Minor - AI APPLICATIONS & EMERGING TECHNOLOGIES - Offered by CAI Department

S.No	Course Code	CourseTitle	F	Scheme of Instructions HoursperWeek L T P C					
			L				I E		Total
1	23MRAIA1	AI in Finance & Business Analytics	3	-	ı	3	30	70	100
2	23MRAIA2	Ethical AI & Responsible AI	3	-	ı	3	30	70	100
3	23MRAIA3	Generative AI & Prompt Engineering	3	-	ı	3	30	70	100
4	23MRAIA4	AI in Cyber Security	3	-	ı	3	30	70	100
5	23MRAIA5	AI in HealthCare	3	-	ı	3	30	70	100
6	23MRAIA6	Generative AI Lab	-	-	3	1.5	30	70	100
7	23MRAIA7	AI Applications Lab	-	-	3	1.5	30	70	100

CAI Department AI APPLICATIONS & EMERGING TECHNOLOGIES

23MRAIA1	AI IN FINANCE & BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVES:

- Understand the fundamentals and applications of AI in finance and business.
- Explore machine learning and deep learning techniques for financial data modeling.
- Analyze predictive analytics for stock market, risk, and fraud detection.
- Develop AI-based solutions for customer segmentation, churn prediction, and pricing.
- Evaluate ethical, regulatory, and technological challenges in deploying AI in business.

UNIT -1: Introduction to AI in Finance & Business:

(9)

Overview of Financial Systems and Analytics- Introduction to Artificial Intelligence and ML in Business- Business Intelligence vs. Business Analytics- Types of Financial Data (Transactional-Time-Series- Textual)- Use Cases of AI in Banking- Insurance- and Stock Markets- Tools for Business Analytics: Python- Power BI- Tableau- Descriptive- Predictive- and Prescriptive Analytics- Case Study: AI in Robo-Advisory Systems

UNIT -2: Machine Learning for Financial Analytics

(9)

Data Preprocessing for Financial Applications- Regression for Stock Price Prediction- Classification Models for Credit Scoring- Clustering for Customer Segmentation- Time Series Analysis using ARIMA- LSTM- Portfolio Optimization using Reinforcement Learning- AI in Algorithmic Trading Strategies- Model Validation Techniques: Cross-validation- A/B Testing

UNIT -3: AI for Risk- Fraud- and Compliance

(9)

Credit Risk Modeling using Decision Trees and XGBoost- Fraud Detection using Anomaly Detection Models- Real-Time Risk Scoring Systems- Anti-Money Laundering (AML) Compliance Models-Sentiment Analysis for Financial News and Tweets- Predictive Maintenance and Financial Risk Analysis- Explainable AI in Financial Decision Systems- Case Study: Fraud Detection in Credit Card Transactions

UNIT -4: AI for Business Process Optimization

(9)

Customer Lifetime Value Prediction- Churn Prediction using Ensemble Models- Dynamic Pricing Models using AI- AI in Demand Forecasting- Chatbots for Customer Support and Financial Advisory- Recommendation Systems in E-Commerce and Retail- Optimization in Supply Chain Analytics- AI-driven Marketing Campaigns and ROI Analysis

UNIT -5: Ethics, Deployment and Future Trends

(9)

Ethics of AI in Finance: Bias- Fairness- and Transparency- Regulatory Frameworks (GDPR- RBI-SEBI- PSD2)- Data Privacy and Governance in Financial Institutions- Explainable AI (XAI) for Auditing and Trust- Scalable AI Architectures (ML Ops in Business)- Fintech Innovations: Blockchain- AI- and Smart Contracts- Generative AI and Large Language Models in Business Analytics- Designing AI-Powered Financial Products (Use Case Projects)

Total Hours: 45

COURSE OUTCOMES:

On su	ccessful completion of the course- students will be able	Bloom's Level
CO1	Understand financial systems and analytics tools for business insights	Understand (L2)
CO2	Apply AI/ML models for risk assessment- fraud detection- and market prediction	Apply (L3)
соз	Analyze customer behavior using segmentation and recommendation systems	Analyze (L4)
CO4	Evaluate AI tools for performance optimization in business decisions	Evaluate (L5)
CO5	Design intelligent business systems using ethical AI techniques	Create (L6)

TEXT BOOKS:

- 1. "Artificial Intelligence in Finance" by Yves Hilpisch O'Reilly
- 2. "Applied Artificial Intelligence in Finance" by Yves Hilpisch Wiley
- 3. "Business Analytics: The Science of Data-Driven Decision Making" by U. Dinesh Kumar
 - Wiley India

REFERENCE BOOKS:

- 1. "Machine Learning for Financial Risk Management" by Abdullah Karasan Springer
- 2. "Data Science for Business" by Foster Provost & Tom Fawcett O'Reilly
- 3. "Machine Trading" by Ernest Chan Wiley
- 4. Research Articles from Journal of Financial Data Science, Harvard Business Review, and ACM Transactions on Management Information Systems.

REFERENCE WEBSITE:

Platform Course Title & Link

Coursera AI in Finance by NYIF

edX Artificial Intelligence in Business

23MRAIA2	ETHICAL AI & RESPONSIBLE AI	L	T	P	C
		3	0	0	3

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVES:

- Understand the ethical foundations and challenges in AI systems.
- Explore fairness, accountability, transparency, and interpretability in AI.
- Identify social, legal, and cultural impacts of deploying AI at scale.
- Learn frameworks for responsible AI governance and regulations.
- Design and evaluate AI systems with ethical and responsible principles.

UNIT -1: Foundations of AI Ethics:

(9)

Introduction to AI and Ethics- Ethical Theories: Utilitarianism- Deontology- Virtue Ethics- AI's Role in Society: Risks and Benefits- Data Ethics and Consent- AI Decision-Making vs. Human Judgment- Algorithmic Responsibility and Trust- Moral Machine Experiment and Human-AI Dilemmas- Case Study: Ethical Challenges in Autonomous Vehicles

UNIT -2: Bias, Fairness & Discrimination in AI

(9)

Understanding Algorithmic Bias- Types of Bias: Historical- Sampling- Label- Measurement-Disparate Impact and Fairness Metrics- Mitigating Bias: Pre-processing- In-processing- Post-processing- Audit and Testing of AI Systems- Intersectionality and Social Justice in AI- Case Study: Racial Bias in Facial Recognition Systems- Tools for Fair AI: IBM AI Fairness 360- Fairlearn

UNIT -3: AI for Risk- Fraud- and Compliance

(9)

Explainability vs Interpretability- Model-Agnostic vs. Intrinsic Explainability- SHAP- LIME- and Counterfactual Explanations- Black-Box vs. Glass-Box Models- Accountability Frameworks for AI Developers- Documentation: Datasheets for Datasets- Model Cards- Role of Human Oversight-Case Study: Transparent Credit Scoring Systems

UNIT -4: Responsible AI Governance & Regulations

(9)

AI Governance Frameworks (OECD- NITI Aayog- EU AI Act)- Ethics Guidelines from IEEE-UNESCO- ISO/IEC- Legal Responsibility and Liability in AI- Data Protection Laws: GDPR- HIPAA-Ethics Boards and Risk Assessment Models- AI Ethics in Industry: Google- Microsoft- Meta Case Studies- Inclusive Design and Accessibility- Open Source & Community Involvement in ResponsibleAI

UNIT -5: Emerging Topics & Global Perspective

(9)

Ethical Issues in Generative AI (ChatGPT- DALL•E)- Deepfakes and Information Manipulation-Autonomous Weapons and AI in Warfare- AI and Climate Change Mitigation- Emotional AI- Neuro AI- and Human Rights- AI in Healthcare- Finance- and Education: Ethical Outlook- Cultural and Geopolitical Dimensions of AI Deployment- Capstone Project: Designing a Responsible AI Use Case

Total Hours: 45

COURSE OUTCOMES:

On su to	ccessful completion of the course- students will be able	Bloom's Level
CO1	Explain ethical theories and values applied to AI systems	Understand (L2)
CO2	Identify bias, fairness, and accountability issues in AI systems	Analyze (L4)
CO3	Evaluate the ethical impact of AI across industries and society	Evaluate (L5)
CO4	Recommend design choices for building responsible AI applications	Apply (L3)
CO5	Develop AI solutions aligned with global policies and ethical standards	Create (L6)

TEXT BOOKS:

- "Ethics of Artificial Intelligence and Robotics" Stanford Encyclopedia of Philosophy
- 2. "Ethics of Artificial Intelligence" by Markus D. Dubber, Frank Pasquale, Sunit Das
- 3. "Weapons of Math Destruction" by Cathy O'Neil
- **4. "Artificial Unintelligence: How Computers Misunderstand the World"** by Meredith Broussard

REFERENCE BOOKS:

- 1. "Rebooting AI" by Gary Marcus and Ernest Davis
- 2. "The Ethical Algorithm" by Michael Kearns and Aaron Roth
- 3. IEEE Standards for Ethically Aligned Design
- 4. UNESCO Recommendations on Ethics of AI.

REFERENCE WEBSITE:

Platform Course Title & Link
Coursera AI For Everyone by Andrew Ng

23MRAIA3	GENERATIVE AI & PROMPT ENGINEERING	L	T	P	C
		3	0	0	3

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVES:

- Understand the fundamental principles behind generative models, including transformers and diffusion models.
- Explore various architectures like GPT, DALL•E, BERT, and Stable Diffusion.
- Learn prompt engineering strategies to guide LLMs effectively for various tasks.
- Develop skills to build applications using Generative AI APIs (e.g., OpenAI, Hugging Face).
- Evaluate the ethical considerations and limitations of generative AI systems.

UNIT -1: Introduction to Generative AI:

(9)

What is Generative AI? – Overview and History, Applications: Text, Images, Code, Audio, Video, Probabilistic Models vs Generative Models, GANs (Generative Adversarial Networks): Intuition, Autoencoders and VariationalAutoencoders, Transformers: Architecture and Attention, Pretrainingvs Fine-tuning, Introduction to GPT, BERT, DALL•E, Stable Diffusion

UNIT -2: Prompt Engineering Techniques

(9)

What is Prompt Engineering?, Few-shot, One-shot, and Zero-shot Prompting, Role-based Prompting (e.g., "Act as..."), Chain-of-Thought Prompting, Prompt Templates and Variables, Prompt Evaluation and Refinement, Prompt Injection Attacks & Defenses, Prompting for Text Summarization, Translation.

UNIT -3: Architectures & Tools for Generative AI

(9)

OpenAI GPT-3, GPT-4: Capabilities & APIs, Hugging Face Transformers and Pipelines, DALL•E and Stable Diffusion for Image Generation, Midjourney& Open-Source Diffusion Models, LangChain for Prompt Chaining, Fine-tuning vs Instruction Tuning, Codex for Code Generation, Tool Use: Notebooks, APIs, VS Code Extensions

UNIT -4: Use Cases & Application Development

(9)

Chatbots& Virtual Assistants with LLMs, Content Generation for Marketing & Blogs, Educational Aids: Auto-Grading & Explanations, Code Generation & Refactoring (Copilot, Codex), Image Generation for Design & Advertising, AI Writing Assistants (e.g., Jasper, Writer.ai), Prompt-Based App Development with LangChain, Evaluating Output Quality: Human-AI Feedback Loop

UNIT -5: Ethical AI & Future Trends

(9)

AI Hallucinations and Misinformation, Bias, Fairness, and Toxicity in Generative AI, Copyright, Plagiarism, and Data Usage Issues, Red Teaming & Safety Testing for LLMs, OpenAI Usage Guidelines and Safety Layers, Explainability& Interpretability in Generative Models, The Future: AGI, Multimodal AI, and Prompt Agents, Capstone Project: Design & Deploy a Prompt-Driven Application

Total Hours: 45

COURSE OUTCOMES:

On su to	ccessful completion of the course- students will be able	Bloom's Level
CO1	Understand foundational concepts of generative AI and prompt engineering	Understand (L2)
CO2	Apply effective prompting techniques for text/image/code generation	Apply (L3)
соз	Analyze different types of generative models and their applications	Analyze (L4)
CO4	Evaluate the performance and output quality of various generative AI tools	Evaluate (L5)
CO5	Design AI-powered solutions using LLMs and prompt design	Create (L6)

TEXT BOOKS:

- 1. "You Look Like a Thing and I Love You" Janelle Shane
- 2. "Deep Learning with Python" François Chollet
- 3. "Prompt Engineering Guide" DAIR.AI (Open Source)
- 4. "Generative Deep Learning" David Foster

REFERENCE BOOKS:

- 1. "Hands-On Generative Adversarial Networks" Josh Kalin
- 2. "Transformers for Natural Language Processing" Denis Rothman
- 3. "Natural Language Processing with Transformers" Lewis Tunstall et al.
- 4. OpenAI Cookbook (GitHub)
- 5. Hugging Face Transformers Documentation

REFERENCE WEBSITE:

Platform Course Title & Link

Coursera Prompt Engineering for ChatGPT

23MRAIA4	AI IN CYBER SECURITY	L	T	P	С
		3	0	0	3

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVES:

- Understand the foundational principles of cybersecurity and AI integration.
- Explore how AI/ML techniques can detect, prevent, and mitigate cybersecurity threats.
- Learn about anomaly detection, malware classification, intrusion detection, and phishing detection using AI.
- Analyze ethical issues, limitations, and adversarial attacks in AI-driven cybersecurity systems.
- Implement AI models for real-time threat intelligence and response.

UNIT -1: INTRODUCTION TO AI IN FINANCE & BUSINESS:

(9)

Overview of Financial Systems and Analytics, Introduction to Artificial Intelligence and ML in Business, Business Intelligence vs. Business Analytics, Types of Financial Data (Transactional, Time-Series, Textual), Use Cases of AI in Banking, Insurance, and Stock Markets, Tools for Business Analytics: Python, Power BI, Tableau, Descriptive, Predictive, and Prescriptive Analytics, Case Study: AI in Robo-Advisory Systems

UNIT -2: Machine Learning for Financial Analytics: (9)

Data Preprocessing for Financial Applications, Regression for Stock Price Prediction, Classification Models for Credit Scoring, Clustering for Customer Segmentation, Time Series Analysis using ARIMA, LSTM, Portfolio Optimization using Reinforcement Learning, AI in Algorithmic Trading Strategies, Model Validation Techniques: Cross-validation, A/B Testing

UNIT -3: AI for Risk, Fraud, and Compliance:

(9)

Credit Risk Modeling using Decision Trees and XGBoost, Fraud Detection using Anomaly Detection Models, Real-Time Risk Scoring Systems, Anti-Money Laundering (AML) Compliance Models, Sentiment Analysis for Financial News and Tweets, Predictive Maintenance and Financial Risk Analysis, Explainable AI in Financial Decision Systems, Case Study: Fraud Detection in Credit Card Transactions

UNIT -4: AI for Business Process Optimization

(9)

Customer Lifetime Value Prediction, Churn Prediction using Ensemble Models, Dynamic Pricing Models using AI, AI in Demand Forecasting, Chatbots for Customer Support and Financial Advisory, Recommendation Systems in E-Commerce and Retail, Optimization in Supply Chain Analytics, AI-driven Marketing Campaigns and ROI Analysis

UNIT -5: Ethics, Deployment, and Future Trends:

(9)

Ethics of AI in Finance: Bias, Fairness, and Transparency, Regulatory Frameworks (GDPR, RBI, SEBI, PSD2), Data Privacy and Governance in Financial Institutions, Explainable AI (XAI) for Auditing and Trust, Scalable AI Architectures (ML Ops in Business), Fintech Innovations: Blockchain, AI, and Smart Contracts, Generative AI and Large Language Models in Business Analytics, Designing AI-Powered Financial Products (Use Case Projects)

Total Hours: 45

COURSE OUTCOMES:

On su to	ccessful completion of the course- students will be able	Bloom's Level
CO1	Explain the fundamentals of AI and its applications in cybersecurity	Understand (L2)
CO2	Apply machine learning models for intrusion and anomaly detection	Apply (L3)
CO3	Analyze malware and phishing threats using AI techniques	Analyze (L4)
CO4	Evaluate and compare different AI-based cybersecurity frameworks	Evaluate (L5)
CO5	Design secure AI-based threat detection and response systems	Create (L6)

TEXT BOOKS:

- 1. "Artificial Intelligence in Finance" by Yves Hilpisch O'Reilly
- 2. "Applied Artificial Intelligence in Finance" by Yves Hilpisch Wiley
- 3. "Business Analytics: The Science of Data-Driven Decision Making" by U. Dinesh Kumar Wiley India

REFERENCE BOOKS:

- 1. "Machine Learning for Financial Risk Management" by Abdullah Karasan Springer
- 2. "Data Science for Business" by Foster Provost & Tom Fawcett O'Reilly
- 3. "Machine Trading" by Ernest Chan Wiley
- 4. Research Articles from Journal of Financial Data Science, Harvard Business Review, and ACM Transactions on Management Information Systems

REFERENCE WEBSITE:

Platform Course Title & Link

Coursera AI in Finance by NYIF

edX Artificial Intelligence in Business

3MRAIA5	AI IN HEALTHCARE	L	T	P	C
		3	0	0	3

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVES:

- To provide a foundational understanding of AI applications in healthcare.
- To familiarize students with medical data types, preprocessing, and ethical considerations.
- To explore ML and DL algorithms tailored for diagnosis, prognosis, and treatment recommendations.
- To expose students to real-world healthcare systems and AI solutions like predictive modeling, EHRs, and medical imaging.
- To enable students to design, evaluate, and deploy AI-driven healthcare applications.

UNIT -1: Introduction to AI in Healthcare:

(9)

(9)

Overview of Healthcare Systems and Data Ecosystem – (U), AI in Clinical Decision Support Systems (CDSS) – (U), Types of Medical Data: EHRs, Imaging, Genomic, Sensor Data – (U), Applications of AI in Diagnosis, Prognosis, and Monitoring – (A), Use Cases: Radiology, Pathology, Oncology, Cardiology – (A), Limitations and Challenges of AI in Healthcare, AI for Telemedicine and Remote Patient Monitoring – (A)

UNIT -2: Medical Data Preprocessing and Feature Engineering:

Data Cleaning, Imputation, and Normalization for Clinical Data – (A), Handling Missing Values, Outliers, and Bias – (A), Feature Engineering from EHRs and Time-Series Data – (A), Text Mining for Medical Notes using NLP – (A), Encoding Diagnosis and Procedure Codes (ICD, CPT) – (U), Temporal Pattern Extraction from Clinical Sequences ,Data Privacy, Anonymization, and HIPAA Compliance – (AN)

UNIT -3: Machine Learning & Deep Learning in Healthcare:

Supervised Learning for Risk Prediction and Classification – (A), Unsupervised Learning for Patient Segmentation – (A), Deep Learning for Medical Imaging: CNNs, Transfer Learning – (A), Recurrent Neural Networks for Time-series Clinical Data ,Survival Analysis and Time-to-Event Prediction – (A), Model Evaluation Metrics: Sensitivity, Specificity, AUC – (E), Handling Imbalanced Datasets in Healthcare – (E), Interpretability in Medical ML Models (LIME, SHAP) – (E)

UNIT -4: Specialized Healthcare AI Applications :

(9)

(9)

AI for Disease Diagnosis: Diabetes, Cancer, Heart Disease – (A), AI in Medical Imaging: X-ray, MRI, CT Scan Analysis – (A), Predictive Modeling for ICU Admission & Mortality Risk – (A), AI in Genomics and Personalized Medicine ,Drug Discovery and Repurposing with AI ,Chatbots and Virtual Health Assistants – (A), Remote Monitoring using IoT&Wearables + AI – (A), Designing an End-to-End AI Solution for a Medical Use Case – (C)

UNIT -5: Ethics, Regulation, and Future Directions in Healthcare AI: (9)

Healthcare: Bias, Fairness, and Accountability ,Regulatory Landscape: FDA Approval, CE Marking – (E), Explainable AI and Clinical Trust – (E), Federated Learning for Privacy-Preserving AI ,Clinical Trials and AI Decision-Support Tools – (E), Case Studies: Google DeepMind, IBM Watson Health, PathAI ,Responsible Deployment of AI in Healthcare Settings – (E), Capstone: Building a Responsible Healthcare AI Proposal – (C)

Total Hours: 45

COURSE OUTCOMES:

On su to	ccess	ful completion of the course- students will be able	Bloom's Level
CO1	•	Understand the scope, challenges, and benefits of AI in healthcare.	
CO2	•	Apply data preprocessing and modeling techniques specific to biomedical data.	
соз	•	Analyze the performance of ML/DL models in clinical contexts.	
CO4	•	Develop AI-driven applications for tasks like disease diagnosis, drug discovery, and patient monitoring.	
CO5	•	Evaluate ethical, legal, and societal implications of AI in healthcare.	

TEXT BOOKS:

- 1. Jiang, Fei et al. Artificial Intelligence in Healthcare: Past, Present and Future.
- 2. Kevin Frick Introduction to Healthcare AI.
- 3. Eric Topol Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again.

REFERENCE BOOKS:

- 1. Mathias Goyen AI in Medical Imaging.
- 2. BertalanMeskó The Guide to the Future of Medicine: Technology and The Human Touch.
- 3. Peter Szolovits Artificial Intelligence in Medicine (Morgan Kaufmann).

REFERENCE WEBSITE:

- Coursera: AI for Medicine Specialization (offered by DeepLearning.AI)
 - https://www.coursera.org/specializations/ai-for-medicine
- HarvardX: Data Science in Healthcare (edX)
 - https://online-learning.harvard.edu/course/data-science-healthcare

23MRAIA6	GENERATIVE AI LAB	L	T	P	С
			-	3	1.5

PRE-REQUISITES: Nil.

COURSE EDUCATIONAL OBJECTIVES:

• To explore generative AI tools and techniques.

Experiments:

- 1. Intro to LLMs and Generative AI
- 2. Text generation with GPT models
- 3. Prompt engineering for Q&A systems
- 4. Image generation using DALL-E / Stable Diffusion
- 5. Text summarization
- 6. Chatbot creation using LLM API
- 7. Fine-tuning LLMs
- 8. Sentiment and emotion generation
- 9. Story or poem generation task
- 10. Prompt optimization and testing
- 11. Mid-journey/Runway ML tools (demo)
- 12. Mini project using Generative AI

23MRAIA7	AI APPLICATIONS LAB	L	Т	P	С
			1	3	1.5

PRE-REQUISITES: Nil.

COURSE EDUCATIONAL OBJECTIVES:

To implement domain-specific AI solutions.

Experiments:

- 1. Health dataset preprocessing
- 2. Disease prediction (Diabetes/COVID)
- 3. Financial fraud detection
- 4. Credit scoring system
- 5. Business dashboard using AI tools
- 6. AI in intrusion detection
- 7. Threat classification using ML
- 8. Explainable AI (SHAP/LIME)
- 9. Domain-specific dataset handling
- 10. Model fairness and bias checking
- 11. Deployment using Flask or Streamlit
- 12. Mini project on any domain

Course Outcomes:

• Develop healthcare/finance/cybersecurity AI use-cases.