B. Tech. in Microelectronics and VLSI Engineering
in
School of Computing and Electrical Engineering (SCEE)

Motivation:

India semiconductor mission is aiming to have a growth in the semiconductor industry in India. The conventional undergraduate courses such as electrical and electronics will give some foundations in the VLSI to pursue higher education in the area of VLSI. This program is designed to support the manpower for the semiconductor industry in the upcoming years with trained undergraduates. This course is designed to train the students in the core area of VLSI with industrial standard EDA tools to understand the current scenario and the state of the art. After undergoing this program, the students will acquire both theoretical knowledge and practical skills in VLSI specialization and chip designing. The curriculum is supported with the advanced courses of VLSI specialization in device level, design, fabrication and tools.

Course Structure:

Academic courses offered by IIT-Mandi for the B. Tech. / B. Tech. (Honors) program are classified as Institute Core (IC), Discipline Core (DC), Discipline Elective (DE) and Free Elective (FE) courses. As per IIT Mandi, a student must complete minimum credit requirements of 160 credits for regular B. Tech. and 172 credits for the B. Tech. with Honors. Hierarchically, IC courses provide a broader view of all engineering disciplines and IIT Mandi believes in making this learning process instrumental. Here, students are conceptualized with the fundamentals of these essential courses via theoretical approach and by conducting methodically structured experiments for the same. The majority of these IC courses are offered during 1st and 2nd semesters of B. Tech. program. In the third semester, the students will be introduced with basic courses in electronics for better foundation in the core field. In the 4th semester, students are offered with the design practicum course which is inspired by the practicum-based learning. Here, students are segregated into groups where each group contains students from various disciplines like computer science, electrical, mechanical, civil, physics etc. Each group is supposed to carry out an interdisciplinary project that solves real-world problems of the society and its cost is fully sponsored by IIT Mandi. In this era of interdisciplinary technology, students are encouraged to take courses apart from the core Microelectronics and VLSI engineering. he discipline core courses will be introduced in the 4th and 5th semester. The DC courses are more focused towards microelectronics and VLSI where the students are escorted deeper into core concepts. These are the fundamental knowledge that every engineer must have on their fingertips when they are working or pursuing higher studies. These DC courses are well structured and cover a wide range of areas in Device and Technology, circuit design and system design. Semiconductor Devices, Fabrication and Packaging will be taught as part of devices and technology. As part of circuits courses such as analog and RF circuit and digital circuits will be taught. As part of system design we consider courses such as RTL design and verification, Design for Testability.

From 6th semester onwards, discipline electives are offered to the students where they can opt for any of these courses with their own interest or by consulting with their faculty advisor(s). The list of DE courses is presented below in this document. They are advanced subjects designed to render in-depth understanding of specific areas in Microelectronics and VLSI engineering. DE courses have a wide variety and their contents are of state-of-the-art standard. These are the subjects which give them an edge while applying for the core-company jobs and makes them highly skilled assets of an organization.

Free Elective courses are offered from 6th semester onwards. Once again, the students can register for these courses based on their interest or the advice taken from faculty advisor(s).

Another flagship practicum course called Interdisciplinary Socio Technical Practicum is available as an elective during 6th semester. This course provides an invaluable opportunity for students to understand the real problems of local surroundings and come up with feasible solutions. In addition, students from IIT-Mandi collaborate with the international students while executing this course. It provides invaluable experience for them to work in multinational culture. The students will be given an opportunity to go for an industrial internship during their course work to get some industrial experience and exposure. Eventually, the students are given optional choice in 7th - 8th semester to carry out a major technical project (MTP) under the supervision of faculty member(s). It is a year-long project taken by B. Tech. students in their fourth year. The MTP is a capstone task which builds upon the previous three years of study taken by B.Tech. students.

Objectives:

- Very strong industry oriented curriculum
- Practicum based learning with industry oriented courses
- The chip designing EDA tools (Cadence, Mentor Graphics, Synopsys, Silvaco, 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 instrumentation facility available for device fabrications and characterizations
- Learning design as well as fabrication aspects of the chip,
- Generation of trained manpower for semiconductor design and upcoming fab-line in India.

B.Tech [Microelectronics and VLSI Engineering]			
Division	Category	No. of courses	No. of Credits
Institute Core (IC)	IC Compulsory	14	39
	IC Basket	2	6
	HSS Courses	4	12
	IKS Course	1	3
Discipline	Discipline core (DC)	16	54
	Discipline Elective (DE)	3/4	12
Electives	Free Elective	6	22
	MTP + ISTP or Electives		12
Total			160

Semester wise distribution

SEMESTER I

S.No	Course Code	Course Name	L-T-P-C
1	ICxxx	Calculus	1.5-0.5-0-2
2	ICxxx	Complex and Vector Calculus	1.5-0.5-0-2
3	IC140	Engineering Graphics for Design	2-0-3-4
4	IC152	Introduction to Python and Data Science	3-0-2-4
5	ICXXX	IC Core basket – 1	2.5-0.5-0-3

6	HSXXX	HSS Course	3-0-0-3
7	IKS181	IKS Course	3-0-0-3
		Total	21

SEMESTER II

S.No	Course Code	Course Name	L-T-P-C
1	ICxxx	Linear Algebra	1.5-0.5-0-2
2	ICxxx	ODE & Integral Transforms	2.5-0.5-0-2
3	IC161	Applied Electronics	3-0-0-3
4	IC 161P	Applied Electronics Lab	0-0-3-2
5	IC 252	Probability and Statistics	3-0-2-4
6	ICXXX	IC Core Basket	2.5-0.5-0-3
7	ICXXX	Foundations of Design Practicum	1-0-6-4
8	IC 221P	Physics Practicum	0-0-3-2
		Total	22

SEMESTER III

S.No	Course Code	Course Name	L-T-P-C
1	IC 272	Machine Learning	3-0-03
2	EE 210	Digital System Design and Practicum	3-0-2-4
3	VLxxx	Electro Magnetic Theory and Transmission Lines	3-0-0-3
4	EE xxx	Signals and Systems	2.5-0.5-0-3
5	EE 301	Control Systems	3-0-2-4
6	EE 203	Network Theory	2.5-0.5-0-3
7	VL xxx	Semiconductor Devices for ICs	3-0-0-3
		Total	22

SEMESTER IV

S.No	Course Code	Course Name	L-T-P-C
1	IC 201P	Design Practicum	0-0-6-3
2	EE 211	Analog Circuit Design	3-0-2-4
3	EExxx	Computer Organization and Design	3-0-2-4
4	VLxxx	CMOS Processing and Practicum	3-0-2-4
5	VLxxx	Reverse Engg (E-Waste Management and Recycling)	0-0-2-1
6	VLxxx	Electronic System Packaging	3-0-0-3
7	HSxxx	HSS course-1	3-0-0-3
		Total	22

SEMESTER V

S.No	Course Code	Course Name	L-T-P-C
1	VLxxx	RF IC Design	3-0-0-3
2	VLxxx	Design for Testability	3-0-2-4
4	VLxxx	CMOS Digital IC Design	3-0-2-4
5	VL xxx	CMOS Analog IC Design	3-0-2-4
5	VLxxx	RTL Design and Verification	2-0-2-3
8	HS xxx	HSS course-1	3-0-0-3
		Total	21

SEMESTER VI

S.No	Course Code	Course Name	L-T-P-C
1	HSxxx	HSS course-3	3-0-0-3
2	DP301 / DE -1	ISTP / DE-1	4
3	DE-2	DE-2	3-0-0-3
4	DE-3	DE-3	3-0-0-3

5	FE-1	FE-1	3-0-0-3
6	FE-2	FE-2	3-0-0-3
7	IC 010	Internship	2
		Total	21

SEMESTER VII

S.No	Course Code	Course Name	L-T-P-C
1	DP401/DE-4	MTP-1/DE-4	3-0-0-3
2	DE-5	DE-5	3-0-0-3
3	DE-6	DE-6	3-0-0-3
4	FE-3	FE-3	4
5	FE-4	FE-4	4
		Total	17

SEMESTER VIII

S.No	Course Code	Course Name	L-T-P-C
1	DP401/DE-7	MTP-II/DE-7	5
2	FE-5	FE-5	4
3	FE-6	FE-6	4
		Total	13

List of Core courses for B.Tech [Microelectronics and VLSI]			
S.No	Course No	Course Name	L-T-P-C
1	EExxx	Signals and Systems	2.5-0.5-0-3
2	EE210	Digital System Design and Practicum	3-0-2-4
3	EE203	Network Theory	2.5-0.5-0-3
4	VLxxx	Semiconductor Device for ICs	3-0-0-3
5	EE301	Control Systems	3-0-2-4
6	VLxxx	Electro Magnetic Theory and Transmission Lines	3-0-03
7	EExxx	Computer Organization and Design	3-0-2-4
8	EE211	Analog Circuit Design	3-0-2-4
9	VLxxx	CMOS Processing and Practicum	3-0-2-4
10	VLxxx	RF IC Design	3-0-0-3
11	VLxxx	Electronic System Packaging	3-0-0-3
12	VLxxx	CMOS Analog IC Design	3-0-2-4
13	VLxxx	CMOS Digital IC Design	3-0-2-4
14	VLxxx	RTL Design and Verification	2-0-2-3
15	VLxxx	Design For Testability	3-0-2-4
16	VL xxx	Reverse Engineering	0-0-2-1