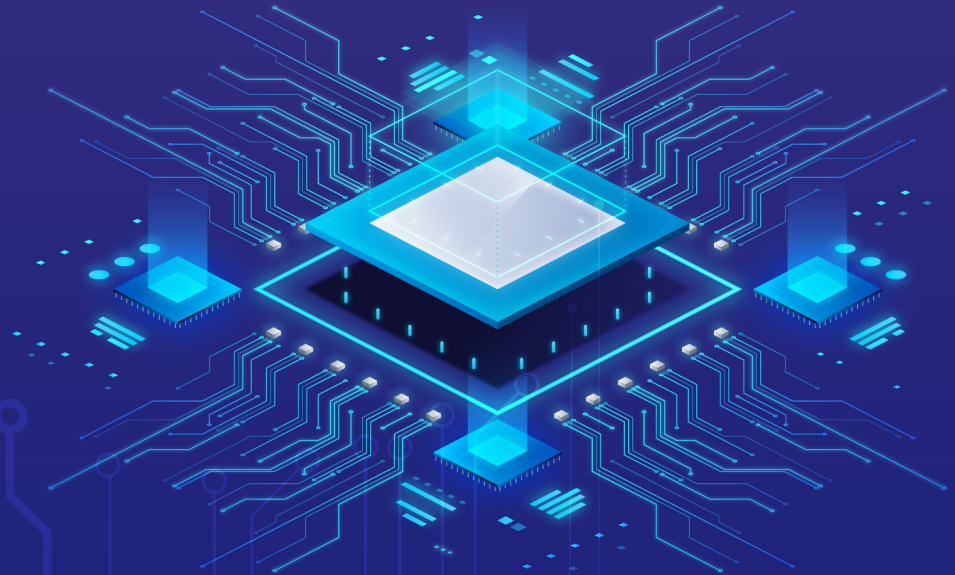




SYNOPSYS®

India Semiconductor Workforce Development Program

Shaping the Global Semiconductor Landscape: India Leads with Innovation and Expertise.
Collaborate, Innovate, and Transform with the India Semiconductor Workforce Development Program.





About this Program:

THE INDIA SEMICONDUCTOR WORKFORCE DEVELOPMENT PROGRAM: A BEACON FOR THE GLOBAL SEMICONDUCTOR LANDSCAPE

In the era of rapid technological advancement, the significance of semiconductors is paramount. They're not just the lifeblood of our digital devices, but they also play a crucial role in the innovation, development, and deployment of next-generation technologies. Recognizing this, the collaboration between the illustrious Indian Institute of Science (IISc) and the globally renowned Synopsys Inclusive, USA, has culminated in the creation of the India Semiconductor Workforce Development Program (ISWDP). But what exactly is this program, and why is it vital not just for India, but for the world?

01 What is the ISWDP?

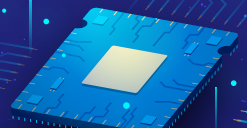
The India Semiconductor Workforce Development Program is a unique and comprehensive initiative tailored to bridge the process technology and device design skill gap in the swiftly expanding semiconductor sector. It's a meticulously designed course, covering the foundations, diving deep into the nuances of device/technology development skills, and offering a hands-on approach through a microelectronics lab experience. Beyond the core curriculum, the program provides an unparalleled practical experience, offering students/industry professionals the chance to implement projects using state-of-the-art research tools, and even opportunities for industry interactions.

02 Benefits for Aspiring Professionals

For individuals aspiring to build a career in semiconductors, the ISWDP is a golden ticket. It offers an avenue to delve deep into semiconductor technology, equipping participants with both foundational and advanced knowledge. The program's association with giants like IISc and Synopsys ensures that students receive unparalleled learning, combining academic rigor with industry relevance. Whether you're a fresh graduate or an industry professional, the program offers something for everyone, ensuring a clear path to leadership in the semiconductor domain.

03 Why Now?

The global semiconductor industry is witnessing a renaissance. From powering our smartphones to being the linchpin for breakthrough technologies like artificial intelligence, quantum computing, and more, semiconductors are pivotal. The present decade, 2020-30, is often dubbed the "decade of semiconductors", and for a good reason. Reports suggest that by 2022, the worldwide semiconductor revenue will touch \$661 billion, with India emerging as a significant player in the industry. India's poised positioning as a potential leader in the semiconductor market, combined with a surging demand across numerous industries, makes it the right time for such a program.





04 A Boost for Industries

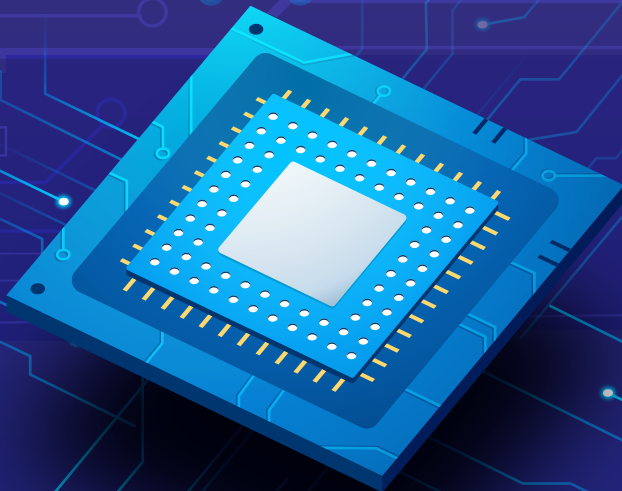
The semiconductor shortage isn't just a workforce issue; it's a supply chain and production challenge, too. With more professionals trained in the art and science of semiconductor development, industries stand to benefit. A skilled workforce means faster innovation, better quality control, and quicker solutions to intricate semiconductor challenges.

05 Addressing the Global Shortage

A persistent concern in recent years is the global semiconductor workforce shortage. As industries evolve and technology becomes more embedded in our daily lives, the demand for skilled professionals in the semiconductor space is skyrocketing. The ISWDP is not just a response to this shortage but a proactive measure, ensuring that India produces plenty of skilled professionals by 2030, ready to take on the challenges of the global semiconductor landscape.

06 Join Now

The India Semiconductor Workforce Development Program is more than just an educational initiative; it's a beacon for the future of global technology. The semiconductor industry's trajectory is clear, and the road ahead is filled with promise and potential. By being a part of ISWDP, participants aren't just embarking on a learning journey; they're becoming integral to the very fabric of the future. Don't just be a spectator to the global technological revolution; be a frontrunner. Enroll in the India Semiconductor Workforce Development Program and be the change you wish to see in the world of semiconductors. Your journey to mastery, innovation, and global leadership starts here.





India Semiconductor Workforce Development Program:

Level-1 (Pre-requisites: Semiconductor Devices)	CONTENTS	TOOLS	DETAILS
	<ul style="list-style-type: none">Basics of Technology CADTCAD Tool WorkflowBasic 2D Structure CreationDiode and MOSFET SimulationDevice AnalysisLook Inside the Device (See how it works)	<ul style="list-style-type: none">Sentaurus Device EditorSentaurus DeviceSentaurus WorkbenchSentaurus Visual	<p>Mini. Qual.: B.Tech. 2nd Year</p> <p>Duration: 1 Week (10 Hrs)</p> <p>Schedule: Once Every 3 Months</p> <p>Learning: Live Virtual / Demo</p> <p>Maximum-Participants: 1000</p> <p>Fees (INR):</p> <ul style="list-style-type: none">Students: 2000 (+GST)Industry (INR): 20,000 (+GST)
	CONTENTS	TOOLS	DETAILS
	<ul style="list-style-type: none">Practical Device Structure Creation Through ScriptsNMOS/PMOS/CMOSAdvanced Device SimulationRealtime Device AnalysisPhysical ModelsMeshing StrategyModel Parameters	L1 + Script Editor	<p>Mini. Qual.: B.Tech. 3rd Year</p> <p>Duration: 3 Weekends (15 Hrs)</p> <p>Schedule: Once Every 3 Months</p> <p>Learning: Live Virtual & Hands-On</p> <p>Maximum-Participants: 500</p> <p>Fees (INR):</p> <ul style="list-style-type: none">Students: 3000 (+GST)Industry (INR): 30,000 (+GST)
Advance (Pre-requisites: Level-2)	CONTENTS	TOOLS	DETAILS
	<ul style="list-style-type: none">2D Process Simulations3D Device SimulationsProcess DevelopmentMixed-mode SimulationsFrequency Dependence, AC, and Thermal analysis <p>RF Device Simulations</p> <p>Parameter Extraction</p> <p>Calibration Basics</p>	L1 + L2 + Sentaurus Process + Scripting in Sentaurus visual	<p>Mini. Qual.: B.Tech</p> <p>Duration: 4 Weekends (20 Hrs)</p> <p>Schedule: Once Every 3 Months</p> <p>Learning: Live Virtual, Hands-On & Assignments</p> <p>Maximum-Participants: 250</p> <p>Fees (INR):</p> <ul style="list-style-type: none">Students: 5000 (+GST)Industry (INR): 60,000 (+GST)
Custom (Pre-requisites: Advanced)	CONTENTS (One of the Following)	TOOLS	DETAILS
	<ul style="list-style-type: none">3D Process SimulationsReliability (HCI & NBTI)ESD SimulationsPower MOSFETsGaN HEMTs (Power)GaN HEMTs (RF)Memory DevicesFinFET & Nanosheet FETsProcess Optimization Strategy	Advance + Content Specific Custom Modules	<p>Mini. Qual: Industry Professional</p> <p>Duration: 1 Week (30 Hrs)</p> <p>Schedule: Once Every 3 Months</p> <p>Learning: In-Person, Hands-On & Assignments & Project</p> <p>Participants: 15 Per Module</p> <p>Fees (INR):</p> <ul style="list-style-type: none">Students: Not EligibleIndustry (INR): 50,000 (+GST Per Module)

India Semiconductor Workforce Development Program:

Level	Modules (Revised Nomenclature)	Detailed Content
Level-1 (Pre-requisites: Semiconductor Devices)	Text Books to TCAD	In this module, students will get to know how to draw basic device structures in TCAD and define doping profiles. This includes the following content 1. Steps to create a basic device structure from scratch using GUI? 2. Defining standard/idealized doping profiles 3. Creating standard mesh.
	First Cut Design	This module deals with porting from building device structure to simulating device characteristics Students will learn, 1. How to carry out basic simulations for estimating output and transfer characteristics of the structure developed through GUI 2. How to generate family of curves.
	Basic Devices	At this level, the following two and three terminal device structures will be discussed 1. Diodes 2. BJTs 3. MOSFETs.
Level-2 (Pre-requisites: Level-1)	Technology Relevant Design	What to expect: 1. Replicating realistic device dimensions 2. Building realistic doping profiles 3. Encapsulating geometrical effects like overlaps Outcome: 1. Preparing realistic device structure and know the intricacies involved in defining doping profiles.
	Advanced Devices	At this level, we will be dealing with next level of sophistication in device structures, including the following: 1. Device structures to be created : pMOS and CMOS 2. Emulate process level variations in geometrical device structure creation tool 3. Creating a complete CMOS structure taking into account device isolation strategy.
	Design Automation	This module deals with the following: 1. Script based device structure creation 2. Learning to build the complete structure using critical design variables 3. Creating multiple variants of the device structure based on variation in geometrical parameters with the help of scripts.
	Deeper Insights	On the device simulation front at this level, we will be advancing the understanding of simulation by including following steps: 1. Explanation of physical models used in estimating device behavior 2. Playing with physical models to understand their impact on electrical characteristics of the device.
Advance (Pre-requisites: Level-2)	Process Design	At this level, we move one more step closer to the real-world device structures with the help of following steps: 1. Process simulations to factor in impact of process variations 2. Complete layout based process flow emulation of practical device structures 3. Analyzing impact of process conditions on critical device features like doping profile, junction depths, etc. 4. Analyzing impact of anisotropic/isotropic etching 5. Learning advanced meshing to properly capture doping variations.
	Advanced Emulations	We take the structure creation to advanced level by including following steps: 1. Developing 3-D structures 2. Meshing strategy for 3-D structures 3. Defining doping profiles in 3-D structures 4. Capturing essential device topologies, curves, edges and corners in 3-D structures.
	Device Calibration	On the device characteristics simulation front, we introduce the most important step to make the analysis relevant for industrial/research purposes. This will be accomplished with the help of following sub-modules 1. Bringing structure as close as possible to real world scenario 2. Learning basics of calibration a. Outlining steps for calibration of silicon based devices b. Learning how to select physical model for calibration c. Identifying different operating regimes in the output and transfer curves d. Identifying critical parameters of device physics models affecting device behavior in these operating regimes.



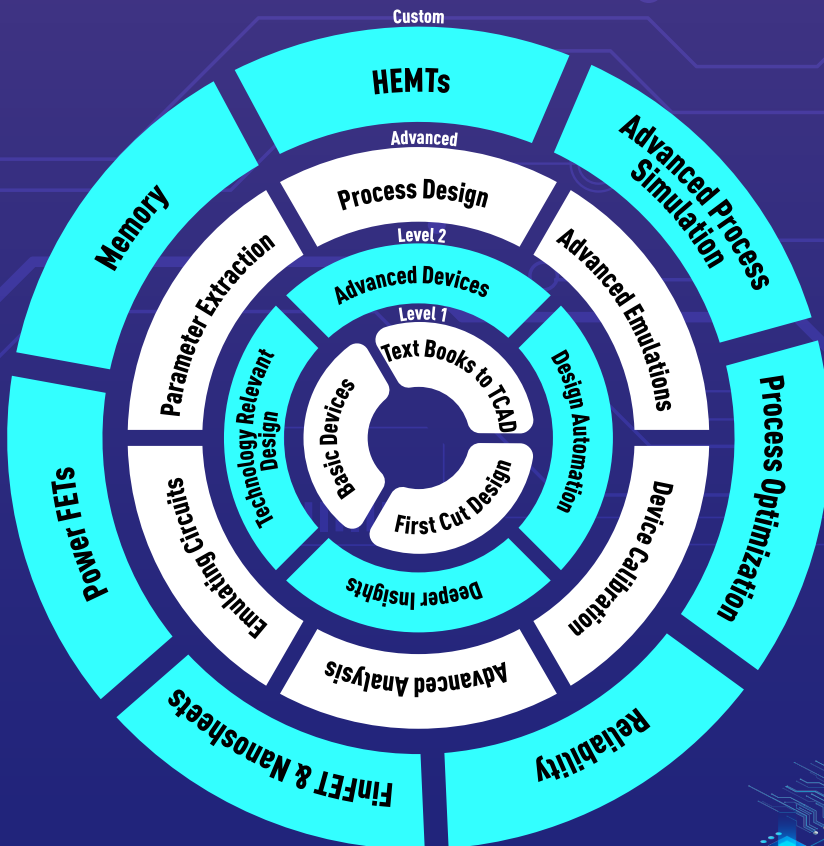
India Semiconductor Workforce Development Program:

Level	Modules (Revised Nomenclature)	Detailed Content
Advance (Pre-requisites: Level-2)	Advanced Analysis	<p>Detailed device analysis to be carried out in the following operating regimes:</p> <ol style="list-style-type: none"> Carrying out Dc analysis <ol style="list-style-type: none"> Output characteristics. Transfer characteristics. Basic breakdown analysis. AC analysis RF analysis Thermal analysis <ol style="list-style-type: none"> Learning how to position the thermodes Defining thermal boundary conditions and thermal resistances Determining temperature based models to be accounted for thermal analysis of the device Analyzing heat distribution and critical areas for heat dissipation in the device Analysing I-V behavior under thermal considerations.
	Emulating Circuits	<p>Leveling up on the simulation capabilities, this module will introduce the students to the following:</p> <ol style="list-style-type: none"> Introduction to mixed mode simulations to enable device analysis in circuit scenarios. Basic circuits, like, inverter will be covered Analysing impact of circuit parasitics on device behavior Analysing impact of device parameters on circuit performance.
	Parameter Extraction	<p>Simulations generate huge volumes of data which increases exponentially with size of the design of experiments. Parameter extraction enables one to extract the most important and relevant parameters from the simulation output to enable quick visualisation and comparison. In this module, you will learn</p> <ol style="list-style-type: none"> To write scripts for automated data plotting Introduction to important functions including functions for extracting threshold voltage, on resistance, on current, saturation current, and breakdown voltage Introduction to building custom scripts for extracting custom parameters as per requirement.
Custom (Pre-requisites: Advanced)	HEMTs	<p>"Industry Professionals will learn how to carry out simulations of HEMT devices. The module will comprise of following sub-modules:</p> <ol style="list-style-type: none"> Building up basic device structure Carrying out calibration for DC and RF performance Identification and explanation of different physical models necessary to simulate DC behavior Analysis of the impact of epitaxial layer arrangement on the channel charge Simulating the Id-Vd and IdVg behavior of the device Enabling trap analysis in GaN HEMT device. Identification of critical parameters to be analyzed. Off-state breakdown analysis of the devices Simulating the RF performance of the device.
	Advanced Process Simulation	<p>To make the device structures industry relevant, this module will introduce following sub-modules:</p> <ol style="list-style-type: none"> Significance of 3D simulation Virtualizing the manufacturing process Switching From 2D to 3D Defining 3D simulation domain Process Flow Efficient meshing strategy Doping mechanism and Structure-modifying steps (etching, deposition, photo, and transform) Visualization of devices in 3D, 2D cutplanes and 1D cutlines Mask-based process simulation with direct import of GDSII layouts, 2D vs 3D.
	Process Optimization	<p>This module comprises of following sub-modules:</p> <ol style="list-style-type: none"> Deeper understanding of process parameters and models of ion implantation, diffusion, etching, and deposition Correlating the process parameter-device structure-device performance Process-aware Designing Optimization of existing processes to allow performance prediction Introducing parameter database browser Changing parameters in the command file Custom calibration.
	Reliability	<p>This module comprises of following sub-modules:</p> <ol style="list-style-type: none"> Importance of predicting reliability Physics of various reliability models, NBTI, TCAD Degradation models - NBTI model, Hot Carrier model, Trap degradation model, Device lifetime and simulation Simulation Hands-on.



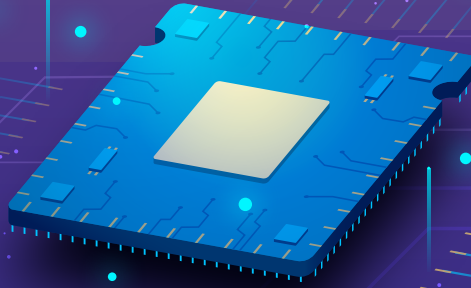
India Semiconductor Workforce Development Program:

Level	Modules (Revised Nomenclature)	Detailed Content
Custom (Pre-requisites: Advanced)	FinFET & Nanosheets	<p>This module comprises of following sub-modules:</p> <ol style="list-style-type: none"> 1. Technology scaling roadmap 2. FinFET architecture 3. TCAD Simulation of Double Gate, Triple Gate FinFETs 4. Simulate various devices in FinFET Technology 5. Understand the effect of device variation on the device performance 6. Optimization guidelines 7. Beyond FinFET technologies – Vertically stacked Nanosheet Technology.
	Power FETs	<p>This module comprises of following sub-modules:</p> <ol style="list-style-type: none"> 1. Generating power MOSFET structures using process simulations 2. Steps to carry out analysis of power MOSFETs 3. Power MOSFET simulations in the presence of thermal effects 4. Breakdown analysis.
	Memory	<p>This module comprises of following sub-modules:</p> <ol style="list-style-type: none"> 1. Generating memory device structures in TCAD 2. Capturing the processes leading to memory effect in the device 3. Running transient simulations to understand the data storage time and date-retention capability 4. Carrying out device analysis to optimize the memory performance"





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