Subject Code	Subject Name	Category	L	T	P	C
GE23621	Problem-Solving Techniques	**EEC**	**0**	**0**	**2**	**1**

Course Objectives:

- To improve the numerical ability
- To improve problem-solving skills.

Course topics:

S.No.	Topics
1	Numbers system
2	Reading comprehension
3	Data arrangements and Blood relations
4	Time and Work
5	Sentence correction
6	Coding & Decoding, Series, Analogy, Odd man out and Visual reasoning
7	Percentages, Simple interest and Compound interest
8	Sentence completion and Para-jumbles
9	Profit and Loss, Partnerships and Averages
10	Permutation, Combination and Probability
11	Data interpretation and Data sufficiency
12	Logarithms, Progressions, Geometry and Quadratic equations.
13	Time, Speed and Distance

Course Outcome:

On successful completion of the course, students should be able to:

5. Have mental alertness
6. Have numerical ability
7. Solve quantitative aptitude problems with more confident

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
AI23632	NATURAL LANGUAGE PROCESSING	PC	3	0	2	4

Objectives:

- To introduce the fundamental concepts of Natural Language Processing (NLP for analysing words based on statistical measures and CORPUS.
- To understand the principles of morphological analysis and language modeling using finite state machines and n-gram models.
- To explore vector semantics and learn how to represent words and their relationships through embeddings and similarity measures.
- To analyze and implement Hidden Markov Models (HMMs) and their applications in Part-Of-Speech (POS) tagging
- To study the architecture of transformers and large language models, including pre-training and evaluation techniques.

UNIT-I	INTRODUCTION TO NATURAL LANGUAGE PROCESSING	9

Introduction to NLP - Various stages of NLP –NLP Pipeline, The Ambiguity of Language: Parts of Speech, Phrase Structure. Statistics Essential Information Theory: Entropy, perplexity, The relation to language: Cross entropy, Text Prepossessing: Character Encoding, Word Segmentation, Sentence Segmentation, Introduction to Corpora, Corpora Analysis

UNIT-II	MORPHOLOGY AND LANGUAGE MODELLING	9

Inflectional and Derivation Morphology, Morphological analysis and generation using Finite State Automata and Finite State transducer.Bag of words, skip-gram, Continuous Bag-Of-Words, N gram model, n -gram Models over Sparse Data: Bins: Forming Equivalence Classes- - Statistical Estimators- Combining Estimators

UNIT-III	VECTOR SEMANTICS AND EMBEDDINGS	9

Lexical Semantics-Vector Semantics-Words and Vectors-Cosine for measuring similarity- TF-IDF: Weighing terms in the vector- Pointwise Mutual Information (PMI) -Applications of the TF-IDF or PPMI vector models-Word2vec -Visualizing Embeddings - Semantic properties of embeddings - Bias and Embeddings - Evaluating Vector Models - Retrieval-Augmented Generation (RAG)

UNIT-IV	MARKOV MODEL AND POS TAGGING	9

Markov Model: Hidden Markov model, Three Fundamental questions of HMM, Implementation properties, and Variants of HMMs, Multiple input observation. **POS**: The Information Sources in Tagging: Markov model taggers, Viterbi algorithm, Applying HMMs to POS tagging, Applications of Tagging.

UNIT-V	TRANSFORMERS AND LARGE LANGUAGE MODELS	9

The Transformer - Attention-Transformer Blocks- Parallelizing computation using a single matrix X , The input: embeddings for token and position-The Language Modeling Head - Large Language Models : Large Language Models with Transformers -Sampling for LLM Generation - Pretraining Large Language Models -Evaluating Large Language Models

	Contact Hours	:	45

List of Experiments	
1.	Develop a morphological analyzer to process and analyze various sentence structures, including interrogative, declarative, and complex sentences with conjunctions. Perform word segmentation and sentence segmentation as part of the analysis. **Suggested Dataset/Corpus: Universal Dependencies (UD) English Treebank**
2.	Design a basic NLP pipeline to preprocess raw text data by performing tokenization, sentence segmentation, and part-of-speech (POS) tagging. Automate the pipeline to process large-scale text efficiently. **Suggested Dataset/Corpus: Universal Dependencies (UD) English Treebank**
3.	Implement a Named Entity Recognition (NER) system using Python libraries such as spaCy or NLTK. Utilize a pre-trained model to extract named entities, including people, organizations, and locations, from a text corpus. **Suggested Dataset/Corpus**: **CoNLL-2003 NER Dataset**

4.	Construct unigram, bigram, and trigram models to analyze their performance on sparse data. Compare the language models based on perplexity and their effectiveness in predicting word sequences. **Suggested Dataset/Corpus**: **The Brown Corpus**
5.	Implement n-gram language models (unigram, bigram, trigram, etc.) and apply smoothing techniques like Laplace smoothing to address data sparsity. Evaluate the models on a large text corpus for accuracy and perplexity. **Suggested Dataset/Corpus**: **Google Ngram Dataset**
6.	Design a spelling correction model using a combination of morphological rules and n-gram probabilities. Test the model on a dataset containing deliberately misspelled words and compare it to established spell-check systems. **Suggested Dataset/Corpus**: **Birkbeck Spelling Error Corpus**
7.	Implement the Term Frequency-Inverse Document Frequency (TF-IDF) model and use cosine similarity to compare the similarity between documents in a given corpus. Visualize the similarity matrix for better insight. **Suggested Dataset/Corpus**: **20 Newsgroups Dataset**
8.	Train a Word2Vec model on a given text corpus and visualize the resulting word embeddings using dimensionality reduction techniques like t-SNE or PCA. Analyze the semantic relationships between words in the embeddings. **Suggested Dataset/Corpus**: **Text8 Dataset**
9.	Build a Hidden Markov Model (HMM) for part-of-speech (POS) tagging. Train the model on a tagged corpus and evaluate its accuracy on a test dataset. **Suggested Dataset/Corpus**: **Universal Dependencies (UD) Treebank**
10.	Use a pre-trained Transformer model (e.g., BERT) to build a sentiment analysis model. Fine-tune the model on a dataset of tweets, classify sentiment (positive, neutral, negative), and evaluate its performance using accuracy and F1-score. **Suggested Dataset/Corpus**: **Sentiment140 Dataset**
11	Use a pre-trained language model to perform sentiment analysis or keyword extraction on a dataset of WhatsApp chat and E mail data. Analyze the conversational patterns, emotions, and key topics discussed in the chats. (Multiple languages such as English, Tamil, etc.) **Suggested Dataset/Corpus**: **WhatsApp Chat Export (User-Generated Data)**
12	Use a pre-trained language model to perform sentiment analysis or keyword extraction from E mail data. Analyze the conversational patterns, information, and key topics from Email Message. (Multiple languages such as English, Tamil, etc.) **Suggested Dataset/Corpus**: **Email Data (User-Generated Data)**
13	Implement a question-answering system using a pre-trained BERT model. Input a passage and a question, and use the model to extract the correct answer from the passage. Evaluate the system on accuracy and relevance of the answers. **Suggested Dataset/Corpus**: **SQuAD (Stanford Question Answering Dataset)**
14	**Mini Project** • Choose a Topic: Identify a deep learning problem of interest, such as image classification, text generation, or anomaly detection. • Research related works using platforms like Google Scholar. • Dataset Selection: Find or collect a suitable dataset from sources like Kaggle or UCI. Ensure it is relevant, well-sized, and consider preprocessing requirements. • Develop Methodology: Start with baseline models, then experiment with advanced architectures (e.g., CNNs, Transformers). Use frameworks like TensorFlow or PyTorch. • Implementation & Evaluation: Train models and evaluate performance using appropriate metrics (e.g., accuracy, F1-score). Document findings systematically. • Discuss & Present: Analyze results, highlight challenges, and present your work with clear insights and

SEMESTER VI

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
AI23611	SECURE SYSTEMS ENGINEERING	PC	3	0	0	3

OBJECTIVES:	
•	To Able to know the fundamentals of secure systems.
•	To Understand the basic cryptography and key management techniques.
•	To Able to build and evaluate trusted system.
•	To Explore different auditing mechanisms and Network security.
•	To Learn the various security systems.

UNIT I	INTRODUCTION TO SECURE SYSTEMS	9
An overview of Computer Security – Access Control matrix – Foundational results Security Policies – Confidentiality policies – Hybrid policies.		
UNIT II	**BASIC CRYPTOGRAPHY AND KEY MANAGEMENT**	**9**
Classical Crypto systems: Transposition ciphers, Substitution ciphers, Data Encryption Standard Public Key cryptography: RSA – Cryptographic checksums: HMAC – Key Management: Key Exchange, Cryptographic key infrastructure – Digital Signature.		
UNIT III	**INTRODUCTION TO ASSURANCE AND EVALUATING SYSTEMS**	**9**
Assurance and Trust – Building secure and trusted systems: Life cycle, Waterfall life cycle model, Prototyping Evaluating Systems: Role of formal evaluation, TCSEC requirements, classes, processes, impact. FIPS requirements, Security levels, impact.		
UNIT IV	**AUDITING AND NETWORK SECURITY**	**9**
Auditing: Anatomy of an auditing system, Designing an auditing system, auditing mechanisms. Network Security: Introduction, Policy Development, Network Organization anticipating attacks.		
UNIT V	**SYSTEM SECURITY, USER SECURITY AND PROGRAM SECURITY**	**9**
System Security: Introduction, Policy, Networks. User Security: Policy, Access, Processes. Program Security: Introduction, Requirements and policy, Design, Refinement and Implementation.		
	Contact Hours : 45	

COURSE OUTCOMES: On completion of the course, the students will be able to	
•	Identify the different secure systems and policies.
•	Apply cryptography and key management techniques to design a secure system.
•	Design and evaluate secure trusted system.
•	Apply different auditing mechanisms and ensure network security.
•	Apply various security systems for real time problem.

TEXT BOOKS:	
1	Ross Anderson ,Security Engineering: A Guide to Building Dependable Distributed Systems, 3rd Edition, Kindle Edition, 2021
2	RON ROSS, Systems Security Engineering, Special Publications,2016

REFERENCES:	
1	John Musa D, Software Reliability Engineering, 2nd Edition, Tata McGraw-Hill, 2005.
2	Julia H Allen, Sean J Barnum, Robert J Ellison, Gary McGraw, Nancy R Mead, Software Security Engineering: A Guide for Project Managers, Addison Wesley, 2008
3	Ross J. Anderson, Security Engineering: A Guide to Building Dependable Distributed Systems, 2nd Edition,WILEY,2008

Web links
https://www.isms.online/iso-27002/control-8-27-secure-system-architecture-and-engineering-principles/
https://csrc.nist.gov/projects/systems-security-engineering-project

CO – PO – PSO mapping

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
AI23611.1	2	2	2	2	2	-	-	-	-	-	1	2	2	3	3
AI23611.2	2	2	2	2	2	-	-	-	-	-	1	2	2	3	3
AI23611.3	2	2	2	2	2	-	-	-	-	-	2	2	3	3	3
AI23611.4	2	2	2	2	2	-	-	-	-	-	2	2	3	3	3
AI23611.5	2	2	2	2	2	-	-	-	-	-	2	2	3	3	3
Average	2	2	2	2	2	-	-	-	-	-	1.4	2	2.6	2.8	2.8

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
No correlation: "-"

Subject Code	Subject Name	Category	L	T	P	C
GE23627	Design Thinking and Innovation (Type - Project based learning)	EEC	0	0	4	2

Objectives:	
•	To understand the design thinking concepts and deep understanding of user needs and experiences.
•	To find the problem statement and To develop innovative design solutions that address identified user challenges
•	To master the process of prototyping and iterating on designs.
•	To conduct thorough market analysis and financial planning
•	To effectively communicate design concepts and findings.

Unit-I: Introduction to Design Thinking : The design thinking concepts - Different design thinking models - Details of Stanford Design thinking process: Empathize, Define, Ideate, Prototype, Test

Activities:

- Case studies of successful domain based Design Thinking and Innovative projects
- Group discussions on design thinking

Unit 2: Empathize and Define : User research methods (interviews, surveys, observation, contextual inquiry) - Persona development- Journey mapping – Brainstorming Defining the design problem statement

Activities:

- Conducting user interviews and surveys
- Creating user personas and journey maps
- Identifying key user needs and pain points
- Analyze the user needs and Brainstorming to define problem statement

Unit 3: Ideate and Create : Brainstorming techniques (e.g., mind mapping, SCAMPER) - Ideation tools (e.g., design thinking tools, concept sketching) - Concept generation and evaluation (e.g. Brainstorming)

Activities:

- Group brainstorming sessions to select the best idea
- Creating concept sketches and prototypes
- Evaluating ideas based on user needs and feasibility

Unit 4: Prototype and Test : Low, Medium and high level fidelity for prototyping-Usability testing -Iterative design

Activities:

- Building low-fidelity prototypes (e.g., paper prototypes)
- Conducting usability tests with users
- Iterating on designs based on feedback

Unit 5: Market Analysis and Implementation : Market research and analysis - Business model development- Financial planning-Implementation strategies

Activities:

- Conducting market research
- Developing a business model canvas
- Creating a financial projection
- Developing an implementation plan
-

Course Outcomes: On completion of the course, the students will be able to	
CO1	Construct design challenge and reframe the design challenge into design opportunity.
CO2	Interview the user, and know the feelings of users to foster deep user understanding and be able to uncover the deep user insights and needs.
CO3	Develop ideas and prototypes by brainstorming.
CO4	Organize the user walkthrough experience to test prototype
CO5	Develop smart strategies and implementation plan that will deliver/achieve the idea/solution deduced from earlier phases.

Assessment:

- Encourage students to work on real-world design challenges based on the user needs
- Group presentations
- Quizzes and exams
- Evaluation of Project report and viva and also encourage the students for filing patent/ copyright / presenting in conference / publishing in journal

Text Book(s):	
1	Handbook of Design Thinking by Christian Müller-Roterberg, Kindle Direct Publishing, 2018**.**
2	Design Thinking – A Beginner's Perspective, by E Balagurusamy, Bindu Vijakumar, MC Graw Hill, 2024

Reference Books:	
1	Design Thinking for Entrepreneurs and Small Businesses: Putting the Power of Design to Work – by Beverly Rudkin Ingle, Apress; 1st ed. Edition, 2013
2	Design Thinking: Understanding How Designers Think and Work by Nigel Cross, Bloomsbury Visual Arts; 2 edition 2023

Web links	
1	Design thinking Guide https://www.rcsc.gov.bt/wp-content/uploads/2017/07/dt-guide-book-master-copy.pdf
2	NPTEL Course on Design Thinking and Innovation By Ravi Poovaiah ; https://onlinecourses.swayam2.ac.in/aic23_ge17/preview
3	IITB Design course tools and Resources https://www.dsource.in/

CO-PO Mapping

COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	3	3	3	2	2	3	3	3	3	3
CO2	3	2	3	3	3	2	2	3	3	3	3	3
CO3	3	2	3	3	3	2	2	3	3	3	3	3
CO4	3	2	3	3	3	2	2	3	3	3	3	3
CO5	3	2	3	3	3	2	2	3	3	3	3	3
Average	**3**	**2**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**

1-Slight (Low), 2- Moderate (Medium), 3- Substantial (High) , "-" No correlation

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
AI23631	PREDICTIVE AND PRESCRIPTIVE ANALYTICS	PC	3	0	2	4

Objectives:	
•	To introduce the fundamental concepts of predictive analytics.
•	To determine if current and historical data patterns are likely to emerge again.
•	To impart the knowledge on various steps those are necessary before constructing the predictive model.
•	To gain knowledge on the assessment of prescriptive models for decision making.
•	Help organizations allocate resources more efficiently by making informed prescriptive about where they will be most effective.

UNIT-I	INTRODUCTION TO PREDICTIVE ANALYTICS	9
Introduction to Analytics – Predictive Analytics – Parametric vs. Non-Parametric Models -Business Intelligence – Predictive Analytics vs. Business Intelligence – Predictive Analytics vs. Statistics – Predictive Analytics vs. Data Mining – Challenges in using Predictive Analytics.		
UNIT-II	**THE PREDICTIVE ANALYTICS PROCESS**	**9**
Predictive Analytic process, Technical requirements, Data Exploration, Information based learning: Decision trees, Shannons Entropy Model, Information Gain,ID3 Algorithm, Tree Pruning, EDA.		
UNIT-III	**PREDICTIVE DATA ANALYTICS**	**9**
Similarity Based Learning: Nearest Neighbour Algorithm, Handling Noisy Data, Data Normalization, Feature Selection, Probability based learning: Bayes Theorem, Bayesian Prediction, Smoothing, Probability Density function, Binning, Error based learning: Linear Regression, Gradient Descent.		
UNIT-IV	**PRESCRIPTIVE ANALYTICS – GRADIENT DESCENT**	**9**
Introduction to Prescriptive Analytics – Gradient Descent fundamentals - Stochastic Gradient descent regression - Forecasting fundamentals - Forecasting techniques : ARIMA		
UNIT-V	**PRESCRIPTIVE ANALYTICS – OPTIMIZATION AND OPTIMAL DECISION**	**9**
Common problem types for LP Solution- Types of Optimization Models - Linear Programming for Optimization - Transportation Problem - Network models - Heuristics Optimization with Genetic Algorithm.		
	Contact Hours : 45	

List of Experiments		
1	Clustering based data analytics using R/Python. (K-Means, SOM algorithms)	
2	Demonstrate the statistics for a sample data like mean, standard deviation, normal/uniform distribution, variance and correlation.	
3	Demonstrate missing value analysis, fixing missing values and outlier analysis in dataset	
4	Demonstrate data visualization, histograms and multiple variable summaries	
5	Demonstrate transformation, scaling, binning, fixing skewed values and sampling.	
6	Demonstration of Apriori algorithm on transaction dataset to find association rules.	
7	Demonstration of Linear and Logistic regression using various domain datasets.	
8	Demonstration of predictive models such as Decision Tree, Neural network and K-Nearest Neighbor using various domain datasets.	
9	Demonstration of Temporal Mining Techniques	
10	Demonstration of predictive analytics to analysis microarray data	
	Contact Hours	**45**
	Total Contact Hours	**75**

Course Outcomes: On completion of the course, the students will be able to	
•	Develop a foundational understanding of predictive modelling and its applications.
•	Apply regression and classification techniques to real-world problems
•	Gain expertise in using Support Vector Machines and Neural Networks for predictive analytics.
•	Analysing prescriptive modelling techniques for the given data.
•	Assess and interpret different prescriptive models for optimization problem.

Text Books:	
1	Nooruddin Abbas Ali, "Predictive Analytics for the Modern Enterprise: A Practitioner's Guide to Designing and Implementing Solutions", O'Reilly Media Publications, first Edition, May 2024.
2	Richard Hurley, "Predictive Analytics: The Secret to Predicting Future Events Using Big Data and Data Science Techniques Such as Data Mining, Predictive Modelling, Statistics, Data Analysis, and Machine Learning" Ationa publications, February 2020.
3	Prescriptive Analytics: Prescribe with Python: The Definitive Prescriptive Analytics Python Guide, First Edition,2023
4	Walter R. Paczkowski , "Hands-On Prescriptive Analytics: Optimizing Your Decision Making with Python", First Edition,2024

Reference Books:	
1	Daniel Vaughan, Analytical Skills for AI and Data Science: Building Skills for an AI-Driven Enterprise, O'Reilly Media, 1st Edition, April 2021.
2	Eric Siegel, The AI-Powered Enterprise: Harnessing the Power of Machine Learning to Lead with Confidence and Transform Your Business, McGraw-Hill Education, 1st Edition, February 2022.
3	Eric Siegel, Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die, John Wiley & Sons Inc. Publishers, Second edition, 2016.
4	Dursun Delen, "Prescriptive Analytics: The Final Frontier for Evidence-Based Management and Optimal Decision Making" First Edition 2024
5	Dean Abbott, Applied Predictive Analytics: Principles and Techniques for the professional Data Analyst, John Wiley & Sons Inc. Publishers, First edition, 2014.

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
AD23633	Generative AI	PC	2	0	2	3

Objectives:

1	To provide a fundamental understanding of the transition from discriminative to generative modelling.
2	To explore the architecture and mechanics of Transformers and Large Language Models (LLMs).
3	To master the art and science of Prompt Engineering for optimizing model outputs.
4	To understand the integration of external data through Vector Databases and Retrieval-Augmented Generation (RAG).
5	To equip students with the skills to build, evaluate, and deploy real-world Generative AI applications.

UNIT I	Foundations of Generative AI	6

Concepts of Generative AI – Discriminative vs Generative AI, Statistical Models: GMM, HMM. Key NLP tasks (text classification, sentiment analysis, summarization), Tokenization, Text Representation – Word embeddings. Ethics and Challenges of Gen AI – Bias in AI models.

UNIT II	Core Architectures of LLMs	6

Generative Models: Variational Autoencoders (VAE) - Generative Adversarial Networks (GAN). Introduction to Transformers: – Encoder-decoder architecture – Self-attention mechanism - Text Generation: Greedy Search Decoding, Beam Search Decoding, Sampling methods (Top-k, Nucleus Sampling).

UNIT III	Prompt Engineering	6

Fundamental of prompt engineering- Prompt Elements - Techniques: Zero-shot, one-shot, few-shot and Chain-of-thought (CoT) – Graph Prompt – Automatic Prompt Engineer (APE). Best practices of Prompt Design – Handling ambiguous or complex queries.

UNIT IV	Retrieval-Augmented Generation	6

Vector Databases - Integrating vector databases with LLMs - FAISS – Pinecone – Deep Lake – Parameter Efficient Fine Tuning - Retrieval Augmented Generation (RAG) – Pipeline – Core Components.

UNIT V	Real World Applications using Gen AI	6

Integrating Gen AI into workflows –Automating tasks using AI. Building Custom Apps – Chatbots and Virtual Assistants, Content generation tools (blog writing, marketing copy), Code generation and debugging tools. Evaluating and Optimizing AI outputs – Metrics for evaluating AI performance, Iterative improvement of prompts and models

Contact Hours	:	30

List of Experiments

1	Develop a predictive text system using N-Gram and HMM (Hidden Markov Models) to predict the next word based on previous context. Dataset: Brown Corpus or Wikipedia dataset.
2	Develop a program to perform Bias Audit on pre-trained word embeddings to identify gender or racial stereotypes using the Word Embedding Association Test (WEAT). Dataset: Common Crawl or Google News Embeddings.

3	Implement a Generative Adversarial Network (GAN) to generate synthetic images or tabular data. Dataset: MNIST (for images) or Synthetic Financial Transactions.			
4	Analyze and compare the text generation capabilities of different LLM architectures and access methods (OpenAI API, Hugging Face).			
5	Analyze the impact of Zero-shot, Few-shot, and Chain-of-Thought (CoT) prompting on the reasoning capabilities of Large Language Models (LLMs) and identify patterns in logical fallacies or "hallucinations." Dataset: SQuAD dataset or GSM8K (Math Word Problems) dataset.			
6	Implement a program to retrieve similar products or movies based on high-dimensional vector embeddings using FAISS or Pinecone. Dataset: MovieLens or Amazon Product dataset.			
7	Integrate a Vector Database with an LLM to build a Retrieval-Augmented Generation (RAG) system that answers questions based on external PDF documents. Dataset: LinkedIn Profile or Research Paper PDFs.			
8	Deploy a fine-tuned language model on Hugging Face Spaces or Streamlit for customer support, and evaluate it using ROUGE and BLEU metrics. Dataset: Customer service dataset or Bank FAQ dataset.			
		Contact Hours	**:**	**30**
		Total Contact Hours	**:**	**60**

Course Outcomes: **The students will be able to**	
1	Apply statistical models and text representation techniques to perform foundational NLP tasks and identify bias in AI models. (K3)
2	Apply generative architectures and evaluate transformer-based components to implement text generation using various decoding and sampling strategies.(K4)
3	Analyze the effectiveness of various prompting techniques by deconstructing model reasoning paths to identify logic errors and optimize response accuracy. (K4)
4	Construct a Retrieval-Augmented Generation (RAG) pipeline by integrating Large Language Models with vector databases and parameter-efficient tuning. (K3)
5	Design an end-to-end Generative AI application and evaluate the model performance using standardized metrics. (K6)
Text Book (s):	
1	Tanmoy Chakraborty, "Introduction to Large Language Models – Generative AI for Text", Wiley, 1st Edition, 2024.
2	Thimira Amaratunga, "Understanding Large Language Models: Learning Their Underlying Concepts and Technologies", Apress, 1st Edition, 2023.
Reference Books(s) / Web links:	
1	Valentiana Alto, "Modern Generative AI with ChatGPT and OpenAI Models: Leverage the capabilities of OpenAI's LLM for productivity and innovation with GPT3 and GPT4", Packt Publishing, 1st Edition, 2023
2	Omar Sanseviero, Pedro Cuenca, Apolinario Passos, Jonathan Whitaker, "Hands-On Generative AI with Transformers and Diffusion Models", O Reilly Media, 1st Edition, 2024
3	Michael Lanham, M, "*AI Agents in Action",* Manning Publications., 2025

CO – PO – PSO matrices of course

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	2	2	-	3	-	-	-	3	1	3
CO2	3	2	2	1	3	-	-	-	-	-	-	3	2	1
CO3	2	3	2	2	3	-	-	-	1	2	-	2	3	1
CO4	2	2	3	2	3	-	-	-	2	-	1	3	3	1
CO5	2	2	3	2	3	1	1	2	3	2	3	3	3	2
Average Mapping	2.4	2.2	2.2	1.4	2.8	0.6	0.2	1	1.2	0.8	0.8	2.8	2.4	1.6

1: Slight (Low)2: Moderate (Medium)3: Substantial (High)
No correlation: "-"