UNIVERSITY OF ENGINEERING AND MANAGEMENT, KOLKATA

PRESENTS

2024 SUMMER SESSION

On

Hands-on with Memory Design & In-Memory Computing (IMC)

2.5 Weeks: 29th May to 14th June 2024
Days: Wednesday & Sunday
Time: 11 am – 1:15 pm & 2 pm-4:15 pm
Course Fees: INR 4000 + 18% GST
Offered by: Department of CST & CSIT in association with School of VLSI Technology, IIEST Shibpur.
Instruction Mode: Online
Open Seats: 50

USP of the Course

"Joining our summer school isn't just about learning; it's about shaping your career up in the fast-paced ever expanding world of computing technologies. And nothing can be better than to start with ***Memory Design & In-Memory Computing*** that is expected to shape the data driven market of AI era**.** The need of memory design engineers in the semiconductor industry is increasing every day and is expected to grow exponentially. Due to the introduction of **FinFET** nodes in the industry a tremendous demand of professionals have grown in the recent years. Alongside that the new cutting edge technology in-memory computing is expected to shape the analytics and machine learning areas ***(Here is what you can find out in this story https://www.linkedin.com/pulse/top-companies-in-memory-computing-market/.)*** Therefore, it is the great time to become industry ready in memory design and get updated with core concepts of IMC.
Our program isn't like any other - it's designed with one goal in mind: to make you semiconductor industry-ready in the field of digital memory design and IMC technology that can change the dimension of data driven arena like AI/ML or Data Analytics. Here's why our sessions are your best bet for breaking into the world of semiconductor industry as a memory design professional:

1. **Practical Experience:** Unlike many theoretical courses, this program offers students a hands-on experience with core concepts of memory design and in-memory computing at the hardware level. Students will have the opportunity to work directly with industry standard technology nodes, gaining practical skills that are highly sought after in the industry.
2. **Cutting-Edge Technology:** Use of **FinFET** technology nodes in memory design and **In-memory computing** are the two cutting-edge technology that is transforming how data is processed and evaluated. By focusing on the circuit components of memory and IMC, students will be at the forefront of technological progress, establishing themselves as early adopters and specialists in a fast changing sector.
3. **Expert Guideline:** The course will be taught by experts from semiconductor industry, research and academia with extensive experience in digital memory design and in-memory

computing. Students will benefit from their expertise, gaining insights and practical knowledge that go beyond what can be found in textbooks or online resources.

4. ****Real-World Application****: The In-Memory Computing (IMC) holds significant promise for Machine Learning (ML**)** and Deep Learning (DL) applications, offering potential benefits in terms of performance, scalability, and energy efficiency.

5. ****Real-time Project based Evaluation****: All the participants will get to work on real-time projects as per the industry standard used cases.

Prerequisite: Basic knowledge in fundamentals of Electronics, MOSFET device physics, digital logic design, computer architecture and elementary programming skills.

Course Summary:

Introduction to IMC**,** Memory technologies for IMC**,** IMC hardware components design, parallel processing in IMC, Real world case studies in ML and DL applications, Future trends and research opportunities, Final Project.

Duration: 2.5 weeks (2 days per week, 4 sessions per week)

Week 1: Introduction to Memory Design

- Session 1 (theory) - Overview of memory hierarchy and types of memory in computing, focus on SRAM, DRAM: characteristics, advantages and applications.
- Session 2 (hands-on-lab) - Setting up development environment for simulations & familiarization with simulation tools (LT-spice or Cadence) and understanding basic memory operations with SRAM cell-read/write & stability analysis.
- Session 3 (theory + hands-on-lab) - DRAM architecture, practical lab session on design and simulation on DRAM at circuit-level, addressing, row/column access and refresh operation.
- Session 4 (theory + lab) - Overview on FinFET technology node: structure operation and benefits, step-by-step guidance on 6T-SRAM cell design and simulation using FinFET node: selection of W/L ratios, supply voltages etc.

Week 2: Advanced Memory Technologies & IMC

- Session 5 (theory) - Overview on NVM (Flash & Phase-Change), characteristics, understanding architecture, programming.
- Session 6 (hands-on-lab) - Designing and simulation of NVM memory cells, endurance and reliability analysis.
- Session 7 (theory) - Overview on IMC, parallel processing techniques in IMC architectures, scalability and performance considerations,
- Session 8 (hands-on lab) - Implementing a simple IMC-based application prototype, testing and benchmarking the performance of the prototype.

Week 3: Final Project and Q&A

- Session 9 (theory)- Final prototype implementation based on given project.
- Session 10 (Q&A and Feedback)- Feedback session and Q&A.

In this 18 hours course, students will explore the principles, applications, and implementation of digital memory design techniques used by semiconductor industries. Participants will be able to learn cutting edge industry standards and new technologies like in-memory computing (IMC) from a hardware perspective. The course covers topics such as memory technologies, hardware design, real-world applications, and future trends. Through a combination of theory sessions and hands-on labs, students will gain practical experience in designing and optimizing memory subsystems systems. By the end of the course, students will be equipped with the skills and insights to understand, design Digital Memory and IMC architectures for various computational challenges.

Eligibility Criteria:

For IEM Students: - Enrollment Requirement: Must be currently enrolled as a degree-seeking student at IEM, Newtown or IEM Saltlake or IEM Kolkata

For Non-IEM Students: - Age Requirement: Applicants must be at least 18 years old by the start of the courses.

For M. Tech Students/ Research Scholars: Registered PhD Scholars and M.Tech students from Recognised Indian Institutes/ Universities.

- Educational Qualification: Students from B.E./ B.Tech (II year onwards)/ Diploma/ M.Tech from equivalents branches of ECE/EEE/EIE/CS & IT.

- English Language Proficiency: Must demonstrate proficiency in English as per the specified requirement.

- Application: Students must complete the Summer Sessions application to gain access to enrol in summer courses. Please note that eligibility criteria may be subject to updates or changes, and prospective applicants should verify the latest requirements on the official UEM website.

***Sessions 4, 5 & 6 are sessions from industry experts