R Square
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AI & Generative AI for Developers
Roadmap & Syllabus

AI is now part of everyday development. Learn the foundations of machine learning, then build real applications with large language models — chatbots, semantic search, RAG and agents.

Python · NumPy & Pandas · scikit-learn · LLM APIs · Embeddings · Vector databases · RAG & Agents

FRESHERS & STUDENTS	EXPERIENCED (JOB SWITCHERS)	WORKING PROFESSIONALS
5–6 months	**2–3 months**	**3–5 months (alongside work)**

Durations are approximate and assume about 2–3 hours of focused study a day. Move faster or slower as you need — understanding matters more than speed.

Contents: 1. Freshers & Students · 2. Experienced (Job Switchers) · 3. Working Professionals · 4. Complete Syllabus

Freshers & Students

Starting from the basics and preparing for a first developer job.

Approximate duration: 5–6 months — Build Python and ML foundations, then your first real AI-powered applications.

1 Python & Data Handling — 5 weeks

- Python fundamentals
- NumPy and Pandas
- Cleaning and visualising data

Milestone: Analyse a real dataset and present findings.

2 Machine Learning Basics — 6 weeks

- Regression and classification with scikit-learn
- Evaluation and overfitting
- Statistics you actually need

Milestone: Train, evaluate and explain a simple model.

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3

LLMs & Prompting

4 weeks

- How LLMs work (intuition)
- Prompt engineering
- Calling an LLM API from Python
- Structured output

Milestone: Build a small LLM-powered tool.

4

RAG Project & Interview Prep

5 weeks

- Embeddings and a vector database
- Build a RAG chatbot over documents
- Deploy with a simple web UI
- AI/ML interview basics

Milestone: Demo a working "chat with your documents" app.

Projects to build

- House-price or student-result prediction model
- Resume or document summariser using an LLM
- RAG chatbot over a set of PDFs

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Experienced (Job Switchers)

1–4 years of experience, preparing to switch jobs or move to a stronger role.

Approximate duration: 2–3 months — For developers already working in Java or JavaScript: add production-grade AI features to real apps.

1

LLM APIs in Your Stack

3 weeks

- LLM APIs from Java (Spring AI) or Node.js
- Prompt design and structured output
- Streaming responses to the UI

Milestone: Ship an AI feature inside an existing app.

2

RAG & Semantic Search

3 weeks

- Embeddings and vector stores
- Chunking and retrieval quality
- Citing sources in answers

Milestone: Build search that understands meaning, not just keywords.

3

Agents, Tools & Evaluation

3 weeks

- Function/tool calling
- Simple agent workflows
- Evaluating output quality
- Cost, latency and guardrails

Milestone: Build an assistant that safely calls your own APIs.

Projects to build

- AI support assistant over company FAQs
- Semantic search for a product catalogue
- Agent that answers questions using your REST APIs

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Working Professionals

Working developers upskilling toward senior, lead or architect responsibilities.

Approximate duration: 3–5 months (alongside work) — Lead AI adoption: architecture, evaluation, security and cost for AI features in production.

1

AI System Architecture

4–6 weeks

- RAG architecture at scale
- Choosing models: hosted vs open-source
- Caching, batching and cost control

Milestone: Design an AI feature that is reliable and affordable.

2

Quality, Safety & Governance

4 weeks

- Evaluation pipelines
- Prompt injection and data-leak risks
- Privacy, compliance and human review

Milestone: Define how your team tests and approves AI output.

3

AI-assisted Engineering

Ongoing

- AI coding assistants in the team workflow
- Reviewing AI-generated code
- Measuring real productivity impact

Milestone: Introduce AI tools to a team with clear guidelines.

Projects to build

- AI feature design document with evaluation plan
- Evaluation harness for prompts and RAG answers
- Internal knowledge assistant with access control

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Complete AI & Generative AI for Developers Syllabus

Everything this track covers, grouped by topic. Use it as a checklist.

01 Python for AI

- Python fundamentals
- NumPy and Pandas
- Data visualisation (Matplotlib)
- Jupyter notebooks
- Virtual environments and packages

02 Math Essentials

- Basic statistics and probability
- Vectors and matrices (intuition)
- What gradients and loss functions mean

03 Machine Learning Basics

- Supervised vs unsupervised learning
- Regression and classification
- Train/test split and overfitting
- Evaluation metrics
- scikit-learn

04 Deep Learning (Overview)

- Neural networks
- How transformers work (intuition)
- PyTorch basics

05 Large Language Models

- Tokens, context windows and temperature
- Prompt engineering
- Calling LLM APIs
- Structured output and function/tool calling
- Cost and latency

06 RAG & Vector Search

- Embeddings
- Vector databases (pgvector, Pinecone, Chroma)
- Chunking and retrieval
- Retrieval-augmented generation (RAG)

07 AI Agents & Integration

- Tool use and agent loops
- LangChain / LlamaIndex (overview)
- Spring AI for Java, LangChain.js for Node.js
- Streaming responses in a web UI

08 Evaluation & Responsible AI

- Testing and evaluating AI output
- Hallucinations and guardrails
- Data privacy and security
- Bias and responsible use

Roles this track prepares you for

AI Engineer · Generative AI Developer · ML Engineer (entry) · Full Stack Developer with AI skills

Want a personal plan or interview preparation?

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Roadmaps are for learning guidance and do not guarantee jobs or placements.

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