M. Tech. in Electrical Engineering (VLSI)

Specialization: Very Large Scale Integration (VLSI)

Duration: 4 semesters

Eligibility: Candidates with engineering field of studies such as BE or B. Tech in Electrical Engineering, Electronics & Communications, Instrumentation, Associate membership of professional bodies equivalent to B.Tech. (EEE/EE/ECE/IN) and M.Sc. in Electronics Science are eligible for this course. (As per ordinance and regulations for M.Tech./M.Sc. of IIT Mandi)

Selection: The candidates are selected through an all India entrance examination (GATE) followed by a written test and an interview.

Objectives of the program:

After undergoing this program, the students will acquire both theoretical knowledge and practical skills in Electrical Engineering with specialization of VLSI and chip designing. The curriculum is supported with the advance learning courses of VLSI specialization in device level understanding, design, fabrication and tools. During M. Tech. theses, the students will use VLSI design, testing and fabrication laboratories. For a better insight of the specialization, the core laboratories for VLSI design and fabrication have been designed with considering experimental understanding of the Specialization Core courses. The laboratory experiments will build the basic concepts and the advanced concepts for chip designing. The VLSI laboratories will be the part of VLSI center of IIT Mandi. Moreover, these VLSI laboratories will be further useful for undergraduate students of IIT Mandi, in advance learning of B. Tech. with VLSI as minor area. The UG students will also use the VLSI center facility to execute their major technical project. It is envisaged that adjunct faculty from industry such as SCL (Mohali), STMicroelectronics, Texas instruments, Analog Devices, NXP, Synopsis, Cadence, Mentor Graphics etc. will be engaged to provide industrial experiences to M. Tech students.

The proposed M. Tech. course is with the vision of upcoming center for design and fabrication of electron devices (C4DFED) at IIT Mandi. The proposal is also a part of the special

man-power development project from system to chip design (SMDP-C2SD) under the Department of Electronics and Information Technology (DeitY). The DeitY will be funding for the designed chip as a part of the M. Tech. theses under the India Chip Program. This initiative to fulfil the goal of development of country in the vision and mission of make in India.

How is this program different?

- Very strong industry oriented curriculum
- Experiments/practical based learning,
- Industry oriented courses,
- The chip designing EDA tools (Cadence, Mentor Graphics, Synopsis, Sylvaco, Centaurus and Comsol) based learning. These tools are the latest one and used in all the VLSI industries.
- 100 Class and 1000 class clean room facility available at IIT Mandi for device fabrications.
- Sophisticated instrumentations facility available for device fabrications and characterizations
- Learning design as well as fabrication aspects of the chip,
- Generate and trained manpower for semiconductor design and upcoming fab-line in India.
- There is a vast market opportunities for the graduating students

Core VLSI specilized faculties

1. Dr. Hitesh Shrimali (SCEE): Analog and mixed signal VLSI design (circuit designing)
2. Dr. Satinder Kumar Sharma (SCEE): VLSI Technology, Semiconductor device physics, MEMS/NEMS and memory design
3. Dr. Shubhajit Roy Chowdhury (SCEE): Embedded system, FPGA, EDA, VHDL and system level design
4. Dr. Kunal Ghosh (SCEE): Microelectronics and photovoltaic devices
5. Dr. Viswanathan Balakrishnan (SE): Nano manufacturing and Nano materials
6. Dr. Rahul Shreshtha (SCEE): Digital MOS LSI, System level design
7. Dr. Ankush Bag (SCEE): MEMS, device fabrication
8. Dr. Rajini Ramalingam (SCEE): Nanosensors, MEMS/NEMS, cryogenic engineering

9. Dr. Srikant Srinivassan: Spintronics

FIRST SEMESTER (1ˢᵗ Sem)

Title of the course	L-T-P-C	Credits	Remarks
CMOS Analog IC design	3-0-2-4	4	Specialization Core-1
CMOS Digital IC design Laboratory	0-0-3-2	2	Specialization Core Lab-1
Microelectronic devices and modeling	3-0-0-3	3	Electrical Engineering Core
Advance Digital Signal Processing	3-0-0-3	3	Electrical Engineering core
Elective - II	3-0-0-3	3	Specialization Elective (VLSI Technology)
Elective - II	3-0-0-3	3	Free elective
Total		**18**	

SECOND SEMESTER (2ⁿᵈ Sem)

Title of the course	L-T-P-C	Credits	Remarks
VLSI technology	3-0-0-3	3	Specialization core-1
VLSI fabrication Laboratory	0-0-3-2	2	Specialization Lab-2
Elective-III	3-0-2-4	**4**	Specialization Elective (VLSI System Design)
Elective - IV	3-0-0-3	3	Free elective
Advance Computer Architectures	3-0-0-3	3	Electrical Engineering core
Numerical Methods for Engineers	3-0-0-3	3	Electrical Engineering core
Technical Communication*	1-0-0-1	1	
Total		**19**	

THIRD SEMESTER (3ʳᵈ Sem)

Course No.	Title of the course	L-T-P-C	Credits
EE XXX	Elective V:	3-0-0-3	3
EE XXX	Elective VI:	3-0-0-3	3
EE XXX	Master of Technology Dissertation – part - I	0-0-20-10	10
	Total		**16**

FOURTH SEMESTER (4ᵗʰ Sem)

Course No.	Title of the course	L-T-P-C	Credits
EEXXX	Master of Technology Dissertation – part - II	3-0-0-3	18
	Total		**18**

Elective –I

- Nano electronics and Microfabrication **(3-0-0-3)**
- Photonics **(3-0-0-3)**
- Mathematical Physics **(3-0-0-3)**

Elective-II and IV (Free Elective from SHSS, SBS and SE) – (3-0-0-3)

The students can choose any elective from the school of humanities and social sciences (SHSS), the school of basic science (SBS) and the school of engineering (SE) for Elective-II.

Elective –III

- Mixed signal VLSI Design **(3-0-2-4)**
- Embedded system Design **(3-0-2-4)**
- Biomedical systems **(3-0-2-4)**
- **Mathematical Modeling for Signal Processing** (3-0-2-4)

Elective –V (Design)

- Advanced embedded system **(3-0-0-3)**
- CAD for VLSI Design **(3-0-0-3)**
- Optical Devices and high Speed Communication **(3-0-0-3)**
- VLSI Test and Verification **(3-0-0-3)**

Elective –VI (Technology)

- **Nanomanufacturing** **(3-0-0-3)**
- MEMS/NEMS **(3-0-0-3)**
- Advance optoelectronics devices **(3-0-0-3)**
- Organic electronics **(3-0-0-3)**
- Sensors and transducers **(3-0-0-3)**