SEVENTH SEMESTER

Sr No	Course Category	Course Code	Course Title	Hours per Week			Credits	Maximum Marks				Minimum Passing Marks	No of Hours for ESE
				L	T	P		Mid Semester Examination	Continual Assessment	End Sem Examination	Total		
1	PCC	23AI701T	Natural Language Processing	3	-	-	3	15	15	70	100	45	3
2	PCC	23AI701P	Natural Language Processing Lab	-	-	2	1	-	25	25	50	25	-
3	PCC	23AI702T	Cloud Computing	3	-	-	3	15	15	70	100	45	3
4	PCC	23AI702P	Cloud Computing Lab	-	-	2	1	-	25	25	50	25	-
5	PEC	23AI703T	Professional Elective- IV	3	-	-	3	15	15	70	100	45	3
6	PEC	23AI704T	Professional Elective - V	3	-	-	3	15	15	70	100	45	3
7	MDM	23AI731M	MDM – V (Refer MDM Basket)	3	-	-	3	15	15	70	100	45	3
8	ELC	23AI705P	Project - II	-	-	4	2	-	50	50	100	50	-
9	ELC	23AI706P	Summer / Winter Internship*	-	-	-	2	-	50	-	50	25	-
			Total	**15**	**0**	**8**	**21**	**75**	**225**	**450**	**750**		

*** Summer / Winter Internship (Evaluation of Four weeks Internship Completion till 6th Semester)**

Multidisciplinary Minor - V	
23AI731M	Expert Systems for Artificial Intelligence

Professional Elective- IV	
23AI703T(i)	Soft Computing
23AI703T(ii)	Business Intelligence and Analytics
23AI703T(iii)	Fundamentals of Cyber Security

Professional Elective- V	
23AI704T(i)	Business Problem Solving with AI
23AI704T(ii)	Generative AI
23AI704T(iii)	Autonomous Systems

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23AI701T	Natural Language Processing	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
This course is intended 1. To Understand linguistic foundations and preprocessing techniques in NLP. 2. To Apply statistical models for language modelling and tagging tasks. 3. To Implement neural network models for text representation and sequence learning.	**Students will be able to** 1. Explain core NLP concepts and preprocessing techniques. 2. Apply statistical methods for POS tagging and sequence modelling. 3. Implement neural language models for NLP tasks. 4. Analyse and fine-tune transformer-based models for information extraction. 5. Design and evaluate NLP applications considering accuracy and ethics.

Unit I Introduction	[9Hrs]
NLP overview, evolution, and applications, Linguistic foundations: morphology, syntax, semantics, pragmatics, NLP pipeline and challenges (ambiguity, low-resource languages, domain shift), Text preprocessing: tokenization, normalization, stemming vs lemmatization, NLP libraries and ecosystems: NLTK, spaCy, Hugging Face (overview), NLP datasets and benchmarks	
Unit II Parsing & Tagging	**[9Hrs]**
Bag of Words, TF–IDF, N-gram language models, Smoothing techniques, Hidden Markov Models (HMMs), POS tagging and sequence labelling, Viterbi algorithm, Evaluation metrics: accuracy, precision, recall, F1-score.	
Unit III : Neural Language Models & Word Representations	**[9Hrs]**
Distributional semantics, Word embeddings: Word2Vec, GloVe, FastText, Neural language models, Recurrent Neural Networks (RNN), LSTM, GRU, Sequence-to-sequence models and attention mechanism, Intro to pre-trained embeddings and transfer learning.	
Unit IV: Transformers & Information Extraction	**[9Hrs]**
Transformer architecture (self-attention concept), Pretrained language models (BERT, GPT – conceptual overview), Fine-tuning for downstream tasks, Named Entity Recognition (NER), Relation Extraction, Topic Modelling (LDA – overview), Semantic similarity and word sense disambiguation.	
Unit V: NLP Applications, Evaluation & Ethics	**[9Hrs]**
Text classification and sentiment analysis, Question answering systems, Multilingual and cross-lingual NLP, Conversational AI and dialog systems, NLP in Information Retrieval, Evaluation frameworks and error analysis, Ethical issues: bias, fairness, privacy, hallucinations, Case studies and industry applications.	

Textbooks

S.N.	Title	Authors	Edition	Publisher
1	Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition	Daniel Jurafsky and James H. Martin	2nd	Prentice Hall, 2008
2	Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit	Steven Bird, Ewan Klein, Edward Loper	1st	O'Reilly Media
3	Foundations of Statistical Natural Language Processing	Christopher D. Manning and Hinrich Schütze	1st	MIT Press, 1999

Reference Books

S.N.	Title	Authors	Edition	Publisher
1	Neural Network Methods for Natural Language Processing	Yoav Goldberg	1st	Morgan & Claypool / Springer
2	Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems	Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana	1st	O'Reilly Media

		July 2026	NEP 1.0	Applicable for 2026-27
Chairman - BoS	Dean – Academics	Date of Release	Version	

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23AI701P	Natural Language Processing lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended to 1. To Learn basics of NLP tools and libraries for text processing. 2. To Apply preprocessing techniques such as tokenization, stemming, and tagging. 3. To Implement statistical and neural models for NLP tasks.	**Students will be able to** 1. Apply NLP libraries to perform text preprocessing tasks. 2. Implement POS tagging, parsing, and chunking techniques. 3. Build basic NLP models for text classification and analysis. 4. Analyze text data using NLP algorithms and evaluation metrics. 5. Develop a mini-project to solve a real-world NLP problem.

Expt. No.	Title of the experiment
1	Text preprocessing: tokenization, lemmatization using NLTK / spaCy
2	POS tagging and chunking
3	N-gram language model implementation
4	Text classification using TF–IDF + ML classifier
5	Word embeddings using Word2Vec / GloVe
6	Named Entity Recognition using spaCy / HuggingFace
7	Sentiment analysis using deep learning
8	Transformer-based text classification (BERT – fine-tuning demo)
9	Mini Project: End-to-end NLP application (chatbot, review analyzer, FAQ bot, etc.)

Reference Books

S.N.	Title	Authors	Edition	Publisher
1	Handbook of Natural Language Processing	Dale R., Moisl H. and Somers H	2^{nd}	MARCEL DEKKER, Inc., 2009
2	Natural Language Processing with Python	Bird, S.K. Ewan and Loper E.	2^{nd}	Oreilly Publication, 2009

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23AI702T	Cloud Computing	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
This course is intended 1. To Provide fundamentals and essentials of Cloud Computing 2. To Adopt Cloud Computing tools and services for real life scenarios 3. To Use commercial systems such as Google Apps, Microsoft Azure and Amazon Web Services etc. 4. To Impart knowledge in applications of cloud computing	**Students will be able to** 1. Deploy real-world applications onto the cloud 2. Distinguish between Public, Private and hybrid clouds 3. List the requirements of various service paradigms in cloud computing 4. Describe Datacenter requirements for the cloud 5. Summarize historical perspective and recent trends

Unit I: Introduction to Cloud Computing	[9Hrs]
Introduction: Importance of Cloud Computing, Characteristics, Pros and Cons of Cloud Computing, Migrating into the Cloud, Seven-step model of migration into a Cloud Trends in Computing Cloud Service Models SaaS, PaaS, IaaS, Cloud Architecture: Cloud Computing Logical Architecture, Developing Holistic Cloud Computing Reference Model, Cloud System Architecture, Cloud Deployment Models	
Unit II: Virtualization	**[9Hrs]**
Introduction to Virtualization: Definition of Virtualization, Adopting Virtualization, Types of Virtualization, Virtualization Architecture and Software, Virtual Clustering Virtualization Application, Pitfalls of Virtualization Grid, Cloud and Virtualization, Virtualization in Grid, Virtualization in Cloud, Virtualization and Cloud Security Virtualization and Cloud Computing Anatomy of Cloud Infrastructure, Virtual infrastructures, CPU Virtualization, Network and Storage Virtualization	
Unit III: Cloud Storage	**[9Hrs]**
Cloud Storage: Data Management, Provisioning Cloud storage, Data Intensive Technologies for Cloud Computing Cloud Storage from LANs to WANs: Cloud Characteristics, Distributed Data Storage.	
Unit IV: Risks Management and Data Security	**[9Hrs]**
Risks in Cloud Computing: Risk Management, Enterprise-Wide Risk Management Types of Risks in Cloud Computing. Data Security in Cloud: Security issues, Challenges, advantages, Disadvantages, Cloud Digital persons and Data security, Content Level Security. Cloud Security Services: Confidentiality, Integrity and Availability, Security Authorization Challenges in the Cloud, Secure Cloud Software I Requirements, Secure Cloud Software Testing	
Unit V: Historical Perspective and Recent Trends	**[9Hrs]**
Historical Perspective, Datacenter Components, Design Considerations, Power Calculations, Evolution of Data Centers. Recent Trends: Trends in Cloud Computing, Mobile Cloud, Automatic Cloud Computing: Comet Cloud. Multimedia Cloud: IPTV, Energy Aware Cloud Computing, Jungle Computing. Distributed Cloud Computing Vs Edge Computing, Containers, Docker, and Kubernetes.	

Text Books

S.N.	Title	Authors	Edition	Publisher
1	Mastering Cloud Computing	Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi,	1^{st}	McGraw Hill Education,
2	Cloud Computing: A Practical Approach for Learning and Implementation	A.Srinivasan, J. Suresh,	1^{st}	Pearson

Reference Books

S.N.	Title	Authors	Edition	Publisher
1	The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling	Ralph Kimball & Margy Ross	3^{rd}	Wiley & Sons

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23AI702P	Cloud Computing Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended 1. To Explain the fundamental principles, characteristics, and historical evolution of Cloud Computing and Data Centers 2. To Examine the various cloud service models (IaaS, PaaS, SaaS) and deployment models (Public, Private, Hybrid) for organizational needs. 3. To Demonstrate the mechanisms of virtualization (CPU, Network, and Storage) and its role in building cloud infrastructure.	**Students will be able to** 1. Analyze the concept and architecture of SaaS and PaaS applications using Salesforce CRM. 2. Implement SaaS and PaaS applications using Salesforce CRM including different cloud services such as App Cloud, Sales Cloud, Service Cloud and Marketing Cloud. 3. Demonstrate the process of launching and configuring IaaS instances in AWS cloud environment. 4. Analyze the procedure of static website hosting and cloud resource management in AWS. 5. Evaluate cloud security and containerization mechanisms by implementing Identity & Access Management (IAM) and containers using Docker or Kubernetes.

Expt. No.	List of Experiments
1	SaaS Application Using Salesforce CRM
2	PAAS Application using Salesforce CRM.
3	App Cloud, Marketing Cloud, Sales Cloud, Service Cloud and different types of Clouds in Salesforce CRM.
4	IaaS Instance Launch in AWS.
5	Static Website Hosting in AWS
6	Identity & Access Management in AWS.
7	Containers – Docker or Kubernet
8	Micro Project

Reference Books

S.N.	Title	Authors	Edition	Publisher
1	Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more	Dr. Kris Jamsa	1^{st}	WPublications
2	Cloud Computing A hands –on approach	A.Bahga & Vijay Madisetti	1^{st}	University Press

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Chairman - BoS	Dean – Academics	Date of Release	Version	

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23AI703T(i)	PE - IV Soft Computing	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
This course is intended 1. To understand the basic concepts of Soft Computing. 2. To apply the variousconcepts of soft computing in other application areas.	**Students will be able to** 1. Learn soft computing techniques and their applications. 2. Analyze various neural network architectures 3. Apply perceptron's and counter propagation networks to real time applications 4. Define the fuzzy systems 5. Analyze the genetic algorithms and their applications.

Unit I: Introduction	**[9Hrs]**
Introduction to soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing. Artificial Intelligence: Introduction, Various types of production systems, characteristics of production systems,	
Unit II: Neural Network	**[9Hrs]**
Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference b/w ANN and human brain, characteristic and applications of ANN, single layer network.	
Unit III: Perceptron	**[9Hrs]**
Perceptron training algorithm, Linear separability , Widrow & Hebb's learning rule/Delta rule, ADALINE, MADALINE, AI v/s ANN. Introduction of MLP, different activation functions, Error back propagation algorithm, derivation of BBPA, momentum, limitation, characteristics and application of EBPA.	
Unit IV: Fuzzy Logic and Algorithms	**[9Hrs]**
Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions. Fuzzy rule base system: Fuzzy propositions, formation, decomposition & aggregation of fuzzy Rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making & Applications of fuzzy logic.	
Unit V: Genetic algorithm	**[9Hrs]**
Fundamental, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator ,Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional methods.	

Text Books

S.N.	Title	Authors	Edition	Publisher
1	Principles of Soft Computing	S.N. Sivanandam & S.N. Deepa,	2nd	Wiley Publication
2	Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications	S Rajasekaran & G.A. Vijayalakshmi Pai,	1st	PHI Publication

Reference Books

S.N.	Title	Authors	Edition	Publisher
1	Neural Network fundamental with Graph, Algorithms & Applications	N.K.Bose, Ping Liang,	1st	TMH
2	Neural Network and Fuzzy System	Bart Kosko	1st	PHI Publication

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23AI703T(ii)	PE - IV Business Intelligence and Analytics	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
This course is intended 1. To understand the concepts, architecture, and applications of Business Intelligence in organizational decision-making. 2. To develop analytical skills using data warehousing, data mining, and visualization techniques. 3. To apply business analytics tools and methods to solve real-world business problems.	**Students will be able to** 1. Explain the fundamentals of Business Intelligence and Analytics and their role in business strategy. 2. Design and implement data warehouses and multidimensional data models. 3. Apply data mining techniques for pattern discovery and predictive analysis. 4. Use business analytics and visualization tools to support managerial decision-making. 5. Analyze business data to generate actionable insights and recommendations.

Unit I: Introduction to Business Intelligence	(9Hrs)
Business Intelligence: Intelligence concepts and definitions, evolution of BI systems, importance of BI in competitive advantage, BI components and architecture, BI lifecycle, BI vs Business Analytics, decision support systems, role of BI in strategic, tactical, and operational decision-making.	
Unit II: Sensors Data Warehousing	**(9Hrs)**
Data Warehouse : Concepts and Characteristics, data warehouse architecture (three-tier architecture), data sources, ETL (Extract, Transform, Load) processes, data cleaning and integration, metadata management, data marts, OLAP concepts and operations (slice, dice, roll-up, drill-down), multidimensional data models, schema design (star, snowflake, fact constellation), performance and scalability issues.	
Unit III: Data Mining Concepts and Techniques	**(9Hrs)**
Data Mining: Introduction and knowledge discovery process, data preprocessing techniques (data cleaning, transformation, normalization), classification techniques (decision trees, naïve Bayes), clustering methods (k-means, hierarchical clustering), association rule mining (Apriori algorithm), regression analysis, anomaly and outlier detection, evaluation of data mining models	
Unit IV: Business Analytics	**(9Hrs)**
Business analytics framework, types of analytics: descriptive, diagnostic, predictive, and prescriptive analytics, statistical analysis for business decisions, forecasting methods, optimization techniques, simulation models, Introduction to Analytic tools and platform.	
Unit V: Data Visualization and Advanced BI	**(9Hrs)**
Feedback and feedforward control, PID control for autonomous systems, Model-Role of visualization in BI, principles and best practices of data visualization, charts and graphs for business reporting, dashboards and scorecards, key performance indicators (KPIs), cloud-based BI solutions, AI and machine learning applications in BI	

Text Books

S.N.	Title	Authors	Edition	Publisher
1	Business Intelligence, Analytics, and Data Science: A Managerial Perspective	Ramesh Sharda, Dursun Delen, Efraim Turban	4th	Pearson Education
2	Business Intelligence Guidebook: From Data Integration to Analytics	Rick Sherman	1st	Morgan Kaufmann / Elsevier
3	Business Intelligence & Data Warehousing Simplified	Arshad Khan	1st	Mercury Learning & Information

Reference Books

S.N.	Title	Authors	Edition	Publisher
1	The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling	Ralph Kimball & Margy Ross	3rd	Wiley & Sons
2	Business Intelligence and Analytics	Naveen Kumar Singh & Shanu Gupta	1st	S.K. Kataria & Sons

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23AI703T(iii)	PE – IV Fundamentals of Cyber Security	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
This course is intended to provide 1. Learning machine learning algorithms and models for Cyber Security problems 2. Demonstration of supervised, unsupervised learning methods. 3. Understand basic theory of classification and regression techniques 4. Use feature extraction from data	**Students will be able to** 1. Comprehend cyber security fundamentals, threats, and data pre-processing techniques. 2. Analyse cyber security data using intrusion detection, clustering, and anomaly detection methods. 3. Apply machine learning algorithms to detect and classify cyber security threats and interpret privacy and ethical concerns. 4. Examine deep learning techniques, privacy-preserving methods, and ethical issues in cyber security systems. 5. Design machine learning-based solutions for real-world cyber security applications.

Unit I : Foundations of Cyber Security & Data Handling	[9Hrs]
Basics of cyber security, types of cyber threats, security data sources, challenges in security data, data preprocessing, feature extraction and selection, case studies.	
Unit II : Cyber Security Analytics & Detection Techniques	**[9Hrs]**
Intrusion detection systems, network and log analysis, anomaly detection, clustering techniques, association rules, evaluation metrics, case studies.	
Unit III : Machine Learning Models for Cyber Security	**[9Hrs]**
Introduction to ML in cyber security, classification (logistic regression, decision trees, SVM), clustering, model evaluation metrics, case studies.	
Unit IV : Deep Learning, Privacy & Ethics in Cyber Security	**[9Hrs]**
Deep learning basics (CNN, RNN), privacy-preserving techniques, ethics and bias in ML models, adversarial attacks, case studies.	
Unit V : Advanced Applications of ML in Cyber Security	**[9Hrs]**
Intrusion detection, malware analysis, fraud detection, phishing detection, cyber threat intelligence, real-time applications, case studies.	

Textbooks

S.N.	Title	Authors	Edition	Publisher
1	Machine Learning for Cyber security Cookbook	Sudhanshu Chouhan	2nd	PHI
2	Feature Engineering for Machine Learning: Principles and Techniques for Data Scientists	Alice Zheng and Amanda Casari	**6th**	Willy

Reference Books

S.N.	Title	Authors	Edition	Publisher
1	Hands-On Machine Learning for Cyber security	Soma Halder and Sinan Ozdemir	2nd	PHI
2	Machine Learning and Security: Protecting Systems with Data and Algorithms	Clarence Chio and DavidFreeman	2nd	Oreilly Publication

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23AI704T(i)	PE - V Business Problem Solving with AI	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
This course is intended 1. Understand the role of AI in business strategy and decision-making. 2. Identify and evaluate AI use cases for real-world business problems. 3. Apply AI techniques such as predictive analytics and automation in business contexts.	**Students will be able to** 1. Analyse business problems and select appropriate AI solutions. 2. Develop predictive models for forecasting and customer analytics. 3. Apply AI techniques in operations, marketing, and decision-making. 4. Evaluate ethical, legal, and governance aspects of AI systems. 5. Formulate strategies for effective AI adoption in organizations.

Unit I The AI Landscape & Strategy	[9Hrs]
AI vs. Traditional Software: Understanding deterministic vs. probabilistic business solutions. The AI Ladder: Data collection, organization, analysis, and infusion into business processes. Identifying Use Cases: Assessing feasibility vs. impact; the AI Readiness Framework. Economic Impact: Cost reduction vs. revenue enhancement; the "Buy vs. Build" dilemma.	
Unit II Predictive Analytics & Forecasting	**[9Hrs]**
Demand Forecasting: Time-series analysis for inventory management and supply chain. Customer Churn & CLV: Using classification models to predict and prevent customer loss. Propensity Modeling: Identifying which customers are most likely to buy, click, or convert. Risk Assessment: Credit scoring and fraud detection in Fintech using anomaly detection.	
Unit III Operational Efficiency & Automation	**[9Hrs]**
Robotic Process Automation (RPA) AI: Moving from simple macros to Intelligent Document Processing (IDP). Optimization Problems: Using Linear Programming and Genetic Algorithms for logistics and scheduling. NLP in Business: Sentiment analysis for brand monitoring and automated customer support (Chatbots/Agents). Knowledge Management: Building internal "Second Brains" using Enterprise Search and RAG (Retrieval-Augmented Generation).	
Unit IV Algorithmic Marketing & Personalization	**[9Hrs]**
Recommender Systems: Collaborative vs. Content-based filtering (The Netflix/Amazon model). Dynamic Pricing: Real-time price optimization based on supply, demand, and competitor data. Market Basket Analysis: Using Association Rules to improve cross-selling and store layouts. Programmatic Advertising: How AI automates the buying and placement of digital ads.	
Unit V AI Governance, Ethics & Implementation	**[9Hrs]**
The Black Box Problem: Explainable AI (XAI) and why stakeholders need to trust the "Why" behind a prediction. Ethics & Bias: Identifying algorithmic bias in hiring, lending, and law enforcement. Data Privacy: GDPR, CCPA, and the implications of using customer data for training models. Change Management: Preparing the workforce for AI augmentation (The "Human-in-the-loop" model).	

Textbooks

S.No	Title	Authors	Edition	Publisher
1	Prediction Machines: The Simple Economics of Artificial Intelligence	Agrawal, A., Gans, J., & Goldfarb, A.	1st	Harvard Business Review Press.
2	Data Science for Business	Provost, F., & Fawcett	1st	O'Reilly Media

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Marketing Data Science: Modeling Techniques in Predictive Analytics	Miller, T. W. (2015).	1st	FT Press
2	Competing in the Age of AI	Iansiti, M., & Lakhani, K. R.	1st	. Harvard Business Review Press

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23AI704T(ii)	PE – V Generative AI	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
This course is intended 1. To provide fundamental concepts and architectures of Generative AI systems. 2. To use Techniques for training and evaluating generative models. 3. To Learn Practical understanding of modern large language models and multimodal systems.	**Students will be able to** 1. Learn the fundamentals, architectures, and applications of Generative AI. 2. Apply preprocessing, representation, and training techniques for generative models. 3. Use different generative approaches (text, image, and multimodal) effectively. 4. Evaluate generative models using appropriate metrics and human evaluation methods. 5. Analyse advanced topics such as prompt engineering, alignment, and ethical considerations.

UNIT I: Introduction to Generative AI	[9 Hrs]
History and evolution of AI to Gen AI, Deep Learning revolution and Transfer Learning, Discriminative vs Generative models, Overview of Neural Networks (ANN, CNN, RNN), Natural Language Processing (NLP) for Generation of text.	
Unit II: Text Processing & Representation	**[9Hrs]**
Text preprocessing: Tokenization, normalization, tokenization, embedding techniques: One-hot encoding, Word embeddings, Contextual embeddings, Sequence modeling basics, Attention mechanism, Positional encoding ,Data preparation for generative tasks ,Handling large-scale datasets	
Unit III: Generative Models	**[9Hrs]**
N-gram Language Models, Neural Language Models, Recurrent Neural Networks (RNN, LSTM, GRU), Transformer architecture, Encoder-Decoder models, Large Language Models (LLMs), Generative models for images: GANs, VAEs, Diffusion models, Multimodal models (text-to-image, text-to-video).	
Unit IV: Training & Evaluation of Generative Models	**[9Hrs]**
Training objectives (Maximum Likelihood Estimation), Loss functions for generation, Evaluation metrics, Human evaluation techniques, Fine-tuning and transfer learning Reinforcement Learning from Human Feedback (RLHF), hallucination, and reliability issues	
Unit V: Advanced Topics & Applications of Gen AI	**[9Hrs]**
Object recognition pipeline: detection vs recognition. Template matching and feature-based recognition. Bag-of-visual-words model. Image classification approaches. Introduction to learning-based visual recognition. Face recognition and object category recognition. Overview of deep learning for visual recognition: convolutional neural networks (CNNs), transfer learning (conceptual). Applications: autonomous systems, medical imaging, surveillance.	

Text Books

S.N.	Title	Authors	Edition	Publisher
1	Generative AI for Everyone: Understanding the Essentials and Applications of This Breakthrough Technology	Altaf Rehmani	1st	Independently Published / Tech Press
2	Deep Learning	Ian Goodfellow, Yoshua Bengio, Aaron Courville	1st	MIT Press, 2016
3	Neural Networks and Deep Learning: A Textbook	Charu C. Aggarwal	1st	Wiley / Tech Publications, 2024

Reference Books

S.N.	Title	Authors	Edition	Publisher
1	Generative Adversarial Networks Cookbook: Over 100 Recipes to Build Generative Models Using Python, TensorFlow, and Keras	Josh Kalin	1st	Packt Publishing, 2018

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23AI704T(iii)	PE – V Autonomous Systems	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
This course is intended 1. To provide the fundamental principles of autonomous systems, including intelligent decision-making, sensing, perception, localization, and navigation techniques. 2. To apply planning, control, and learning methods that enable autonomous behavior in intelligent systems. 3. To use knowledge for real-world autonomous applications such as robots, drones, and self-driving vehicles.	**Students will be able to** 1. Explain the architecture and components of autonomous systems 2. Apply sensing and perception techniques for environment understanding. 3. Design navigation and path-planning algorithms 4. Implement control strategies for autonomous agents 5. Analyze ethical, safety, and real-world challenges in autonomy.

Unit I: Introduction to Autonomous Systems	[9 Hrs]
Definition, Characteristics (5Vs), Challenges & Applications, Levels of autonomy, System architecture and Sensors, actuators, computation and components of Autonomous System. Applications: robotics, autonomous vehicles, drones, industrial automation	
Unit II: Sensors and Perception	**[9 Hrs]**
Types of Sensors, Sensors used in Autonomous System, Proprioceptive vs exteroceptive sensors, Cameras, LiDAR, Radar, Ultrasonic sensors, Sensor fusion concepts, Feature extraction and object detection, Introduction to computer vision for autonomy, Autonomous ground vehicles, Aerial and underwater autonomous systems	
Unit III: Localization and Mapping	**[9 Hrs]**
Definition, Standard Protocols in Localization, Coordinate frames and transformations, Localization techniques: GPS, dead reckoning, Kalman Filter and Extended Kalman Filter, Simultaneous Localization and Mapping (SLAM), Autonomous Simulations for Practices, Map representations	
Unit IV: Path Planning and Navigation	**[9 Hrs]**
Configuration space, Path Planning, Graph-based planning: Dijkstra, A*, Sampling-based planning: RRT, PRM, Obstacle avoidance techniques, Motion planning in dynamic environments, multi-agent and swarm systems	
Unit V: Control and Decision Making	**[9 Hrs]**
Feedback and feedforward control, PID control for autonomous systems, Model-based vs model-free control, Decision-making under uncertainty, Introduction to Reinforcement Learning agent for autonomy, Future trends in autonomous intelligence	

Text Books

S.N.	Title	Authors	Edition	Publisher
1	Introduction to Autonomous Mobile Robots	Roland Siegwart, Illah R. Nourbakhsh, Davide Scaramuzza	2nd	MIT Press
2	Probabilistic Robotics	Sebastian Thrun, Wolfram Burgard, Dieter Fox	1st	MIT Press
3	Planning Algorithms	Steven M. LaValle	1st	Cambridge University Press

Reference Books

S.N.	Title	Authors	Edition	Publisher
1	Modern Robotics: Mechanisms, Planning, and Control	Kevin M. Lynch, Frank C. Park	1st	Cambridge University Press
2	Introduction to Robotics: Mechanics and Control	John J. Craig	4th	Pearson

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23AI731M	MDM – V Expert Systems for Artificial Intelligence	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
This course is intended to 1. Learn the basics of an expert system. 2. Gain knowledge about implementation of an expert system.	**Students will be able to** 1. Interpret the basics of the expert system. 2. Learn theoretical foundation of expert system. 3. Distinguish the various types of expert systems. 4. Comprehend the various components of an expert system. 5. Develop the expert system.

Unit I: Introduction to Expert Systems	[9Hrs]
The nature of Expert Systems Types of applications of Expert Systems relationship of Expert Systems to Artificial Intelligence and to Knowledge-Based Systems. The nature of expertise Distinguishing features of Expert Systems. Benefits of using an Expert System Choosing an application.	
Unit II: Inference in ES	**[8Hrs]**
Theoretical Foundations What an expert system is; how it works and how it is built. Basic forms of inference: abduction; Deduction; induction.	
Unit III: Knowledge base in ES	**[10Hrs]**
The representation and manipulation of knowledge in a computer; Rule-based representations (with backward and forward reasoning); logic-based representations (with resolution refutation); taxonomies; meronomies; frames (with inheritance and exceptions); semantic and partitioned nets (query handling).	
Unit IV: Development of ES	**[9Hrs]**
Basic components of an expert system; Generation of explanations; Handling of uncertainties; Truth Maintenance Systems; Expert System Architectures; An analysis of some classic expert systems; Limitations of first-generation expert systems; Deep expert systems; Co-operating expert systems and the blackboard model.	
Unit V: Representation and evaluation	**[9Hrs]**
Building Expert Systems Methodologies for building expert systems: knowledge acquisition and elicitation; formalization; representation and evaluation. Knowledge Engineering tools, Case Study.	

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1	Introduction to Expert Systems	P Jackson	2nd	Addison Wesley.
2	Artificial Intelligence	Elaine Rich, Kevin Knight	2nd	McGraw-Hill, Inc.

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1	Problem Solving and Artificial Intelligence	Jean-Louis Lauriere	3rd	Prentice Hall.

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23AI705P	Project – II	-	-	4	2	50	50	100

Course Objectives	Course Outcomes
This course is intended to provide 1. Provide students with exposure to real-world problem identification and solution development processes. 2. Enable students to apply theoretical knowledge and technical skills to design and develop practical systems. 3. Foster analytical thinking, experimentation, testing, and performance evaluation abilities. 4. Cultivate professional ethics, teamwork, documentation practices, and technical communication skills.	**Students will be able to** 1. Analyze real-world problems and formulate clear problem statements with defined objectives and scope. 2. Design and develop appropriate solutions using suitable algorithms, tools, and methodologies. 3. Implement, test, and evaluate the project outcomes using relevant performance metrics and validation techniques. 4. Demonstrate professional ethics, effective documentation, teamwork, and technical presentation skills during project execution.

Course Plan	4 Hrs
The course is designed to cover the complete project development lifecycle, beginning with problem identification, literature review, and formulation of clear objectives. This is followed by system design and selection of appropriate algorithms, tools, and methodologies. The project progresses through development, implementation, testing, and performance evaluation with continuous monitoring through scheduled seminars and reviews. The course concludes with final validation, report submission, and technical presentation, ensuring structured exposure to real-world project development practices and professional standards.	