



M.Tech. (ICT) with specialization in VLSI and Embedded Systems



Academics

Service to Society

DA-IICT

Research & Innovation





Program Overview

Very-large-scale integration (VLSI) is the process of integrating or embedding millions of transistors on a single silicon semiconductor chip. VLSI technology is promising due to its high packing density, high speed and low power consumption. Embedded Systems is a domain where VLSI technology is used to build an application specific system and meet user requirements. VLSI and Embedded systems have opened up avenues in various fields such as aerospace, agriculture, automobile, consumer electronics, biomedical and many others. As per the statistics provided by Dr. Handel Jones, International Business Strategies (IBS) global VLSI/Semiconductor market revenue will approximately hit \$600B by 2025. This revenue will be mainly derived from Internet of Things (IoT) semiconductor hardware and sensor market, semiconductor foundry, DRAM, Flash memory and Embedded Systems. Thus, VLSI and embedded systems play a major role in offering the best job opportunities.

In order to support research and development for the VLSI and Embedded System industry, it is desirable to have a knowledge of semiconductor physics, IC fabrication technology, analog and digital design, low power VLSI circuits, Embedded Systems etc. Thus, in summary VLSI and Embedded Systems (VES) is one of the important components of the Information and Communication Technology (ICT) discipline.

The VES research group of ICT department in DA-IICT encompasses wide spectrum ranging from Microelectronics, Digital and Analog Integrated Circuits, VLSI Electronic Design Automation to Nanotechnology, MEMS and Embedded systems. The department has excellent research laboratories with availability of various state-of-the-art CAD tools, low power system testing, PCB fabrication facility to carry out research. The core research areas and on-going projects are in the areas of

- Processor design and implementation, Low Power VLSI design, AI/ML in edge computing and HPC
- Hardware security primitives, Hardware Security Modules (HSM) for Industrial IoT, Machine learning based solutions for Hardware Trojan detection and prevention, Design and modelling of MEMS sensors
- Digital VLSI Architecture Design for High Performance Computer Arithmetic and Signal Processing Algorithms
- Ultra Low Power and Sub-threshold Circuit Methodologies, Very Low Voltage Circuits for Wireless Sensor Networks, Power Management for Energy Harvesters, Signal Processing Hardware for Color Image Processing
- Chip design for application-oriented domains and embedded systems in areas, namely, military, automotive and agriculture
- Digital VLSI design, Nanotechnology, Flexible electronics, Numerical Methods, Circuit and system design for bio-medical applications, System design for agriculture modernization, Graphene Interconnects and devices
- MEMS, Sensor & System Design, IoT, Sensors Signal Conditioning, Self-healing Systems
- Intelligent system and VLSI circuit engineering, Humanoid Robotics

The research carried out by the VES group has culminated into various publications in journals, conferences and book chapters of international repute, bringing several funded projects and incubation of many start-ups. The department has experienced faculty and dedicated labs for supporting Ph.D. and M.Tech. curriculum in VLSI and Embedded Systems. The program provides wide range of core VES subjects together with many electives from domains such as Machine Learning, Signal Processing and IoT to make the program more comprehensive and dynamic.



Program Overview

The important takeaways of the M.Tech. program in VLSI and Embedded Systems are as follows:

- **Choice based curriculum:** Flexibility to register for courses of your choice along with other compulsory courses:

- To strengthen the foundation of VES through courses listed under Specialization Core and Specialization Electives

- To broaden knowledge through courses listed under General Electives

- **Hands-on Exposure through Minor Project-I:**

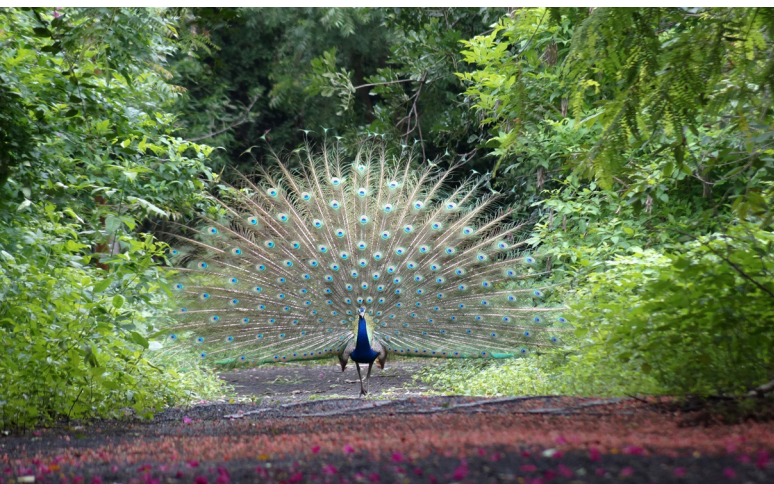
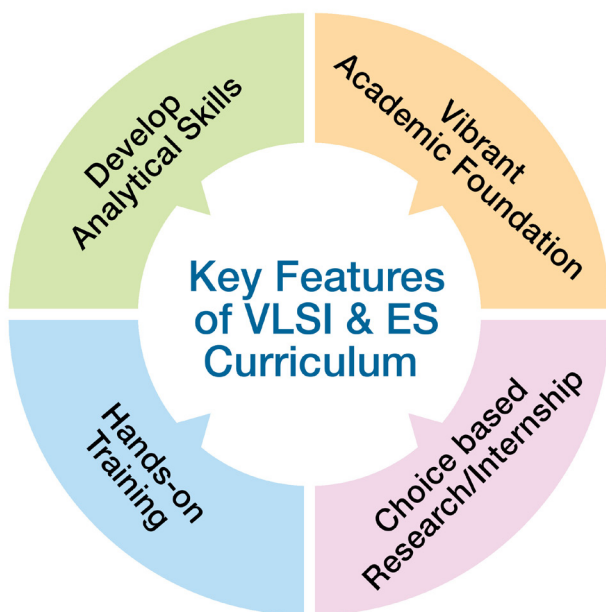
Equips students to be ready for contesting job positions in industry

- **Research Exposure through Major Project-I:**

Allows students to get an exposure on how to handle a project through a systematic approach based on the principles of carrying out a formal research assignment

- **Flexibility in Semester-IV to prioritize Research Track through Major Project-II (for higher studies) over exclusive Industry Internship or vice versa:**

Students may extend their research progress culminating into a thesis, or may choose to pursue industry internships depending upon their inclination





Program Structure

Characterization of program: This program has an intersection of VLSI and Embedded Systems with machine learning, IoT and sensor networks.

The key attractive features of **VLSI & ES** curriculum at DA-IICT Gandhinagar are as follows:

- **To build a vibrant academic foundation:** Courses in the PG curriculum enable the students to get a fine grip over the foundation courses of VLSI and Embedded Systems
- **Develop analytical skills:** The knowledge gained through coursework is further exemplified through extensive usage of VLSI CAD tool suites for chip design and prototyping intelligent embedded systems to carry out projects
- **Familiarization with state-of-the-art skill sets:** Both Minor and Major projects are developed as part of the curriculum to enable students gain hands-on training of applying their theoretical knowledge to practice, thereby
 - Increasing the scope of employability in industry
 - Equipping students better to pursue higher studies
- **Uniqueness of the program:**
 - The fourth semester is made available for students to pursue internship in industry/academia, or to extend their research work from the previous semesters
 - Encourage the students to enrich their curriculum knowledge with hands-on experience using industry standard EDA tool suites
 - Foundation course on Mathematics made compulsory in Semester-I to empower and broaden the knowledge spectrum and fulfill the current information technology demands

Program Structure and Objectives

Coursework Specific Details:

The coursework subjects are categorized under 3 broad headings:

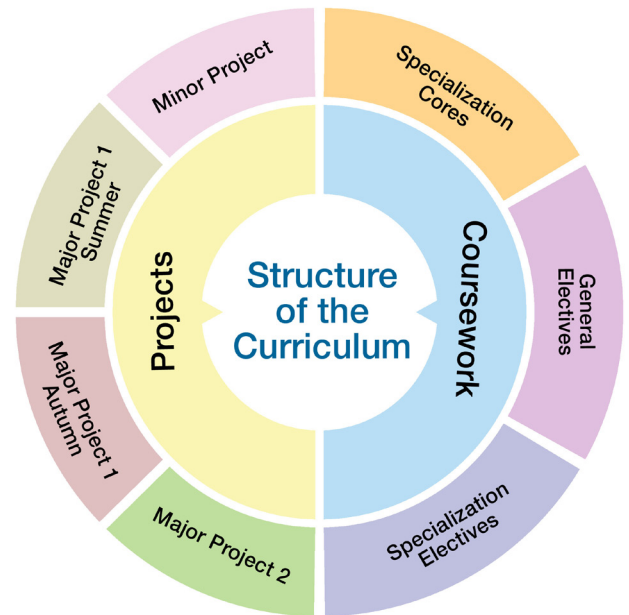
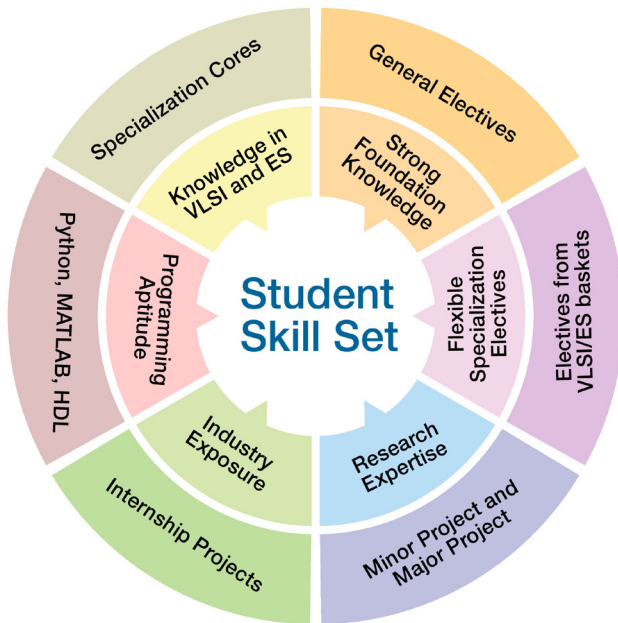
- **Specialization Core:** Courses in this basket are designed to build a strong foundation on VLSI and ES specific courses
- **General Elective:** Courses in this basket are designed to broaden the knowledge spectrum in VLSI & ES
- **Specialization Elective:** Courses in this basket shall enable to delve into the deeper realms of the curriculum, and aid in specializing across different sub-domains

Project Specific Details:

- **Minor Project (Hands-on experiments):** VLSI & ES coursework knowledge gathered in Semester-I are translated to hands-on experiments in minor project of Semester-II for enhancing the analytical capabilities of the students
- **Major Project I (Summer) (Research exposure):** Comprises completion of literature survey, finalizing problem definition, and clearly defining the motivation, objective and scope of the project during the summer (after completion of the first year)
- **Major Project I (Autumn):** Scheduled in Semester-III, it is preferably an extension of Major Project I
- **Major Project II (optional):** An extension of the project work carried out in previous semesters, culminating into a thesis



Program Structure





Course Curriculum

Autumn Semester (Semester-I)

Course Name	Credits (L-T-P-C)
General Elective – Mathematics	3-0-0-3
Communication Skills and Technical Writing	2-0-0-2
Programming Lab	1-0-4-3
Specialization Core I: VLSI System Design	3-0-2-4
General Elective – Technical	3-0-0-3

*Choose from the general elective baskets

Winter Semester (Semester-II)

Course Name	Credits (L-T-P-C)
Specialization Core II: Embedded Hardware Design	3-0-2-4
Specialization Elective I: Choose one	3-0-0/2-3/4
1. ASIC Design	
2. Analog VLSI Design	
Specialization Elective II: Choose one	3-0-0/2-3/4
1. Digital System Architecture	
2. Internet of Things	
Minor Project	0-0-6-3

Summer

Course Name	Credits (L-T-P-C)
Major Project I (Summer)	0-0-8-4

Autumn Semester (Semester-III)

Course Name	Credits (L-T-P-C)
Specialization Elective III-IV: (Choose any two)	3-0-0/2-3/4
VLSI Testing and Verification	3-0-0/2-3/4
Low Power VLSI Design	
VLSI for Digital Signal Processing	
Device Modeling and Simulation	
Edge Computing	
Nanoelectronics	
Major Project I (Autumn)	0-0-12-6

Winter Semester (Semester-IV)

Course Name	Credits (L-T-P-C)
Major Project II / Industrial Training Project	0-0-24-12

General Electives – Mathematics in the areas of:

Linear Algebra, Probability and Random Variables

General Electives – Technical in the areas of:

Machine Learning, Embedded AI, Robotics, Embedded Operating System
Digital Design using HDL and FPGA



Admissions

Total Seats: 16, Seats through GATE : 12 and Seats through Non-GATE : 4

Eligibility Criteria

GATE Qualified candidates

- A candidate with a qualifying degree in any one of the following:
- BE/BTech (CS/IT/EL, ECE, Electrical, Instrumentation), MSc (Electronics)
- The aggregate marks in the qualifying degree should not be less than 60% or equivalent as per the norm set by the degree awarding Institute/University.

Non-GATE Qualified candidates

- MSc (Electronics), BE/BTech (ECE/EE/EL)
- The aggregate marks in the qualifying degree should not be less than 65% or equivalent as per the norm set by the degree awarding Institute/University.

Candidates appearing in their final degree examination and expecting to complete it by July 2022 may also apply. However, their final admission will be subject to the condition that they obtain an aggregate of marks required based on mode of admission i.e. GATE/Non-GATE, or its equivalent as per the norms set by the degree granting Institute/University. All admitted candidates have to submit their degree certificates or proof of completion of degree, before 30 October 2022 failing which their admission is liable to cancellation.

There is no age limit applicable to this program.

Selection Process

Admission to M. Tech. (ICT) with specialization SS, ML and VLSI will admit candidates through two channels from this year: GATE and NON-GATE.

Candidates who have a valid GATE score in the disciplines of Electronics & Communication Engineering (EC), Electrical Engineering (EE), Computer Science and Information Technology (CS), only can apply. The ranking of candidates with GATE score of 425 or above will be on the basis of GATE score only. The candidates with GATE score less than 425 may be required to appear for an interview at DA-IICT in person/Online. Ranking of such candidates will be based on the GATE score and performance in the interview.

Non-GATE candidates selection will be based on their qualifying degree and performance in the interview.

Weightage will be as follows:

40% weightage -> qualifying degree

60% weightage-> interview

Note: At the time of finalization of admissions, it is likely that some of the Universities in the country would not have announced the final year results of the qualifying degrees prescribed for admissions. In such cases, 40% weightage in qualifying degree will be assigned to the aggregate marks obtained in all the previous University examinations of the qualifying degree. However, if the applicant fails to receive 65% aggregate marks in the qualifying degree after announcement of final year results, her/his admission will stand discontinued forthwith and no representation/appeal will be entertained.



Admissions

The candidates can give up to two preferred specializations based on their eligibility conditions. Counseling for allotment of the specialization will be done online. Applicants are advised, from the date of announcement of first merit list, to check for e-mail communications from the Institute to learn about the admission status and steps they need to take to continue with the counseling process.

Note: The decision of the Competent Authorities of DA-IICT regarding eligibility and selection of any candidate shall be final.

How to Apply

Candidates submit an online application by clicking on the link given on the Institute website.

Admission Offer

Final merit list of the confirmed and wait-listed candidates (based on their performance in the entrance examination/interview) shall be posted in the website of the institute.

Important Dates

Online application website opens	11 th March 2022
Last date for submission of online applications	30 th May 2022
Date of Interview for Non-GATE category (tentative)	15 th /16 th June 2022
Announcement of first merit list for Admissions (tentative)	25 th June 2022
Commencement of academic session	TBD

Fees Structure*

At the time of admission an amount of Rs. 89, 500/- (Rs.64, 500/- towards Tuition Fee for the First Semester and Rs. 25,000/- towards Caution Deposit) is to paid. The registration fee is payable at the time of registration and hostel rent on allotment of the hostel room.

Tuition fee	Rs. 64,500 per Semester
Registration Fee	Rs. 2,500 per Semester
Caution Deposit	Rs. 25,000 (Refundable at the end of the program)
Hostel Rent	Rs. 23,000 per semester
Food	On actuals. There are multiple food options available in the campus (The expense will be approximately Rs. 5,500 per month)

*Subject to revision

Education Loan

The Institute will facilitate the students to avail educational loan from selected Banks. The bank officials will be present on campus at the time of registration of admitted students so as to enable the students to obtain details on procedures and terms and conditions of the loan. The students can also avail loan from banks of their choice and in either of the case; the Institute will extend support in completing the loan documentation process.

Financial Assistance

All GATE admitted students would be eligible for a monthly stipend of Rs. 12400/- in the form of Teaching Assistants in the first semester. In subsequent semesters, the continuation would depend on their satisfying the academic requirements.

For Inquiries: Voice Call: 080 66 91 91 80



The Faculty

Blending academic excellence, research eminence & professional experience

DA-IICT successfully attracts the best teaching and research talents who have completed their doctoral studies at premier institutes in India (such as IISc, ISI, IPR, PRL, IITs, IIITs, NITs, HBNI, Central Universities etc.) or international institutes of repute (in USA, Canada, Europe, Australia, Korea, Singapore etc). All our faculty members are active researchers in their respective fields. Most of our faculty members have significant international exposure in terms of research and industry experience, and are involved in national/international collaborative research projects. They are an exceptional group of academicians in Mathematics,

Statistics, Computer science, Physics, Data Science, Computational Science, Communication, Signal Processing, Electronics, Design, Humanities and Social Sciences who are determined to push the frontiers in research and technology. They conduct advanced research and the new knowledge they create routinely benefits classroom learning.

The complete list of our faculty members and their research interests can be found at:

<https://www.daiict.ac.in/people/faculty/>

Message to Prospective Students

The Post Graduate programme – MTech (ICT) with specialization in VLSI and Embedded systems is a unique fusion of foundation courses in Electronics with underlying intersection with machine learning, IoT, sensor networks, and exposure to the techniques, tools used in VLSI and Embedded systems to solve problems in related areas. The primary objective of this program is to produce Industry ready quality human resources with strong Analytical Skills to take up challenges in research activities, which are of national importance.

Dr. K. S. Dasgupta

Director

VLSI is an integral part of ICT. DAIICT has well equipped labs and well known faculty working in this exciting area and they are handling interesting projects. I am sure by joining DAIICT, you will gain abundant knowledge to build your career in this area. Hence, I strongly recommend you to join DAIICT and help us in taking this field to a greater height.

Dr. Manjunath Joshi

Dean (Research & Development)

The MTech (ICT) with specialization in VLSI and Embedded Systems has found a unique place among other specializations in the MTech program. Faculty involved in this specialization are highly experienced and committed to provide a strong foundation in the field, impart knowledge in industry relevance courses and a compulsory thesis training. The specialization attracts the best talents from different parts of the country because of our alumni who have been well appreciated in industry and in the society. I welcome all aspirants to take part of the journey of this specialized program.

Dr. Maniklal Das

Dean (Academic Programs)

