



## About

The last two decades have witnessed rapid growth of artificial intelligence and machine learning (AI/ML) techniques in various fields of study, industry and research. This is possible due to the fast improvement in the domain of very large-scale integration (VLSI) technology and computer architecture during the last six decades. The demand for suitable architectural support varies with different AI/ML techniques. The traditional central processing units (CPUs) with limited parallel processing support are often not suitable for AI/ML applications. The graphical processing units (GPUs) and tensor processing units (TPUs) offer massive parallelism to accelerate the AI/ML programs. The field-programmable gate array (FPGA) technology provides design reconfigurable architectures for the required AI/ML techniques. In-memory computing can be performed on memristor crossbars and resistive random-access memories (ReRAM). This accelerates the AI/ML methods using digital as well as analog computation as an alternative to GPUs and TPUs.

The goal of this course titled "Computer Architecture for Artificial Intelligence" is to provide a foundation on various computer architectures suitable for different AI/ML techniques on the basis of performance, power and cost.

## Course Coverage

### Day 1:

- Review of Traditional Computer Architecture
- Basic Computer Organization, Cache Memory, Register File, Pipelining

### Day 2:

- Architectures for Parallelism, Flynn's classification of computer architectures, SISD/SIMD/MISD/MIMD architectures
- Vector Processors, Systolic Array, Matrix Multiplication, Fast Fourier Transform,

### Day 3:

- GPU architectures - Streaming Multi Processors, Cache Hierarchy, The Graphics Pipeline.
- TPU architectures, Advantages of GPU and TPU over CPU.

### Day 4:

- Introduction to CUDA and OpenCL programming

### Day 5:

- Implementation of matrix and linear algebra related algorithms on GPU

### Day 6:

- Optimization of CUDA and OpenCL programs

### Day 7:

- Implementation of AI/ML algorithms on CPU and GPU, Application Design: Efficient Neural Network Training/Inferencing AI/ML acceleration using GPU, TPU

### Day 8:

- AI/ML on FPGA, AI/ML acceleration on FPGA

### Day 9:

- AI/ML in embedded system devices, Tiny ML

### Day 10:

- In-memory computing on memristors and resistive RAM, combination of digital and analog computing for AI/ML on memristor crossbar

## Key Speakers :

- Prof. Bibhudatta Sahoo, NIT Rourkela
- Prof. Ashok Kumar Turuk, NIT Rourkela
- Prof. Pabitra Mohan Khilar, NIT Rourkela
- Dr. Aryabhartta Sahu, IIT Guwahati
- Dr. Devashree Tripathy, IIT Bhubaneswar
- Dr. Dev Narayan Yadav, NIT Rourkela
- Dr. Sumanta Pyne, NIT Rourkela



**NATIONAL INSTITUTE OF TECHNOLOGY  
ROURKELA**

Short Term Course (Hybrid Mode)  
on

**COMPUTER ARCHITECTURES  
FOR ARTIFICIAL INTELLIGENCE  
(CAAI 2026)**

**May 06 - 15, 2026**

Patron

**Prof. K. Umamaheshwar Rao**  
Director NITR

Chairman

**Prof. Bibhudatta Sahoo**

Principal Coordinators

**Dr. Sumanta Pyne**

Coordinators

**Dr. Dev Narayan Yadav**

Organized By

**DEPT. OF COMPUTER SCIENCE AND ENGINEERING  
NATIONAL INSTITUTE OF TECHNOLOGY ROURKELA  
ORISSA 769008**

## Introduction:

Computer Architectures for Artificial Intelligence focuses on designing and optimizing hardware systems to efficiently execute AI/ML workloads. The course begins with a review of traditional computer architecture, covering basic organization, cache memory, register files, and pipelining. It then explores parallel architectures and Flynn's taxonomy, including SISD, SIMD, MISD, and MIMD models, along with vector processors, systolic arrays, matrix multiplication, and FFT. Modern accelerators such as GPUs (streaming multiprocessors, cache hierarchy, graphics pipeline) and TPUs are studied, highlighting their advantages over CPUs. Practical exposure includes CUDA and OpenCL programming, optimization techniques, and implementation of linear algebra and AI/ML algorithms on CPU and GPU. The course further addresses efficient neural network training and inference. Emerging alternatives such as FPGA-based acceleration, in-memory computing, memristors, and resistive RAM are discussed, emphasizing hybrid digital-analog approaches. Finally, AI/ML acceleration using GPU, TPU, in-memory crossbar arrays, and FPGA is examined for high-performance intelligent systems.

## Online Account Details:

**Account No :** 10138951784

**Account Name:** CONTINUING EDUCATION NIT ROURKELA

**IFSC Code :** SBIN0002109

**Branch :** State Bank of India, NIT Campus Rourkela

**SCAN  
TO PAY**



## About the Institute:

National Institute of Technology (NIT) Rourkela is an institute of importance funded by the ministry of Education. NIT Rourkela was established as Regional Engineering College (REC) on August 15, 1961. NIT Rourkela was ranked 601-800 in the world by the times Higher Education World University Ranking of 2018 and 126th in Asia. In India, it was ranked 13th among engineering colleges by the National Institutional Ranking Framework (NIRF) 2025. For details about the institute Please visit <https://www.nitrkl.ac.in/>

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Engg.

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Research

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QS Asia

## About the Department:

The department of Computer Science and Engineering is established with the vision to prepare its students for professional employment and graduate education through study and implementation of the fundamental principles of theory, abstraction, and software design. The department offers various UG and PG programmes with the mission to provide high-quality education that prepares the graduates for success in their professional practice and advanced studies. The department also offers M. Tech in Computer Science, Information Security, and Software Engineering; and Ph. D for regular as well as sponsored candidates. Please visit <https://nitrkl.ac.in/CS/> to know more about the department of CSE.

## Online Registration form :

<https://forms.gle/jzA63FHWAhYVNJaq8>

## Registration Details :

Category	Online Registration Fee in INR(including 18% GST)
Research Scholars/ PG / UG Student	590/-
Faculty from Engineering Institutes	1180/-
Engineers from Industry and R&D Organizations	2360/-
No registration fee for students / staffs of NIT Rourkela	

## IMPORTANT DATES

Registration Deadline: May 3, 2026

Short-term Course Date: May 06-15,2026

## Contact Us:

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