Q( $\lambda$ ), Off- policy Eligibility Traces using Importance Sampling.

**Planning and Learning with Tabular Methods:** Models and Planning, Integrating Planning, Acting, and Learning, Prioritized Sweeping.

**08 Hours**

**Teaching Learning Methodology:** Chalk & Talk.

**Tutorial Plan:**

1. Demonstrate eligibility trace accumulation and decay.
2. Understand off-policy corrections and integrate planning.

**Module - V**

**On-policy Approximation of Action Values:** Value Prediction with Function Approximation, Gradient-Descent Methods, Linear Methods.

**Policy approximation:** Actor-Critic Methods, Eligibility Traces for Actor-Critic Methods, R-Learning and the Average-Reward Setting.

**Teaching Learning Methodology:** Chalk & Talk

**Tutorial Plan:**

1. Train a policy network using linear approximation
2. Implement Actor-Critic in PyTorch for CartPole

**Assessment Details (Both CIE / IAT and SEE):**

<b>Theory Component</b>	IAT-1 after completion 45 to 50% Syllabus	25 Marks
	IAT-2 after completion 95 to 100% Syllabus	25 Marks
	Average of two IATs	<b>25 Marks</b>
	<b>Total 25 Marks : Reduced to 15 Marks</b>	
	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	<b>25 Marks</b>
<b>Total 25 Marks : Reduced to 10 Marks</b>		
<b>Lab Component</b>	Lab Record and execution of programs	<b>15 Marks</b>
	<b>Lab Test at the end of 15<sup>th</sup> week</b>	<b>10 Marks</b>
	<b>Total</b>	<b>25 Marks</b>
<b>Grand Total of CIE Marks (min marks 20 / 50)</b>		<b>50 Marks</b>
SEE conducted for 100 and scaled down to 50 (min marks 18/50)		<b>50 Marks</b>
CIE + SEE (min marks 40)		<b>100 Marks</b>

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

- Learn the basic concepts of Reinforcement learning
- Identification of suitable learning tasks to which these learning techniques can be applied
- Appreciation of some of the current limitations of reinforcement learning techniques
- Investigate Reinforcement techniques and derive effectively learning rules.
- Appreciation of some of the current limitations of reinforcement learning techniques

**Text Books:**

1. Reinforcement Learning An Introduction by Richard S. Sutton and Andrew G. Barto, Second Edition
2. Algorithms for Reinforcement Learning by Csaba Szepesvári

**Reference Books:**

1. Algorithms for Reinforcement Learning” Csaba Szepesvari, Ronald Brachman, Thomas Dietterich
2. Markov Decision Processes: Discrete Stochastic Dynamic Programming (9780471727828): Martin L. Puterman

**E – Resources:**

- <https://www.coursera.org/specializations/reinforcement-learning>
- <https://www.deepmind.com/learning-resources/reinforcement-learning-lecture-series-2021>
- <https://www.youtube.com/playlist?list=PLoROMvodv4rOSOPzutgyCTapiGIY2Nd8u>

**CO-PO Mapping:**

CO/PO	Program Outcomes (PO)											PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	3						2	3	2	3
CO2	3	3	2	2	3						2	3	2	3
CO3	3	3	2	2	3						2	3	2	2
CO4	3	3	3	3	3						2	3	2	3
CO5	3	2	2	2	3						2	3	2	2
Avg	3	2.8	2.2	2.2	3						2.0	3	2	2.6

BLOCKCHAIN & ITS APPLICATIONS					
Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22CII73	3:0:2:0	04	IAT:50 SEE:50	03 Hours	IPCC
<b>Pre- Requisites:</b> <ul style="list-style-type: none"> <li>• Basic knowledge of Cryptography, Object oriented programming concepts</li> <li>• Basic knowledge of mathematics.</li> </ul>					
<b>Objectives:</b> <ol style="list-style-type: none"> <li>1. Understand the basics of Blockchain technology</li> <li>2. Learn concepts of Cryptocurrency.</li> <li>3. Gain knowledge to choose the blockchain technology for implementing real world problems.</li> <li>4. To learn smart contracts to develop Dapps for suitable real world cases.</li> </ol>					
<b>Teaching - Learning Process:</b> <p>These are sample Strategies, used in Blockchain subject to accelerate the attainment of the various course outcomes.</p> <ol style="list-style-type: none"> <li>1. Chalk and talk</li> <li>2. Pre-video links of the concept are sent to students well in advance so that students will be able to grasp the topics that is taken in class.</li> <li>3. After the class quiz is been asked in the class with respect to the topics to know their understanding level and which also promotes critical thinking.</li> <li>4. Problem Based Learning (PBL) id adopted, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.</li> <li>6. Every concept can be applied to the real world - and when that's possible, is taught in the class which helps improve the students' understanding.</li> </ol>					
<b>Module - I</b>					
<b>Introduction:</b> Basics for Blockchain: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Distributed Systems,. The Public Key Cryptography, Hash function, Digital Signature.					
<b>08 HOURS</b>					
<b>Module - II</b>					
<b>Bitcoin:</b> The history of blockchain and Bitcoin, Electronic cash, Blockchain, Blockchain defined Peer-to-peer, Distributed ledger, Cryptographically-secure, ,Append-only, Updateable via consensus, Generic elements of a blockchain, How blockchain works, How blockchain accumulates blocks, Benefits and limitations of blockchain, Tiers of blockchain technology Features of a blockchain, Types of blockchain, The structure of a block, Bitcoin Transaction Life cycle. Adding node to a bitcoin network.					
<b>08 HOURS</b>					
<b>Module - III</b>					
<b>Ethereum Blockchain,</b> The structure of a block header, The genesis block, Mining, Tasks of the miners, Mining rewards, Proof of Work (PoW), The mining algorithm, The hash rate, Mining systems, CPU, GPU, FPGA, ASICs, Mining pools,Ethereum Virtual Machine (EVM), Wallets for Ethereum, Solidity, Smart Contracts, examples on smart contract, deploying smart contracts, ,Metamask,					
<b>08 HOURS</b>					
<b>Module - IV</b>					
<b>Tiers of Blockchain Technology:</b> Blockchain 1.0, Blockchain 2.0, Blockchain 3.0, Types of Blockchain: Public Blockchain, Private Blockchain, Semi-Private Blockchain, Sidechains. , Soft & hard Fork. Applications of blockchain in various fields, Use cases, Vulnerabilities in Smart contracts, attacks on Smart contracts.					
<b>08 HOURS</b>					

**Module - V**

Types of Consensus Algorithms: Proof of Stake, Proof of Work, Delegated Proof of Stake, Proof Elapsed Time, Deposit-Based Consensus, Proof of Importance, Federated Consensus or Federated Byzantine Consensus, Practical Byzantine Fault Tolerance. Proof of Burn, Difficulty Level, SybilAttack.

**08 HOURS**

<b>SL.NO</b>	<b>Part – A LAB PROGRAMS</b>
1	Simulate Bitcoin Mining using Suitable simulator
2	Simulate Block, blockchain, hash concepts using blockchain demo
3	Write a basic Solidity smart contract to understand the fundamentals of the language
4	Install MetaMask, connect to an Ethereum testnet, and interact with a deployed smart contract.
5	Set up Truffle and Ganache, compile and deploy a Solidity contract on a local blockchain
6	Write a smart contract to send ether from account to another

**Part - B**

Students has to Develop a Dapp on any of the topic selected by them in a group of min 2 and max 4 and needs to present it to the Batch incharge.

**Assessment Details (Both CIE / IAT and SEE):**

<b>Theory Component</b>	IAT-1 after completion 45 to 50% Syllabus	25 Marks
	IAT-2 after completion 95 to 100% Syllabus	25 Marks
	Average of two IATs	<b>25 Marks</b>
	<b>Total 25 Marks : Reduced to 15 Marks</b>	
	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	<b>25 Marks</b>
<b>Total 25 Marks : Reduced to 10 Marks</b>		
<b>Lab Component</b>	Lab Record and execution of programs	<b>15 Marks</b>
	<b>Lab Test at the end of 15<sup>th</sup> week</b>	<b>10 Marks</b>
	<b>Total</b>	<b>25 Marks</b>
<b>Grand Total of CIE Marks (min marks 20 / 50)</b>		<b>50 Marks</b>
SEE conducted for 100 and scaled down to 50 ( <b>min marks 18/50</b> )		<b>50 Marks</b>
CIE + SEE (min marks 40)		<b>100 Marks</b>

**Course Outcomes :**

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

CO1 Apply the principles of Blockchain and Cryptocurrency for a given application.

CO2 Analyze the various protocols and mining techniques in Blockchain.

CO3 Design Blockchain based solution for a given scenario.

CO4 Conduct practical experiments to solve problems using Blockchain technology.

**Text Books:**

<b>Sl. No.</b>	<b>Book Title</b>	<b>Authors</b>	<b>Edition</b>	<b>Publisher</b>	<b>Year</b>
1	Bitcoin and Cryptocurrency	Arvind Narayanan, Joseph Bonneau,		Princeton	2016



<b>R-PROGRAMMING</b>					
<b>Course Code</b>	<b>L:T:P:S</b>	<b>Credits</b>	<b>Exam Marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>22CIO751</b>	<b>3:0:0:0</b>	<b>3</b>	<b>IAT:50 SEE:50</b>	<b>3 Hours</b>	<b>OE</b>
<b>Pre- Requisites:</b> Basic Mathematical Skills like statistics, probability, calculus, linear algebra, and familiar with programming knowledge like Python or Java.					
<b>Course Objectives:</b> To enable students to understand and apply the basic concepts of R programming for data manipulation, analysis, and visualization. This course prepares students with foundational programming skills in R and equips them for further study in data science and statistical computing.					
<b>Teaching - Learning Process:</b>  These are sample Strategies, used in R-Programming to accelerate the attainment of the various course outcomes. <ol style="list-style-type: none"> <li>1. Chalk and talk</li> <li>2. Pre-video links of the concept are sent to students well in advance so that students will be able to grasp the topics that is taken in class.</li> <li>3. After the class quiz is been asked in the class with respect to the topics to know their understanding level and which also promotes critical thinking.</li> <li>4. Problem Based Learning (PBL) id adopted, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.</li> <li>6. Every concept can be applied to the real world - and when that's possible, is taught in the class which helps improve the students' understanding.</li> </ol>					
<b>Module - I</b>					
<b>Introduction to R:</b> Applications, Basic Operations and Data Types, Numeric and Arithmetic Operations, Variables and Assignment Operators, Expressions and Precedence Rules, Logical Expressions and Relational Operators, Basic Functions in R, Introduction to Vectors: Creation, Indexing, and Operations.					
					08 HOURS
<b>Module - II</b>					
<b>Matrices and Arrays:</b> Defining a Matrix, Creating and Manipulating Matrices and Arrays Sub-setting, Matrix Operations (Transpose, Inverse, and Multiplication), Conditions and Looping: if statements, else if, else, looping constructs: for, while and repeat, Vectorized programming and Efficient Coding.					
					08 HOURS
<b>Module - III</b>					
<b>Lists and Data Frames:</b> Creating and Accessing Lists, Data Frames: Creation, Access, and Modification, Special Values: NA, NaN, Inf, and NULL, Apply Family of Functions: apply(), lapply(), sapply(), tapply().					
					08 HOURS
<b>Module - IV</b>					
<b>Functions:</b> Function Arguments: Default, Named, and Variable-length, Scope and Environment: Local vs Global Variables, Writing Custom Functions, Specialized functions and Recursion.					
					08 HOURS
<b>Module - V</b>					

**Pointers:**

Packages, Installing and Loading Packages, The environment() and frame Concepts, debugging, Debugging Techniques and Tools: browser(), traceback(), debug(), manipulation of code, compilation of the code. Case Study: Diagnosing and Debugging a Real-World R Script for Data Cleaning.

08 HOURS

**Assessment Details (Both CIE / IAT and SEE):**

<b>Theory Component</b>	IAT-1 after completion 45 to 50% Syllabus	25 Marks
	IAT-2 after completion 95 to 100% Syllabus	25 Marks
	Average of two IATs	<b>25 Marks</b>
	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	<b>25 Marks</b>
<b>Grand Total of CIE Marks (min marks 20 / 50)</b>		<b>50 Marks</b>
SEE conducted for 100 and scaled down to 50 (min marks 18/50)		<b>50 Marks</b>
CIE + SEE (min marks 40)		<b>100 Marks</b>

**Course Outcomes :**

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

**CO1.** Understand and apply the basic R programming concepts such as variables, arithmetic operations, and vectors.

**CO2.** Construct and manipulate matrices, arrays, and control structures using loops and conditionals in R.

**CO3.** To Work with structured data using lists and data frames; apply built-in functions for efficient computation.,

**CO4.** Develop user-defined functions, manage scoping rules, and handle argument matching for modular code.

**CO5.** Utilize R packages, environments, and debugging tools to manage. To prepare or tidy data for in preparation for analyze.

**Text Books:**

1. Jones, O., Maillardet. R. and Robinson, A. (2014). Introduction to Scientific Programming and Simulation Using R. Chapman & Hall/CRC, The R Series.

**Reference Books:**

1. Michael J. Crawley, "Statistics: An Introduction using R", Second edition, Wiley, 2015

**E – Resources:**

- [http://www.tutorialspoint.com/r/r\\_useful\\_resources.htm](http://www.tutorialspoint.com/r/r_useful_resources.htm)
- <https://rstudio-education.github.io/hopr/>

**CO-PO Mapping:**

CO/PO	Program Outcomes (PO)											PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	1	-	-	-	-	-	-	-	1	3	2	
<b>CO2</b>	3	3	2	2	-	-	-	-	-	-	1	3	2	
<b>CO3</b>	3	3	3	2	-	-	-	-	-	-	2	3	3	
<b>CO4</b>	3	3	3	3	-	-	-	-	-	-	2	3	3	
<b>CO5</b>	3	2	2	2	3	-	-	-	-	1	3	3	3	

## INTRODUCTION TO COMPUTER VISION

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22CIO752	3:0:0:0	3	IAT:50 & SEE:50	03 Hours	OE

**Pre- Requisites:**

- Basic knowledge of coordinate geometry, linear algebra and probability.
- Basic knowledge of Image Processing .
- A decent coding skill in a modern language. C++, Matlab and Python ...

**Objectives:**

Students will gain

1. The knowledge of Image Formation, Image Enhancement and Segmentation.
2. Learn various feature extraction techniques.
3. Emphasis on core vision tasks through Motion estimation and Object as well as pattern recognition. 4. Explore the areas where automation can be possible through Image processing and Computer Vision.

**Teaching - Learning Process:**

These are sample Strategies, used in FCV to accelerate the attainment of the various courseoutcomes.

1. Chalk and talk
2. Pre-video links of the concept are sent to students well in advance so that students will be able to grasp the topics that is taken in class.
3. After the class quiz is been asked in the class with respect to the topics to know their understanding level and which also promotes critical thinking.
4. After the completion of module hands on is been conducted in the class /lab with respect to the topics to know practically.  
their understanding level and which also promotes critical thinking
5. Problem Based Learning (PBL) is adopted, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.

Every concept can be applied to the real world - and when that's possible, is taught in the class which helps improve the students' understanding.

### Module - I

**Introduction:**

Digital Image fundamentals, Image Sensing and acquisition, Sampling and Quantization, Image formation models, Overview of Computer Vision, Applications of Image processing and Computer Vision.

**08 HOURS**

### Module - II

**Image Enhancement:**

Image enhancement in spatial domain, Basic grey level Transformations, Histogram Processing Techniques, Spatial Filtering, Image smoothing and Image Sharpening, Image enhancement process in frequency domain, Low pass filtering, High pass filtering

**08 HOURS**

### Module - III

**Image Segmentation:**

Point, line and edge detection, Thresholding, Regions Based segmentation, Edge linking and boundary detection.

**08 HOURS**

### Module - IV

**Feature Extraction:**

Importance of Features, Feature extraction techniques, Histogram of Oriented Gradient (HOG), Scale Invariant Feature Transform (SIFT), Background subtraction techniques, Image Matching, Principal Component Analysis (PCA).

**08 HOURS****Module - V**

Object Recognition ,Applications of Image Processing and Computer vision  
Object Recognition techniques: Deep learning algorithms for Object Recognition. Gaussian Mixture Model (GMM), Face Recognition, Facial Expression Recognition, Optical Character Recognition.

**08 HOURS****Assessment Details (Both CIE / IAT and SEE):**

<b>Theory Component</b>	IAT-1 after completion 45 to 50% Syllabus	25 Marks
	IAT-2 after completion 95 to 100% Syllabus	25 Marks
	Average of two IATs	<b>25 Marks</b>
	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	<b>25 Marks</b>
<b>Grand Total of CIE Marks (min marks 20 / 50)</b>		<b>50 Marks</b>
SEE conducted for 100 and scaled down to 50 ( <b>min marks 18/50</b> )		<b>50 Marks</b>
CIE + SEE (min marks 40)		<b>100 Marks</b>

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

1. Understand fundamentals of image processing and computer vision.
2. Understand and apply concepts of Image formation and Image Enhancement.
3. Understand and apply image segmentation and feature extraction methods.
4. Acquire knowledge about various Object Detection, Object Recognition, Motion estimation techniques and their applications.
5. Ability to apply various Image processing and Computer vision algorithms to solve real time problems.

**Text Books:**

Computer Vision: Algorithms and Applications. R. Szeliski, Springer, 1<sup>st</sup> Edition, springer, 2011

**Reference Books:**

- Digital Image Processing- Refael C. Gonzalez and Richard E. Woods, Wesley
- Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
- Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.
- Computer Vision, D. H. Ballard, C. M. Brown, Prentice-Hall, Englewood Cliffs, 1982.

**E – Resources:**

1. <https://www.cs.princeton.edu/>
2. <https://www.opendatastructures.org/ods-cpp>
3. <https://www.lib.mdp.ac.in/ebook/DSa>
4. <https://ww.cs-fundamentals.com/data-structures/introduction-to-datastructures.php>

5. <https://www.cprogramming.com/algorithms-and-data-structures.html>
6. <https://online-learning.harvard.edu/course/data-structures-and-algorithms>

**CO-PO Mapping:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
<b>C01</b>	3	2	2	2							2	3	2	2
<b>C02</b>	3	3	2	2							2	3	2	2
<b>C03</b>	3	3	2	2							2	3	2	2
<b>C04</b>	2	2	3	2				2			2	3	2	2
<b>C05</b>	2	2	3	2				3			2	3	2	2
<b>AVG</b>	2.6	2.4	2.4	2				2.5			2	3	2	2

<b>Introduction to Natural Language Processing</b>					
<b>Course Code</b>	<b>L:T:P:S</b>	<b>Credits</b>	<b>Exam Marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
22CIO753	3:0:0:0	03	100	03	Open Elective Theory
<p><b>Pre- Requisites:</b>  Natural Language Processing requires usage of many modern machine learning algorithms and involves a lot of math and programming. Therefore one should feel comfortable with probability, linear algebra, and calculus along with Python programming.</p>					
<p><b>Objectives:</b>  This course provides:  CLO 1: A sound understanding of Natural Language Processing and challenges involved.  CLO2: Knowledge of implementation and evaluation of basic NLP tasks.</p>					
<p><b>Teaching - Learning Process:</b>  Chalk &amp; Board, PPT, Activity Based Learning.</p>					
<b>Module - I</b>					
<p><b>Overview and language modeling:</b> Origins and challenges of NLP-Language and Grammar-Processing Indian Languages-NLP Applications Information Retrieval. Language Modeling: Various Grammar-based Language Models - Statistical Language Model.</p> <p style="text-align: right;"><b>08 HOURS</b></p>					
<b>Module - II</b>					
<p><b>Word level and syntactic analysis:</b> Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing – Spelling Error Detection and correction- Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context- free Grammar – Constituency – Parsing –Probabilistic Parsing.</p> <p style="text-align: right;"><b>08 HOURS</b></p>					
<b>Module - III</b>					
<p><b>Semantic Analysis and Discourse Processing:</b> Introduction, Meaning representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation. Discourse Processing: Cohesion, Reference Resolution.</p> <p style="text-align: right;"><b>08 HOURS</b></p>					
<b>Module - IV</b>					
<p><b>Natural Language Generation:</b> Architectures of NLG Systems, Generation tasks and Representations. Machine Translation: Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches - Direct Machine Translation, Rule based Machine Translation.</p> <p style="text-align: right;"><b>08 HOURS</b></p>					
<b>Module - V</b>					
<p><b>Lexical Resources and Applications of NLP:</b> WordNet, FrameNet, Stemmers, Other Applications: Information Extraction, Automatic Text Summarization, Question-Answering System.</p> <p style="text-align: right;"><b>08 HOURS</b></p>					
<b>08 HOURS</b>					

### Assessment Details (Both CIE / IAT and SEE):

<b>Theory Component</b>	IAT-1 after completion 45 to 50% Syllabus	25 Marks
	IAT-2 after completion 95 to 100% Syllabus	25 Marks
	Average of two IATs	<b>25 Marks</b>
	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	<b>25 Marks</b>
<b>Grand Total of CIE Marks (min marks 20 / 50)</b>		<b>50 Marks</b>
SEE conducted for 100 and scaled down to 50 ( <b>min marks 18/50</b> )		<b>50 Marks</b>
CIE + SEE (min marks 40)		<b>100 Marks</b>

### Course Outcomes :

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

- CO1. Understand the fundamentals of Natural Language Processing.
- CO2. Apply the knowledge of various levels of language processing to perform basic NLP tasks.
- CO3. Gain knowledge on automated Natural Language Generation and Machine Translation.
- CO4. Implement and evaluate different NLP applications.

### Text Books:

1. Natural language processing and information retrieval by Tanveer Siddiqui & U.S. Tiwary, Publisher: New Delhi Oxford 2021.

Textbook 1: Chapter 1: 1.1 to 1.9; Chapter 2: 2.1, 2.2.1, 2.2.2, 2.3; Chapter 3: 3.1 to 3.7; Chapter 4: 4.1 to 4.5; Chapter 5: 5.1 – 5.5; Chapter 6: 6.2 & 6.3; Chapter 7: 7.2 & 7.3; Chapter 8: 8.2 to 8.6; Chapter 11: 11.2 to 11.4; Chapter 12: 12.2 to 12.5.

### Reference Books:

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 3rd Edition, 2019.
2. "Natural Language Processing: An information Access Perspective", Kavi Narayana Murthy, Ess Ess Publications, 2006.
3. Anne Kao and Stephen R. Poteet(Eds), "Natural Language Processing and Text Mining", Springer-Verlag London Limited 2007.

### E – Resources:

1. <https://www.deeplearning.ai/resources/natural-language-processing/>
2. <https://www.datacamp.com/blog/what-is-natural-language-processing>
3. <https://www.analyticsvidhya.com/blog/2021/02/basics-of-natural-language-processing-nlp-basics/>
4. <https://www.freecodecamp.org/news/natural-language-processing-techniques-for-beginners/>
5. <https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial/what-is-natural-language-processing-nlp>

**CO-PO Mapping:**

<b>POs COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>
<b>CO 1</b>	3	2	1								2	2		2
<b>CO 2</b>	3	3	2	2	3						2	3	3	3
<b>CO 3</b>	3	2	2		2						2	3	3	2
<b>CO 4</b>	3	3	3	3	3				1	1	2	3	3	3
<b>Avg</b>	3	2.5	2	1.25	2				0.25	0.25	2	2.75	2.25	2.5

INDIAN KNOWLEDGE SYSTEMS					
Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22CIT76	1:0:0:0	0	IAT:100	--	NCCM
<b>Objectives:</b> <ol style="list-style-type: none"> <li>To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.</li> <li>To make the students understand the traditional knowledge and analyse it and apply it to their day-to-day life.</li> </ol>					
<b>Module - I</b>					
<b>Introduction to Indian Knowledge Systems (IKS):</b> Overview, Vedic Corpus, Philosophy, Character scope and importance, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge vs. western knowledge.					
<b>05 HOURS</b>					
<b>Module - II</b>					
<b>Traditional Knowledge in Humanities and Sciences:</b> Linguistics, Number and measurements- Mathematics, Chemistry, Physics, Art, Astronomy, Astrology, Crafts and Trade in India and Engineering and Technology.					
<b>05 HOURS</b>					
<b>Module - III</b>					
<b>Traditional Knowledge in Professional domain:</b> Town planning and architecture- Construction, Health, wellness and Psychology-Medicine, Agriculture, Governance and public administration, United Nations Sustainable development goals.					
<b>05 HOURS</b>					
<b>Course Outcomes :</b> <b>At the end of the course the student will be able to :</b> CO1: Provide an overview of the concept of the Indian Knowledge System and its importance. CO2: Appreciate the need and importance of protecting traditional knowledge. CO3: Recognize the relevance of Traditional knowledge in different domains. CO4: Establish the significance of Indian Knowledge systems in the contemporary world.					
<b>Text Books:</b> Introduction to Indian Knowledge System- concepts and applications, B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R N, 2022, PHI Learning Private Ltd, ISBN-978-93-91818-21-0					
<b>Reference Books:</b> Traditional Knowledge System in India, Amit Jha, 2009, Atlantic Publishers and Distributors (P) Ltd., ISBN-13: 978-8126912230, 2 Knowledge Traditions and Practices of India, Kapil Kapoor, Avadesh Kumar Singh, Vol. 1, 2005, DK Print World (P) Ltd., ISBN 81-246-0334,					
<b>E – Resources:</b> <ul style="list-style-type: none"> <li>• <a href="https://www.youtube.com/watch?v=LZP1StpYEPM">https://www.youtube.com/watch?v=LZP1StpYEPM</a></li> <li>• <a href="http://nptel.ac.in/courses/121106003/">http://nptel.ac.in/courses/121106003/</a></li> <li>• <a href="https://unctad.org/system/files/official-document/ditcted10_en.pdf">https://unctad.org/system/files/official-document/ditcted10_en.pdf</a></li> </ul>					

**CO-PO Mapping:**

<b>POs COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>
<b>CO1</b>	2							3			1			
<b>CO2</b>						2								
<b>CO3</b>			2	2										
<b>CO4</b>						3	2							