

# M. Tech. in Microelectronics & VLSI

## Curriculum Structure (AY 2025-26 Onwards)



Department of Electronics Engineering  
Indian Institute of Technology Jodhpur

## Introduction

The proposed M.Tech. program in Microelectronics & VLSI is designed to provide training to graduate students with the state of the art knowledge in the domain of VLSI Systems, including semiconductor fundamentals, emerging devices and compact modelling, advanced circuits and systems, system on chip design, signal processing, on-chip machine learning algorithms, VLSI for communication and others. The proposed M.Tech. programme for Microelectronics & VLSI of IIT Jodhpur includes state of the art analog and digital VLSI circuits and systems, mixed signal circuits, testing and verification algorithms, issues with system integration for performance considerations, covering wide aspects of embedded and computing systems, and emerging applications. It will cover a wide aspect of fundamentals, design skills, hands on through experiential learning consisting of lab exercises, assignments, case studies and current trends in the semiconductor industry.

## Objectives

The main objective of this program is to train students by imparting them skills related to the current era of VLSI systems with a deeper understanding of its various components: from devices to hardware design. By imparting extensive knowledge and research experience, the program focuses on novel approaches to processing and computation for energy- and memory-efficient hardware. With the availability of massive data acquisition and data processing, the current research and trend in future computing systems is oriented towards memory-driven and edge computing AI architectures.

The graduates will eventually be contributing to all-encompassing areas of MicroElectronics & VLSI which include emerging semiconductor devices and modelling, analog & mixed-signal circuits, RF integrated circuits (ICs), ASIC and SoC Design, embedded intelligence, self-adaptive systems, flexible electronics, neuromorphic computing, hardware for AI, state of the art non-volatile memories, machine learning, 5G communication, Internet of things (IoT) and others. The course will rigorously train the graduate students so as to enable them to take up new challenges and solve the problems in the domain of the current and future VLSI systems. The knowledge of theoretical concepts with in depth analysis and understanding of practical design issues will make their understanding more refined and result oriented in the areas of next generation VLSI systems.

Various state of the art computational facilities are available in the institute like NVIDIA DGX2 which will help the candidates to learn high performance computing, to implement machine learning algorithms and learn the concepts of data analysis. The students will have access to various design/EDA tools like Cadence Virtuoso, Mentor Graphics, Synopsys tool suite etc.

The objectives of this program are summarised as follows:

- Insight of semiconductor device physics, modelling and fabrication.
- Theoretical as well as practical knowledge of circuits and systems
- System Design issues and challenges
- Embedded Intelligence
- Machine learning algorithms, signal processing and data acquisition
- Algorithm level and architectural level optimization and implementation
- State-of-the art system design methodologies as well as current trends in the semiconductor industry
- Brain-Inspired Technologies
- Novel approaches to processing and computation for energy and memory-efficient hardware
- Development of testing and verification skills through state of the art algorithms
- Exposure to layout, floorplanning, placement and routing techniques
- High speed system design issues and performance considerations

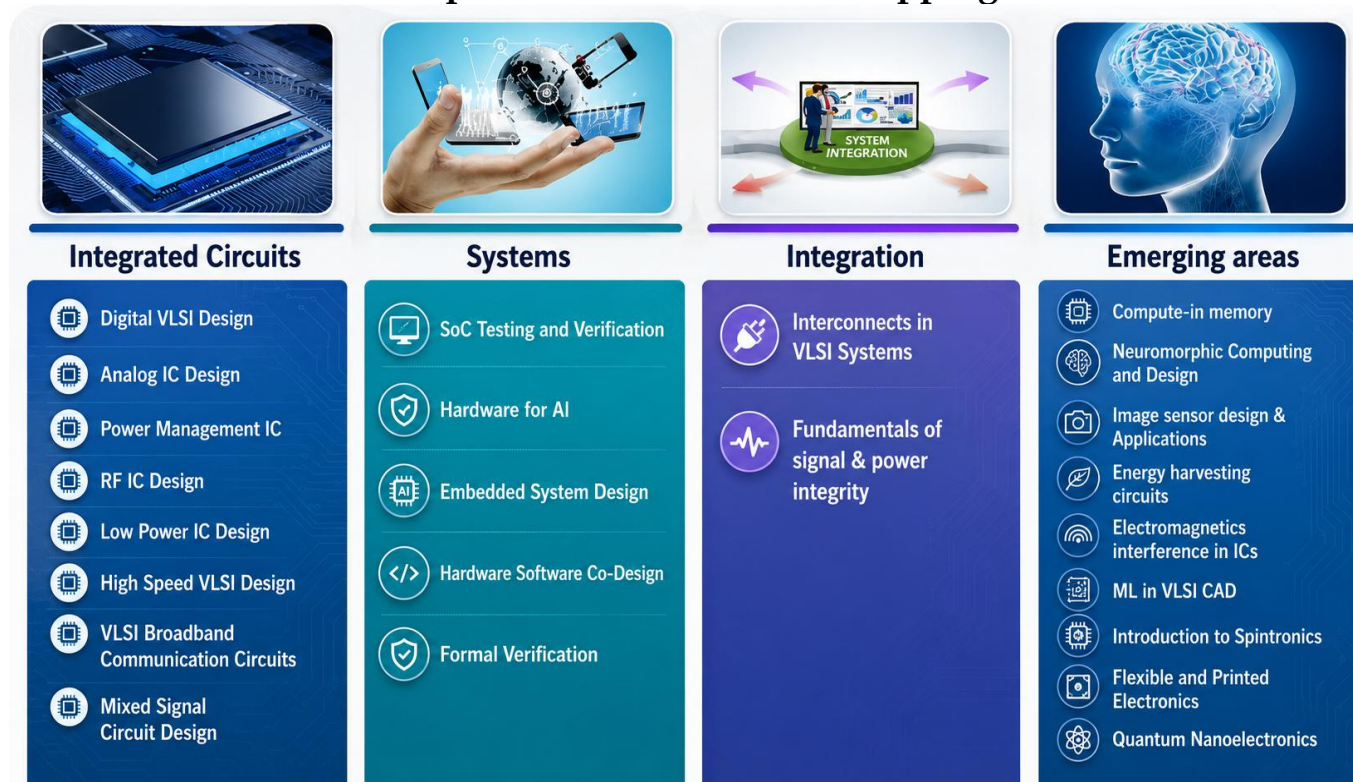
## Graduate attributes

- Ability to follow a multidisciplinary approach for design and implementation of systems, involving various domains of Engineering, and Sciences
- To learn top-to-bottom approach for IC design
- Exposure to computing for embedded intelligent systems
- To learn machine learning tool and its application in domains like VLSI for signal processing and communication
- To apply the skills and course aspects directly in the profession
- Exposure to design issues and challenges in ASIC and SoC Design
- Exposure to system level integration and challenges including packaging and PCB related issues

## Learning outcomes

- Ability to design digital, analog, mixed signal circuits
- Knowledge of ASIC flow for IC fabrication and tape out
- Exposure to state-of-the-art compact models, process and IC fabrication technology
- Implementation of intelligence in traditional VLSI systems/architectures
- Knowledge of VLSI design flow covering both front end and back end.
- Knowledge of programming, algorithms and system development techniques
- Able to design and implement algorithms for optimising hardware
- Knowledge of complete system integration and challenges associated with high-speed designs

## Topic Clouds and Course Mapping



# Curriculum

## M.Tech. in Microelectronics & VLSI

**Table 1 Course categories and credits**

S.No.	Category	Course Category Title	Total Courses	Total Credits
1	C	COMPULSORY	4	14
2	E	ELECTIVES	4	12
3	NG	Non-Graded	2	0
3	T	Thesis	<b>2 (16+16)</b>	32
<i>Total</i>				<b>58</b>

**Table 2 Semester-wise Course Distribution**

	Cat. Course Number, Course Title			L-T-P Credits		Cat. Course Number, Course Title		L-T-P	Credits
<b>I Semester</b>					<b>II Semester</b>				
C	EEL7XX0	<b>Solid State Devices</b>	3-0-0	3	C	EEL7XX0	<b>IC Technology</b>	3-0-2	4
C	EEL7XX0	<b>Digital VLSI Design</b>	3-0-0	3	E	EEL7XX0	<i>Elective</i>	3-0-0	3
C	EEL7XX0	<b>Analog IC Design</b>	3-0-2	4	E	EEL7XX0	<i>Elective</i>	3-0-0	3
E	EEL7XX0	<i>Elective</i>	3-0-0	3	E	EEL7XX0	<i>Elective</i>	3-0-0	3
	NG1 HSN7XX0	Non-Graded I	1-0-0	S/X		NG2 HSN7XX0	Non-Graded II	1-0-0	S/X
<i>Total</i>				<b>13</b>	<i>Total</i>				<b>13</b>
<b>III Semester</b>					<b>IV Semester</b>				
T	EET8XX0	Thesis		16	T	EET8XX0	Thesis		16
<i>Total</i>				<b>16</b>	<i>Total</i>				<b>16</b>

**Table 03 List of Elective Courses**

<b>S.No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>L-T-P</b>	<b>Credits</b>
1	EEL7XX0	<i>Flexible and Printed Electronics</i>	3-0-0	3
2	EEL7XX0	<i>Semiconductor Device Characterization</i>	3-0-0	3
3	EEL7XX0	<i>Physics and Modelling of MOS Transistors</i>	3-0-0/2-0-2	3
4	EEL7XX0	<i>Introduction to Electronics Packaging</i>	3-0-0	3
5	EEL7XX0	<i>VLSI Broadband Communication Circuits</i>	3-0-0	3
6	EEL7XX0	<i>Radio Frequency Integrated Circuit Design</i>	3-0-0	3
7	EEL7XX0	<i>Signal and Power Integrity</i>	3-0-0	3
8	EEL7XX0	<i>Hardware Design for Artificial Intelligence</i>	3-0-0	3
9	EEL7XX0	<i>SoC Testing &amp; Verification</i>	3-0-0	3
10	EEL7XX0	<i>In-memory computing</i>	3-0-0	3
11	EEL7XX0	<i>Mixed Signal Circuit Design</i>	3-0-0	3
12	EEL7XX0	<i>Hardware-Software Co-design</i>	3-0-0	3

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