VECTOR INDIA

DRIVES YOU TO INDUSTRY



SCHOOL OF AI & DATA INTELLIGENCE

BUILD THE SCHOOL THAT AI-DRIVEN CAREERS DEMAND

Our premier course offerings



Python for Data Science & AIML

2 months



Generative AI & Agentic Systems

4 months

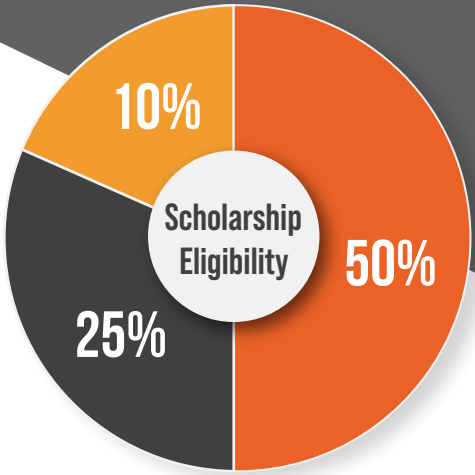


Data Science with Generativ AI & Agentic Systems

6 months

Test Syllabus

- Basics of Python
- General aptitude



50%

Entrance Test
>80%

Final Degree
>60%

25%

Entrance Test
70% to 79.9%

Final Degree
>60%

10%

Entrance Test
50% to 69.9%

Final Degree
>70%/
Gate Score

www.vectorindia.org

TRAINING PROCESS

- 6-days a week, theory (1.5 hrs) and practical (2 hrs) sessions
- Regular MCQ tests, assignments, and weekly assessments to evaluate learning progress.
- Mock interviews to assess technical and communication skills.
- Project guidance and mentoring to help students build industry relevant projects.
- Parallel classes will be conducted whenever required

ELIGIBILITY FOR PLACEMENTS

- Candidates must meet all the following criteria to be eligible for placement assistance.
- Online students must achieve a **minimum score of 40% in the Placement Eligibility Test,** which will be conducted physically at the institute premises. The test is mandatory for online students seeking placement assistance.

Criteria	Minimum Attendance	Minimum Internal Score	Mock & Assessment Interview
Theory	75%	40%	Recommendation
Lab	75%	40%	Recommendation
Internal Assessment	75%	40%	Recommendation
Mock Interview	—	—	Recommendation
Communication Skills	—	—	Recommendation
Prescribed Projects	—	—	Successful Completion

DATA SCIENCE WITH GENERATIVE AI & AGENTIC SYSTEMS

Programming & Software Engineering

- Python
- Git
- DSA
- Pydantic
- OOP
- Linux
- Fast API

Data Science & ML Foundations

- NumPy
- Pandas
- EDA
- SQL (MySQL)
- MongoDB
- Power BI
- Scikit-learn (ML)
- Stats

Deep Learnin & CV

- Neural Nets
- PyTorch/TensorFlow
- CNNS
- Object Detection (YOLO)

Advanced Generative AI & Agentic Systems

- LLMs (GPT, Gemini, Claude)
- Prompt Engineering
- RAG (FAISS, ChromaDB)
- Vector DBs
- LangChain/LangGraph
- CrewAI

MLOps & Production AI

- Docker, AWS Cloud
- CI/CD (GitHub Actions)
- System Design
- AI Guardrails
- MCP
- A2A

PROFESSIONAL SOFT SKILLS

Communication Skills & Interpersonal Development

PROJECT PORTFOLIO

25+ hands-on mini projects

Final Project

1 Industry-grade Capstone Project

Python Programming Foundations

Core Syntax & Logic :

- Python syntax & execution flow
- Data types, variables & operators
- Conditional statements & control flow
- Loops, patterns & nested logic
- String manipulation
- List comprehensions

Data Structures & Algorithms

- Lists, tuples, sets & dictionaries
- Searching & sorting algorithms
- Stack & Queue implementations
- Time complexity (Big-O notation)

Advanced Python

- Functions & recursion
- Lambda, map, filter & reduce
- Decorators & generators
- Regular expressions
- Modules & Packages
- Logging
- OOP — classes, objects, inheritance, Encapsulation, Polymorphism, Abstraction
- Exception handling
- File & I/O handling
- Type Hints
- Dataclasses
- Pydantic
- Os, requests library
- Environment variables (python-dotenv)
- Concurrency
- Working with dates/times & JSON
- Virtual Environments & Dependency Management (pip, uv)
- Testing with pytest

Data Analysis & Visualization

Numerical Computing

- NumPy arrays & broadcasting
- Array indexing, slicing & boolean masking
- Vectorized operations & reshaping
- Linear algebra basics
- Random number generation

Data Wrangling - Pandas

- DataFrames & Series
- Reading & writing data — CSV, Excel, JSON, SQL
- Data cleaning & imputation
- Feature engineering
- Merging & reshaping data
- GroupBy & aggregations
- Datetime data handling



Visualization & Databases

- Matplotlib charts & subplots
- Seaborn statistical plots
- Plotly interactive charts
- EDA — Univariate, Bivariate & Multivariate analysis, Correlation analysis, Outlier detection, Data quality assessment and Business insight generation
- SQL — joins, subqueries, window functions
- Connecting Python to databases (SQLAlchemy)
- MongoDB — CRUD & aggregation pipelines

Power BI & Dashboarding

- Power BI — reports & dashboards
- DAX measures & calculated columns
- Data storytelling & KPI design principles
- Google Looker Studio



Mathematics for Data Science

Probability & Distributions

- Probability theory fundamentals
- Bayes' theorem
- Normal & binomial distributions
- Poisson distribution
- Sampling methods
- Central limit theorem

Descriptive & Inferential Statistics

- Mean, median, mode & spread
- Variance & standard deviation
- Confidence intervals
- Hypothesis testing (t-test, z-test)
- Chi-square & ANOVA
- p-values & A/B testing



Linear Algebra & Calculus

- Vectors & matrix operations
- Eigenvalues & eigenvectors
- Derivatives & chain rule
- Gradient descent intuition
- Partial derivatives

Machine Learning - Core Algorithms

Supervised Learning

- Linear & Logistic Regression
- Ridge & Lasso (Regularization)
- K-Nearest Neighbors (KNN)
- Decision Trees & Random Forests
- Gradient Boosting (XGBoost)
- LightGBM
- CatBoost
- Support Vector Machines (SVM)
- Naive Bayes classifier
- Ensemble methods

Unsupervised Learning

- K-Means Clustering
- Hierarchical Clustering
- DBSCAN (density-based)
- PCA – Dimensionality Reduction
- t-SNE visualization
- Anomaly Detection methods

Model Engineering

- Bias-Variance tradeoff
- Cross-validation strategies
- Feature selection & importance
- Hyperparameter tuning (GridSearch)
- Evaluation metrics
- Model interpretability (SHAP, LIME)
- Imbalanced datasets (SMOTE)
- Pipeline building
- Saving & loading models
- Hands-on ML Mini Projects

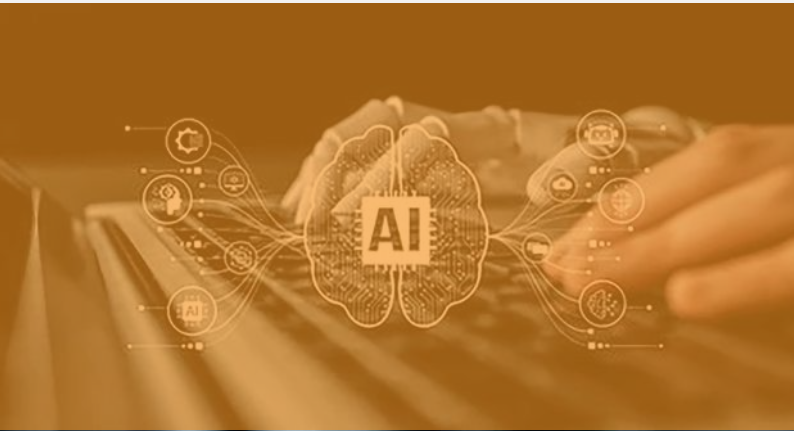
Deep Learning & Computer Vision

Neural Network Foundations

- Neurons & network architecture design
- Activation & loss functions
- Optimizers – Adam, SGD, RMSProp
- Backpropagation & gradient flow
- Overfitting, dropout & regularization
- Batch normalization

Computer Vision

- CNNs – Conv, Pool, Flatten layers
- Transfer learning (ResNet, EfficientNet)
- Object detection with YOLO



NLP, Transformers & Large Language Models

NLP Fundamentals

- Text preprocessing & tokenization
- Bag-of-Words & TF-IDF
- Word2Vec embeddings
- Sentiment analysis
- Named Entity Recognition (NER)
- Text classification

Sequence Models

- RNN, LSTM, GRU architectures
- Bidirectional RNNs
- Encoder-Decoder architecture
- Attention mechanism deep dive

Transformers & LLMs

- Transformer architecture — Self-attention, Multi-head attention, Positional encoding, Encoder, Decoder, Residual connections, Layer normalization, Feed forward networks, Masking, Tokenization Context windows .
- BERT
- GPT series — architecture & usage
- HuggingFace pipelines & models
- Prompt Engineering strategies
- Embeddings & vector search
- Gemini / Claude / GPT API integration
- Chatbot development with LLMs

Generative AI, RAG & Agentic Systems

LLM Application Foundations

- LangChain fundamentals
- Prompt Templates
- Chains & LCEL (LangChain Expression Language)
- Output Parsers & Structured Outputs
- Streaming
- LangSmith (tracing & debugging)
- Model selection strategies
- Token counting & cost optimization

Context Engineering

- Data ingestion & preprocessing
- Document chunking strategies
- Metadata enrichment
- Embeddings & semantic search
- Vector databases (FAISS, Chroma, Pinecone)
- Context window management
- LLM application architecture

Retrieval-Augmented Generation (RAG)

- RAG system design & architecture
- Retrieval techniques & hybrid search strategies
- Query understanding & query rewriting
- Prompt engineering for RAG
- Memory & conversational RAG
- Self-RAG & Graph RAG
- Agentic RAG
- RAG evaluation metrics

Agentic Systems - Core Concepts

- Foundations of Agentic AI
- Core Agent Architecture
- Tool Use / Function Calling — external APIs, Python tools, database tools, web search tools, calculator tools, file system tools
- Planning & Reasoning
- Memory Systems
- Multi-Agent Systems

Orchestration Frameworks

- LangGraph — graph architecture, state management, nodes, edges, conditional routing, cycles, checkpointing
- LangChain Agents
- CrewAI

Agent Communication Protocols & Standards

- MCP (Model Context Protocol)
- A2A (Agent-to-Agent protocol)
- Function/tool schema standards
- Agent discovery mechanisms

Autonomous Agent Design Patterns

- Supervisor pattern
- Planner–Executor pattern
- Hierarchical agents
- ReAct
- Tree of Thoughts
- Reflection & self-consistency
- Planning loops
- Deep Research agents
- Human-in-the-Loop
- Agent streaming

Evaluation, Safety & Observability

- Prompt evaluation
- Agent evaluation
- RAG evaluation
- Tracing, logging & monitoring
- AI Guardrails & Safety
- Responsible AI

MLOps & Model Deployment

Version Control & Tracking

- Git & GitHub
- Branching & pull requests
- Model registry & versioning

Model Serving & APIs

- FastAPI endpoint design
- REST API design principles
- API documentation with Swagger
- Authentication & security basics (JWT)

Frontend for AI Apps

- JavaScript fundamentals
- Linux Fundamentals
- React basics for AI-powered UIs

Containerisation & CI/CD

- **Docker fundamentals**
- **Docker fundamentals**
- **GitHub Actions (CI/CD pipelines)**

Cloud Deployment

- **AWS (EC2, S3, RDS)**
- **Cloud deployment strategies**

Monitoring & Observability

- **Application & model logging**
- **Model performance monitoring & drift detection**
- **Basic observability tooling (Prometheus/Grafana concepts)**

Capstone Project — Industry Grade

Project Execution

- Real-world problem statement selection
- Data collection & pipeline design
- EDA & feature engineering
- Model building & evaluation
- Generative AI or Agentic component
- FastAPI backend development
- Docker containerisation
- Deployment to cloud platform

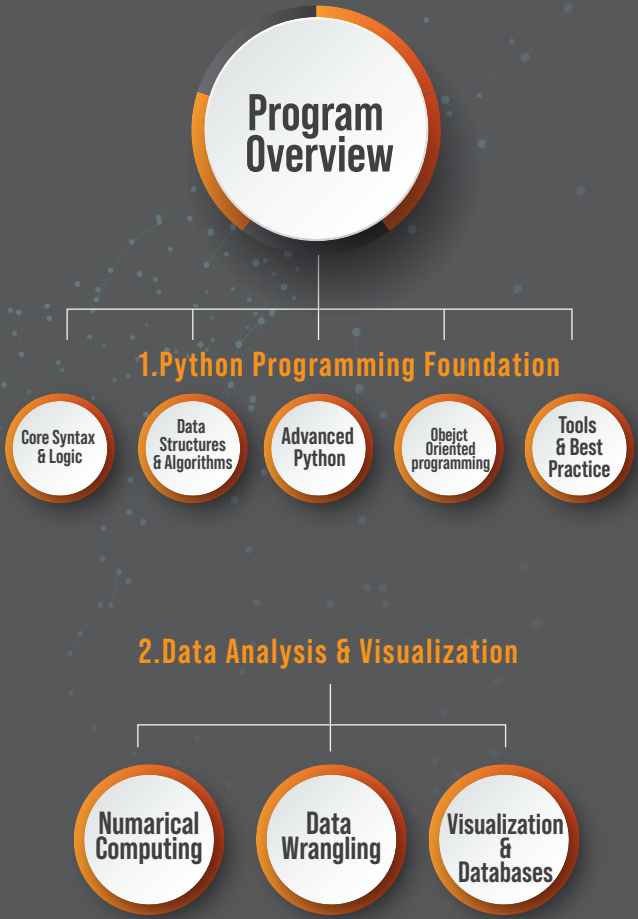
Career Preparation

- GitHub portfolio setup
- Resume preparation guidance
- Technical interview preparation
- Mock interviews with feedback

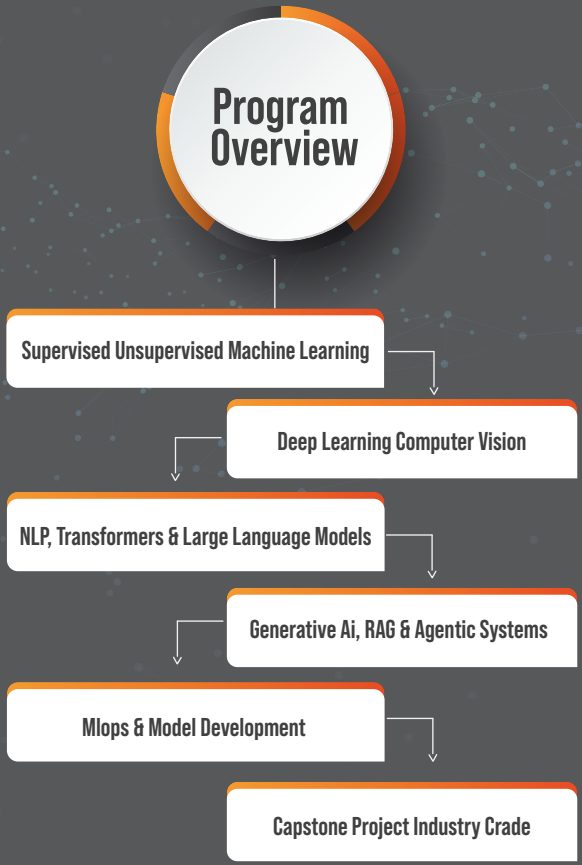
Capstone Deliverables

- A GitHub repository with clean code, README, architecture diagram, and demo instructions
- A deployed web application or API accessible via a public URL

Python for Data Science & AIML



Generative AI & Agentic Systems



HYDERABAD

#502, 5th Floor, Nagasuri Plaza (Bank of India Building), Behind
HUDA Maithrivanam,Ameerpet, Hyderabad - 500038
Ph: 040 2373 6669, Cell: + 91 98 66 66 66 99
Email: info@vectorindia.org

BENGALURU

33/49, 27th Cross, 12th Main Jayanagar 4th Block Bengaluru - 560011
Ph: 080 2654 6474, Cell: + 91 87 62 45 67 89
Email: info.blr@vectorindia.org

CHENNAI

2nd Floor, 179, 1st Main Road, Nehru Nagar, Lane Opp to Turyaa Hotel,
Perungudi, Chennai - 600096
Ph: 044 2454 3969, Cell: +91 94 44 22 24 59
Email: info.chen@vectorindia.org

Vector India Pvt. Ltd.
@VectorInstitute
vectorindiainstitute
@Vector_India
@vectorindia9

VECTOR INDIA

www.vectorindia.org