Certificate in AI for Finance

Syllabus

Module 1: Foundations of AI in Finance

- Definition and evolution of artificial intelligence.
- Artificial intelligence, machine learning, deep learning and generative AI.
- Rules-based systems versus learning systems.
- Narrow AI, general-purpose AI and AI agents.
- History of AI adoption in financial services.
- The AI value chain: data, models, compute, applications and people.
- AI use cases across banking, capital markets, asset management, wealth, insurance and fintech.
- Indian AI ecosystem: IndiaAI Mission, digital public infrastructure and fintech adoption.
- Global AI adoption trends in finance.
- Benefits, limitations and risks of AI.
- Myths and realities of AI in finance.
- Roles in AI: business user, analyst, data scientist, engineer and AI product owner.

Module 2: Data Foundations for AI

- Role of data in AI systems.
- Structured, semi-structured and unstructured data.
- Financial data sources: transactions, market data, filings, documents and communications.
- Data collection, labelling and annotation.
- Data quality and its impact on model performance.
- Data cleaning, transformation and feature preparation.
- Data pipelines and data platforms for AI.
- Synthetic data and data augmentation.
- Data governance, lineage and ownership.
- Consent and lawful use of data for AI.
- Data bias and representativeness.
- Building AI-ready data foundations.

Module 3: Tools and Platforms for AI

- Python for AI: core libraries and workflows.
- Notebooks and development environments.
- Machine learning libraries.
- Deep learning frameworks.
- Cloud AI platforms and services.
- AI model hubs and open-source models.
- Low-code and no-code AI tools.
- Spreadsheet and productivity AI assistants.
- Business intelligence tools with AI features.
- APIs and integrating AI into applications.
- Choosing between building, buying and partnering.
- Cost of AI: compute, licensing and maintenance.

Module 4: Machine Learning Fundamentals

- How machines learn from data.
- Supervised, unsupervised and reinforcement learning.
- Features, labels and targets.
- Training, validation and test sets.
- Overfitting, underfitting and the bias-variance trade-off.
- Regularisation.
- Cross-validation, including for time series.
- Model evaluation metrics: accuracy, precision, recall, F1 and AUC.
- Regression metrics: MAE, RMSE and R-squared.
- Imbalanced data in financial problems.
- Hyperparameter tuning.
- The machine learning project life cycle.

Module 5: Supervised Learning for Finance

- Linear and logistic regression.
- Decision trees.
- Random forests.
- Gradient boosting methods.
- Support vector machines.
- k-nearest neighbours.

- Ensemble methods.
- Credit scoring and default prediction.
- Churn and propensity models.
- Price and return forecasting.
- Feature importance and model interpretation.
- Case studies in supervised learning.

Module 6: Unsupervised Learning and Anomaly Detection

- Clustering: k-means, hierarchical and density-based methods.
- Customer and investor segmentation.
- Dimensionality reduction: PCA and its applications.
- Factor discovery in markets.
- Anomaly and outlier detection.
- Fraud and suspicious-transaction detection.
- Market regime detection.
- Association rules and pattern mining.
- Graph and network analysis.
- Case studies in unsupervised learning.

Module 7: Deep Learning and Neural Networks

- Neurons, layers and activation functions.
- Training neural networks: loss functions, gradient descent and backpropagation.
- Feed-forward networks.
- Convolutional networks and document images.
- Recurrent networks and LSTMs for sequences.
- Transformers and the attention mechanism.
- Deep learning for time series forecasting.
- Autoencoders for anomaly detection.
- Transfer learning and pre-trained models.
- Compute requirements and GPUs.
- When deep learning is and is not appropriate in finance.

Module 8: Reinforcement Learning in Finance

- Agents, environments, rewards and policies.
- Exploration and exploitation.

- Q-learning and policy-gradient methods.
- Reinforcement learning for trading and execution.
- Reinforcement learning for portfolio allocation.
- Dynamic pricing and recommendation.
- Simulation environments and backtesting.
- Limitations and risks of reinforcement learning in live markets.

Module 9: Natural Language Processing for Finance

- Text as data in finance.
- Text preprocessing: tokenisation, normalisation and stop words.
- Text representation: bag of words, TF-IDF and embeddings.
- Sentiment analysis of news, filings, social media and earnings calls.
- Named entity recognition.
- Information extraction from financial documents.
- Document classification.
- Topic modelling.
- Summarisation.
- Speech-to-text and voice analytics.
- Multilingual and Indian-language NLP.
- Case studies in financial NLP.

Module 10: Large Language Models and Generative AI

- What large language models are and how they work.
- Pre-training, fine-tuning and alignment.
- Tokens, context windows and model parameters.
- Proprietary and open-weight models.
- Multimodal models: text, image, audio and video.
- Capabilities: drafting, summarisation, reasoning, coding and analysis.
- Limitations: hallucination, outdated knowledge and inconsistency.
- Evaluating LLM outputs.
- Choosing the right model for a task.
- Cost, latency and deployment options.
- Small language models and on-premise deployment.
- Generative AI use cases in financial services.

Module 11: Prompt Design and AI Productivity for Finance Professionals

- Principles of effective prompting.
- Role, context, task and format in prompts.
- Few-shot examples and structured outputs.
- Step-by-step and chain-of-thought prompting.
- Prompting for financial analysis and calculations.
- Prompting for research, summaries and reports.
- Prompting for spreadsheets, code and data analysis.
- Reviewing and verifying AI outputs.
- Prompt libraries and templates for finance teams.
- Protecting confidential information when using AI tools.
- Building personal and team AI workflows.
- Measuring productivity gains from AI.

Module 12: Retrieval-Augmented Generation and Knowledge Assistants

- Why LLMs need access to trusted information.
- Retrieval-augmented generation architecture.
- Document ingestion and chunking.
- Embeddings and vector databases.
- Search, retrieval and re-ranking.
- Grounding answers and citing sources.
- Knowledge assistants for policies, products and regulations.
- Research assistants for analysts and advisers.
- Evaluating accuracy and relevance.
- Access controls and confidentiality in knowledge systems.

Module 13: AI Agents and Intelligent Automation

- From chatbots to AI agents.
- Agent components: reasoning, tools, memory and planning.
- Single-agent and multi-agent systems.
- Tool use and API integration.
- Robotic process automation and AI.
- Intelligent document processing.
- Workflow automation in finance operations.
- Human-in-the-loop design.
- Guardrails, permissions and audit trails for agents.

- Risks of autonomous AI in regulated environments.
- Case studies in agentic automation.

Module 14: AI in Banking and Lending

- AI across the banking value chain.
- Digital onboarding and e-KYC.
- Credit underwriting with traditional and alternative data.
- Cash-flow based lending and the Account Aggregator framework.
- Early-warning systems and collections analytics.
- Personalised offers and next-best-action.
- Conversational banking and virtual assistants.
- Treasury and liquidity forecasting.
- MSME and retail lending use cases.
- Case studies from Indian and global banks.

Module 15: AI in Investment Management and Trading

- AI in the investment process.
- Research automation and earnings analysis.
- Alternative data and AI-driven signals.
- Machine learning in factor investing.
- Portfolio construction and optimisation with AI.
- Algorithmic and high-frequency trading.
- Trade execution and transaction cost analysis.
- Risk monitoring for portfolios.
- Overfitting and backtest risk in AI strategies.
- SEBI framework for algorithmic trading.
- Case studies in AI-driven investing.

Module 16: AI in Wealth Management and Advisory

- AI in client acquisition and onboarding.
- Robo-advice and hybrid advice models.
- Risk profiling and suitability with AI.
- Goals-based planning tools.
- Personalised portfolio recommendations.
- AI copilots for relationship managers.

- Meeting preparation, notes and follow-ups.
- Client communication and content generation.
- Family-office and private wealth reporting.
- Regulatory boundaries for AI-assisted advice.
- Case studies in AI-enabled wealth management.

Module 17: AI in Insurance

- AI across the insurance value chain.
- Underwriting and risk selection.
- Pricing and actuarial modelling.
- Claims processing and automation.
- Claims fraud detection.
- Customer service and policy servicing.
- Health and motor telematics.
- Distribution and cross-sell.
- Case studies in insurance AI.

Module 18: AI in Risk, Compliance and Financial Crime

- AI in enterprise risk management.
- Credit, market and liquidity risk modelling with AI.
- Operational risk and loss-event analysis.
- Transaction monitoring and AML.
- KYC, sanctions and adverse-media screening.
- Payment and UPI fraud detection.
- Reducing false positives in alerts.
- Regulatory change tracking with AI.
- Compliance monitoring of communications.
- RegTech and SupTech.
- Case studies in AI for compliance.

Module 19: AI in Corporate Finance, Accounting and FP&A

- AI in the finance function.
- Automated bookkeeping and reconciliations.
- Invoice processing and accounts payable automation.
- Financial close and reporting automation.

- AI-driven forecasting and budgeting.
- Variance analysis and management commentary.
- Audit analytics and continuous auditing.
- Tax and GST compliance with AI.
- Valuation, due diligence and M&A analysis.
- Investor relations and board reporting.
- Case studies in AI for finance teams.

Module 20: AI in Operations, Payments and Customer Experience

- AI in back-office and middle-office operations.
- Customer service chatbots and voice bots.
- Complaint analysis and grievance management.
- Payments routing and optimisation.
- Real-time fraud scoring in payments.
- Personalisation and customer journeys.
- Process mining and operational efficiency.
- Measuring customer experience with AI.
- Case studies in AI-led operations.

Module 21: Model Risk Management and Explainability

- Model risk in AI systems.
- Model inventory and risk tiering.
- Model development standards and documentation.
- Independent validation of AI models.
- Explainability methods: SHAP, LIME and interpretable models.
- Explaining decisions to customers and regulators.
- Monitoring models in production.
- Data drift, concept drift and retraining.
- Validating generative AI and LLM applications.
- Third-party and vendor model risk.
- Model incidents and remediation.

Module 22: Responsible AI, Ethics and Fairness

- Principles of responsible AI.
- Fairness and non-discrimination in financial decisions.

- Measuring and mitigating bias.
- Transparency and disclosure to customers.
- Accountability and human oversight.
- Consumer protection in AI-driven services.
- Deepfakes, misinformation and impersonation risks.
- Intellectual property and copyright in generative AI.
- Environmental impact of AI.
- Ethical dilemmas in AI for finance.
- Building a responsible AI culture.

Module 23: AI Regulation and Governance

- AI governance frameworks for financial institutions.
- RBI's Framework for Responsible and Ethical Enablement of AI (FREE-AI).
- SEBI requirements on the use of AI and machine learning by regulated entities.
- IRDAI and PFRDA perspectives on AI.
- Digital Personal Data Protection Act and AI.
- India's AI governance guidelines.
- EU AI Act and its relevance to Indian firms.
- Global standards and principles for AI in finance.
- Board and senior-management oversight of AI.
- AI policies, risk appetite and approval processes.
- AI audits and assurance.

Module 24: AI Security, Privacy and Cyber Risk

- Security risks in AI systems.
- Prompt injection and jailbreaking.
- Data leakage and confidentiality risks.
- Data poisoning and model tampering.
- Adversarial attacks on models.
- AI-enabled cyber attacks and fraud.
- Privacy-preserving techniques: anonymisation, federated learning and differential privacy.
- Secure deployment and access control.
- Incident response for AI systems.
- Cybersecurity expectations for regulated entities.

Module 25: AI Strategy, Implementation and Leadership

- Building an AI strategy for a financial institution.
- Identifying and prioritising use cases.
- Business cases and return on AI investment.
- Pilots, proofs of concept and scaling.
- AI operating models and centres of excellence.
- Vendor and technology selection.
- MLOps and LLMOps.
- Change management and adoption.
- Reskilling and AI literacy for finance teams.
- Working across business, technology, risk and compliance.
- Communicating AI to boards and senior management.
- Case studies in AI transformation.

Module 26: Emerging Trends in AI for Finance

- Agentic AI and autonomous finance.
- Multimodal and voice-first financial services.
- Domain-specific financial language models.
- AI and tokenisation of assets.
- Quantum computing and AI.
- Open finance and AI-driven personalisation.
- Embedded finance and AI.
- AI and the future of financial jobs.
- Regulatory trends in AI.
- Scenarios for AI in finance in 2030 and beyond.