



# NEW AGE SOFTWARE ENGINEERING PROGRAM

FROM IHUB DIVYASAMPARK, IIT ROORKEE

# About iHUB DivyaSampark, IIT Roorkee

- **iHUB DivyaSampark, IIT Roorkee:** A Section 8, not-for-profit Technology Innovation Hub at IIT Roorkee, established under the National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS) by the Department of Science & Technology (DST), Government of India.
- **Strong Industry & Research Ecosystem:** With active collaborations, incubators, and innovation hubs, IIT Roorkee bridges academia and industry to drive real-world impact
- **Industry-Focused Learning:** IIT Roorkee maintains strong ties with industries across its campus locations, providing students with opportunities for internships, real-world projects, and networking with business leaders.

## Why Choose This Course?

- **Prestigious Certification:** Receive a certificate of completion from iHUB DivyaSampark, IIT Roorkee, recognising your achievement.
- **Campus Immersion:** An optional 3 day campus immersion for direct interaction with industry experts and peers.
- **Future Proof Career Gateway:** Launch into a high-growth, future-proof New Age Software Engineering career with in-demand skills.
- **Advanced Curriculum:** Access cutting-edge software engineering content, engaging simulations, and practical evaluations. Focus on real-time project implementation for hands-on mastery.
- **Case Based Learning:** Engage in real-world, case-based sessions that connect theory with practical software engineering challenges.
- **World Class Faculty:** Learn directly from IIT's top-tier faculty and industry experts

## What Will You Learn?

Elevate your software engineering prowess. Learn to build intelligent applications, deploy scalable cloud solutions, and integrate Generative AI for unparalleled innovation. Drive your career forward with a robust portfolio built from hands-on labs simulating real-world AI development and cloud deployments. Secure your place as a high-impact software engineering professional, ready to lead with data-driven strategies and build intelligent digital products.

### Toolkit



kubernetes



PostgreSQL



LangChain

GitHub

& more

## Course Details

**Course Duration**  
7 Months

**Time Commitment**  
8-10 hours per week

**Certification**  
iHUB DivyaSampark IIT Roorkee

# Course Curriculum

## **Module 1:**

### **Generative-AI Foundations & Prompt Craft**

- Grasping the fundamental architecture behind large language models
- Zero-shot, few-shot, and chain-of-thought prompting for improved model responses
- Using role personas, and formatting outputs with JSON/Markdown.
- Understanding token budgeting, latency considerations, and cost implications
- Introduction to basic safety filters in generative AI

## **Module 2:**

### **Production-Grade AI Engineering Fundamentals**

- Managing the lifecycle of AI models and version control.
- Implementing regression tests and continuous evaluation for AI models.
- Setting up tracing, metrics, and alerting for AI systems.
- Establishing guardrails and policy layers for ethical and safe AI deployment.

## **Module 3:**

### **Serverless & Edge AI Deployments**

- Exploring Cloudflare Workers, AWS Lambda, and Vercel Functions for AI deployment.
- Implementing secrets rotation and authentication mechanisms.
- Handling streaming data, retries, and webhooks for dynamic AI services.
- Understanding autoscaling and mitigating cold-start issues.
- Building dashboards to monitor cost and latency of deployed AI services.

## **Module 4:**

### **Community Models & Custom Fine-Tuning**

- Navigating resources like Hugging Face and PapersWithCode for model discovery.
- Performing local inference with Ollama and GGUF models.
- Utilizing Transformers.js and WebGPU for in-browser AI applications.
- Implementing LoRA (Low-Rank Adaptation) and QLoRA for custom model tuning.
- Understanding the legal and ethical considerations of open models.

### **Module 5:**

#### **Knowledge Retrieval & Semantic Memory**

- Techniques for chunking and creating effective text embeddings.
- Working with vector databases like pgvector, Pinecone, and Weaviate.
- Combining hybrid keyword and vector search for comprehensive retrieval.
- Establishing safety and quality controls for RAG systems.
- Understanding recall, precision, and Mean Reciprocal Rank (MRR) for retrieval systems.

### **Module 6:**

#### **AI Agents & Agentic Workflows**

- Understanding ReAct (Reasoning and Acting) and Plan-Act-Reflect loops.
- Using JSON-schema for function calling and managing tool registries.
- Implementing reflection, retries, and guardrails for robust agent behavior.
- Coordinating multiple agents using frameworks like CrewAI and LangGraph.
- Ensuring agents adhere to predefined output formats.

### **Module 7:**

#### **Vision-Enabled & Multisensory AI**

- Understanding prompt styles and generation techniques for diffusion models.
- Exploring capabilities like image captioning and Optical Character Recognition (OCR).
- Implementing image editing and in-painting chains for creative AI applications.
- Utilizing describe, generate, refine workflows for visual AI.
- Discussing NSFW detection, watermarking, and adversarial risks in visual AI.

### **Module 8:**

#### **Capstone Sprint**

- Comprehensive review of solution architecture and design.
- Integrating components like vector databases, AI agents, and a streaming user interface.
- Optimizing the solution for performance and cost efficiency.
- Ensuring the solution meets observability and regulatory compliance standards.
- Preparing the solution for live demonstration and presentation.

*Due to the evolving nature of the industry expectations and partner institute feedback, some syllabus aspects may change. Any updates will be communicated during the Inauguration Session(s) or at the start of the relevant module*

## Our Instructors



**Dr. R. Balasubramanian**

**Professor in Data Science and Engineering, IIT Roorkee**

Dr. Balasubramanian Raman is a Professor and Head of the Computer Science and Engineering Department at IIT Roorkee. He also holds a Joint Faculty position in the Mehta Family School of Data Science and AI and was formerly an iHUB Divyasampark Chair Professor. His career at IIT Roorkee spans roles in both Computer Science and Mathematics departments, and he has been a Guest Professor at Osaka Metropolitan University.



**Abhinandan S.P.**

**Assistant Professor in Data Science & Engineering,  
IIT Palakkad**

Dr. Abhinandan S. P. is an Assistant Professor in the Mehta Family School of Data Science and Artificial Intelligence at the Indian Institute of Technology Palakkad. His research focuses on using mathematical and machine learning methods to solve system problems in emerging cloud networking technologies, such as IoT, Edge-Cloud continuum, Systems for AI/ML, and 6G. He has published numerous research papers in prominent journals and conferences and co-authored a book on Cloud Computing.



### **Dr. Suman Banerjee**

**Assistant Professor in Computer Science & Engineering,  
IIT Jammu**

Dr. Suman Banerjee is an Assistant Professor in the Discipline of Computer Science & Engineering at IIT Jammu. He completed his Ph.D. at IIT Kharagpur and has professional experience as a Post Doctoral Fellow at IIT Gandhinagar. His research interests include Social and Information Network Analysis, Algorithmic Data Management, and Time Varying Graph Analysis. He also has teaching interests in Algorithms, Graph Theory, and Databases.



### **Hritik Gupta**

**Software Engineer, Goldman Sachs**

Hritik Gupta is a skilled professional with a B.Tech from IIT Mandi and extensive experience in software and web development. He has held key roles at global companies like Goldman Sachs and Amazon, where he contributed to significant projects such as the Consolidated Trade Ledger and application runtime platforms for devices. His expertise spans a variety of technologies, including Java, Spring Boot, React.js, and Kubernetes. Hritik also has a strong background in research and development, with internships at Siemens Technology India and work on blockchain projects for the Hyperledger Mentorship Program.



### **Yash Jain**

**AI Engineer, BMC Software**

Yash Jain is a seasoned professional with a Master of Technology (M.Tech) from BITS Pilani. He is a Lead Machine Learning Engineer at BMC Software with nearly a decade of experience in developing end-to-end scalable solutions for a variety of machine learning use cases, including topic modeling, forecasting, and recommendation systems. His technical expertise includes PyTorch, Elasticsearch, Spring Boot, and Kubernetes, and he has a strong background in developing solutions integrated with products using a microservice architecture.

# Admission Process



## Clear Qualifier Test

You must pass the exam to confirm your seat for the program.



## Complete Counselling

Only shortlisted candidates go through the counselling process.



## Start Learning

Learn from India's top educators and stand out from the crowd.

# Fees Structure

<b>Qualifier Test Fee</b> (Non-Refundable)	<b>₹99</b>
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	Option 1	Option 2
	Upfront	EMI Through Masai's NBFC Partners
<b>Secure Seat Fee</b> (Non-Refundable)	₹4,000	₹4,000
<b>Programme Fee</b> (Non-Refundable)	₹56,000	₹7,156 x 9 months
<b>Total</b>	₹60,000 + GST*	₹68,404 + GST*

\*GST at 18% extra, as applicable





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