शैक्षिक प्रसार
Educational Outreach

e-Post Graduate Diploma (ePGD) in IC Design in Practice

Table of Contents

About the e-Post Graduate Diploma (ePGD) in IC Design in Practice

The e-Post Graduate Diploma (ePGD) in IC Design in Practice offers a meticulously structured academic journey through the full breadth and depth of integrated circuit design. Developed by IIT Bombay's Department of Electrical Engineering, the curriculum covers everything from the physics of semiconductor devices to the architectural and fabrication challenges of modern integrated circuits. This is not a surface-level overview, but a graduate-level exploration into how today's chips are conceived, modeled, simulated, verified, and ultimately manufactured.

The ePGD begins by developing a detailed understanding of semiconductor devices - ranging from the basics of semi-classical descrption of semiconductors, common electronic devices like diodes and MOSFETs to the current state of the art CMOS devices. Then moving onto develop the necessary background on analog and digital IC design, starting from first principles.

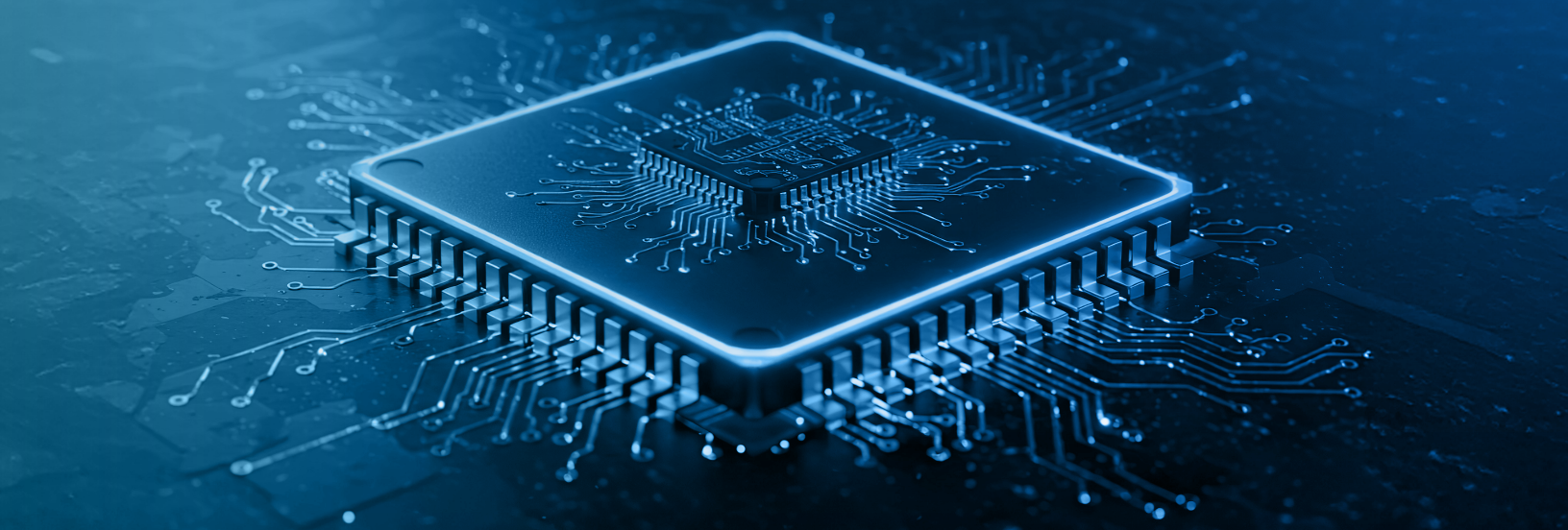
With Digital IC Design, you will develop the necessary skills required to fabricate and test a digital integrated circuit. Understand the wide-bandgap materials and the advantages of GaN materials and heterostructures with course on GaN Devices and MMICs.

Today electronic chips (or integrated circuits known as IC's) are a part of almost all sectors of technology. Among them, mixed-signal IC's are crucial blocks which are capable of acquiring continuous-time analog signals with high-precision and/or high-speed from a noisy natural environment and convert them to discrete-time quantized-values, known as digital signals for further processing and computation. Moreover, mixed-signal IC's bring digital and analog domains on a single-chip using specially-designed architectures, while physical constraints such as signal integrity issues are solved using special techniques. Mixed-Signal IC Design in Practice is intended to provide the core and basic skills in the design of mixed-signal IC's where analog and digital domain interfacing, conversion and integration while managing signal information preservation, power, speed and accuracy.

Establish a foundation for IC design of wireless communication transcivers using modern CMOS processes in RF IC Design for Wireless Communications course. Finally the SerDes IC and System Design course focuses on training IC design engineers to handle these and other such present and future requirements.

Key Features

- Curriculum designed and delivered by IIT Bombay faculty
- Upto 12 months of blended learning with the renowned IIT Bombay faculty
- Earn outreach program credits from IIT Bombay which can be saved in the Academic Bank of Credits (ABC)
- Online six-course curriculum designed for both working professionals and fresh graduates
- Hands-on learning through industry-relevant tools
- Earn a diploma in IC Design from IIT Bombay
- Gain access to IIT Bombay's Lateral Hiring Group
- Live sessions from IIT Bombay EE faculty for learning and query resolution
- Experience campus immersion and the chance to attend an in-person graduation ceremony at IIT Bombay campus
- Earn the prestigious IIT Bombay alumni status and engage in peer-learning & networking opportunities with industry professionals



Industry Trends

Automotive Semiconductor Expansion

The shift towards electric vehicles (EVs) and autonomous driving is driving demand for automotive-grade chips, including power management ICs, sensors, and connectivity solutions. The automotive semiconductor market is projected to grow at a CAGR of 7-9% from 2026 to 2030.

source: markets&markets

Global Fabless IC Design Market

Valued at approximately $203.6 billion in 2023, the market is anticipated to reach $546.9 billion by 2030, reflecting a CAGR of 13.3%.

source: Valuates Reports

Strategic Investments

India is making significant strides to bolster its semiconductor industry, including a $10 billion incentive package and investments from major companies like Tata Electronics and NXP Semiconductors

source: Glomore-Electro tech

Semiconductor Market Projected to Reach $707 Billion by 2025

The global semiconductor market is expected to grow from $628 billion in 2024 to $707 billion by 2025, at a growth rate of 12.5%

source: markets&markets

Who Is This Course For?

Recent Graduates in Electronics & Electrical Engineering

- B.E./B.Tech or M.E./M.Tech degree holders in ECE, EEE, or related fields
- Looking to specialize in IC design and build strong industry-ready technical skills
- Interested in transitioning into VLSI, semiconductor design, or chip-level R&D roles

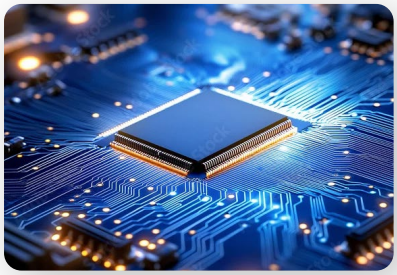
Early to Mid-Career Professionals in Semiconductor or EDA Domains

- Engineers with 1–8 years of experience in roles like RTL design, verification, analog layout, or circuit simulation
- Professionals seeking to upskill or transition to advanced design roles across digital, analog, RF, or mixed-signal IC domains
- Working in fabless companies, EDA tool providers, or system integrators and aiming to deepen technical proficiency

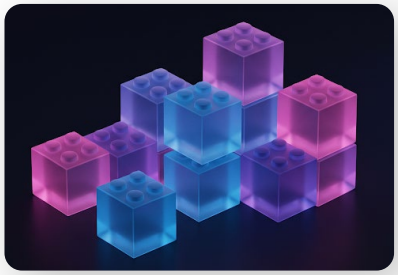
Professionals in Adjacent Tech Fields Seeking Specialization

- Engineers working in embedded systems, hardware, or telecom looking to pivot into IC design
- Professionals with foundational electronics knowledge who want formal academic training from a reputed institution

Key Learning Outcomes

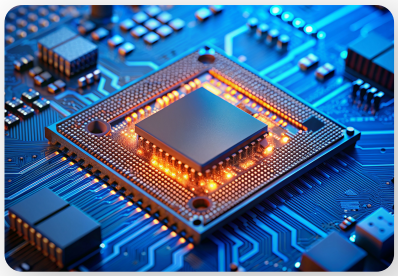


Master Core Semiconductor Concepts



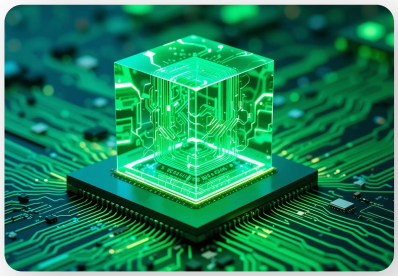
Design Analog & Digital Building Blocks

Implement Complete IC Design Flows



Develop High-Performance Mixed-Signal Systems

Design and Simulate RF and MMIC Circuits



Build Industry-Ready Design Expertise

Core Courses

- Semiconductor Devices
- Pillars of Digital and Analog IC design

Elective Courses

- Digital IC Design
- Mixed Signal Design and IC Practice
- SerDes IC and System Design
- GaN Devices and GaN MMICs
- RF IC Design for Wireless Communication

Semiconductor Devices:

In this course we develop a detailed understanding of semiconductor devices - ranging from the basics of semi-classical description of semiconductors, common electronic devices like diodes and MOSFETs to the current state of the art CMOS devices. The course also covers the techniques and concepts associated with fabrication of integrated circuits. The learners will also be exposed to the emerging research on novel materials and devices, reliability of electronic devices, etc.

Topics Covered:

- Understand carrier transport in semiconductors
- Learn the working mechanism of PN junction diodes
- Insights on Solar Cells and Light Emitting Diodes
- Analyze MOSFET device physics and state-of-the-art CMOS technology
- Gain exposure to research in novel materials, devices, and scaling challenges.
- What is reliability and how reliability influences circuit design?
- Learn the fundamentals of IC fabrication techniques

Pillars of Digital and Analog IC design:

In this course, we will develop the necessary background on analog and digital IC design, starting with the first principles. You will learn the device physics and its equivalent model as an abstraction for IC design and build fundamental blocks necessary for analog and digital IC design. As the course progresses, you will learn the different levels of circuit abstractions and how they are different for analog and digital circuits. The assignments will involve mathematical analysis of your circuits and the course projects will enable you to put your learning into test by designing practical circuit blocks.

Topics Covered:

- Introduction to MOS device physics
- MOS device models
- First principles of CMOS Analog design
- Common Source, Common Gate, Common Drain Amplifiers
- Single stage Operational Transconductance Amplifiers (OTA)
- Frequency response of CMOS amplifiers
- Design and analysis of a CMOS inverter
- Two stage OTAs and Compensation
- Noise Margins
- Static CMOS gates: NAND, NOR
- Timing analysis in digital circuits
- Parasitics, delay and power consumption of digital circuits
- CMOS layout: Stick diagram and layout rules
- Lumped wire line model, Elmore delay and delay estimation
- CMOS sequential circuits and their timing characteristics

Digital IC Design:

In this course we will develop the necessary skills to fabricate and test a digital integrated circuit. You will learn the concepts of delay minimization, the principles behind it, development of IPs including adders, multipliers, standard cell library, IO library, SRAMs. The course will emphasize different abstraction views required to develop a digital chip fully, how these views are built, and what stage of the design cycle they will be used. At the end of the course, you will have hands-on skills and the requisite theory behind them to implement a full-fledged digital chip.

Topics Covered:

- IC design and test cycle: introduction to design flow
- Delay optimization in digital circuits
- Adder architectures: RCS, carry skip, CSA, Root CSA, Tree Adders
- Multiplier architectures: Array, Booth, Wallace, Dadda
- CMOS Standard cell library development:
- Functional, physical, timing, power views
- CMOS IO libraries, ESD protection etc.
- Synthesizable designs in Verilog
- Yosys based Synthesis
- SRAM bit cell design and array considerations
- Static timing analysis and clock tree synthesis
- Physical Design: Macro (hard/soft) based floorplan, placement and routing
- Complete RTL to GDSII with functional & physical verification

GaN Devices and GaN MMICs:

This course will introduce wide-bandgap materials and the advantages of GaN materials and heterostructures. We will discuss various aspects of GaN RF transistors. A commercial TCAD device simulator will be used to emphasize various aspects of the device design. A compact model will be developed, which will be used to show MMIC simulations using an RF advanced design simulator. The participants will be given a project where they will execute all the steps of RF MMIC starting from the device.

Topics Covered:

- Advantages of wide-bandgap materials, particularly GaN
- GaN as a material and its family members InN and AlN, ternary alloys and quaternary alloys
- Basics GaN heterostructure transistors, physics of operations
- RF performance of GaN transistors, fabrication, and reliability
- Small-signal, large-signal and ASM HEMT model of the RF transistors
- Development and demonstration of the model in a RF advanced simulator
- Development of passives (R, L, and C) and model
- GaN-based amplifier basics
- GaN based MMICs and designs
- Design and demonstration of various MMICs

Mixed Signal Design and IC Practice:

Mixed-Signal IC Design in Practice is a course which will provide potential IC designers to the core knowledge and basic skills for the practical design of mixed-signal integrated circuits, which are key building blocks of electronic systems in almost all applications. For example, foundations of the analysis and design of sampling circuits, discrete-time signal processing circuits, analog to digital converters, digital to analog converters and frequency synthesizers will be taught. This course will provide training on the analyzing architectures along with performance evaluations and insights towards managing trade-offs among circuit specifications. This course also brings analysis and design skills for PLL (phase locked loop) and ADPLL (all digital phase locked loop) circuits on the chip. Learners will use IC design EDA tools in a part of the course to design the target integrated circuits under multiple constraints.

Topics Covered:

- Review of Fourier Series, Fourier Transform, Continuous time and Discrete time, Sampling, Review of Z Transform
- Sampling switch design
- Switched capacitor circuits
- Comparator
- Basics and performance measures of data converters (ADC and DAC)
- Nyquist Rate ADCs and DAC's (Parallel ADC, Charge Redistribution DAC, Multi-step ADC, Pipelined ADC, Current Steering DAC), Mixed-Mode DAC
- High Resolution Data Converters
- Phase Locked Loop (PLL)
- All-digital PLL (ADPLL)

RF IC Design for Wireless Communication:

This course will establish a foundation for the IC design of wireless communication transceivers using modern CMOS processes. It will also familiarize students with foundational concepts of traditional RF/microwave design and the design of key transceiver building blocks and their architectures.

Topics Covered:

- Communication fundamentals
- Basic concepts in RF design, Noise, Distortion
- TL theory, Smith Charts, Matching Networks
- Basic Transceiver Architectures
- Low-noise amplifiers
- Passive and Active Mixers
- VCOs, and introduction to frequency synthesizers

SerDes IC and System Design:

This advanced module focuses on designing and implementing Serializer/Deserializer (SerDes) systems, which are critical in high-speed data communication across modern integrated circuits. The course introduces the architecture, timing, and power challenges of SerDes links, signal integrity, equalization techniques, and clock data recovery (CDR). With growing data rates and shrinking technology nodes, SerDes design is vital for enabling high-speed communication in SoCs, data centers, and communication systems. Learners will explore system-level considerations and transistor-level implementations, gaining valuable insights into high-speed interface design.

Topics Covered:

- Concept of Serializers and Deserializers, i.e. the SerDes system.
- Clocking schemes in serial links for SerDes systems
- Eye diagrams and bit-error-rate estimation in wireline interconnects.
- Phase-locked loops (PLLs) and delay locked loops (DLLs) - basic concepts, building blocks, analysis of loop dynamics, non-idealities, noise and jitter.
- Clock and data recovery using PLLs and DLLs - architectures and techniques.
- Understanding pulse propagation in transmission lines using s-parameters and other transmission lines concepts, to understand the channel.
- Equalization in serial links - architectures and techniques.
- High-density die-to-die/chiplet interconnects.

Certificates

Upon successfully completing the e-Post Graduate Diploma in IC Design in Practice, you'll have the opportunity to attend an in-person graduation ceremony at the IIT Bombay campus.

भारतीय प्रौद्योगिकी संस्थान मुंबई

<विद्यार्थी का नाम >

को एतद्द्वारा (Name of the Programe in Hindi) में

इ-स्नातकोत्तर डिप्लोमा

की उपाधि प्रदान करता है ।

अभिषद की अनुशंसा पर संस्थान की मुद्रांकित यह उपाधि
विनियमों में विहित पाठ्यक्रमों को सफलता पूर्वक पूर्ण कर लेने पर
मुंबई, भारतीय गणराज्य में आज XX अगस्त, 20XX को दी गई है ।

Indian Institute of Technology Bombay

upon recommendation of the Senate hereby confers the

e-Postgraduate Diploma

in (Name of the Programe in English)

on

<Name of the student>

who has successfully completed
the courses of study as prescribed under the regulations.

Given this day, under the seal of the Institute at Mumbai in the
Republic of India, the XXth day of August 20XX.

अध्यक्ष, अभिषद
Chairperson, Senate

कुलसचिव
Registrar

अध्यक्ष, शासी मंडल
Chairperson, Board of Governors

IIT Bombay Faculty Details

Prof. Apurbha Narayan Bhattacharya

Professor of Practice
Former Distinguished Scientist and Associate Director, SAC, ISRO
Distinguished Professor, IIT Jodhpur

Research Interests

- Microwave and mm-wave devices, MMICs and Systems, GaN HEMT and MMIC
- Advanced Packaging Technologies – LTCC, WLP
- Satellite Communication, Navigation and Microwave Remote Sensing payloads
- Devices for Quantum Communication

Prof. Veeresh Deshpande

Associate Professor, IIT Bombay

Research Interests

- 3D Integration
- Neurmorphic computing
- Ferroelectric and resistive memory devices

Prof. Shalabh Gupta

Professor, Electrical Engineering

Research Interests

- High Speed Serial Links and Interconnects
- CMOS Analog/RF/mmWave Integrated Circuits and Systems
- Communication Circuits and Signal Processing Techniques
- Microwave Photonics / Ultrafast Data Conversion Using Optics
- Optical Fiber Communication, Silicon Photonics and Data Center Interconnects
- Beamforming Antenna Systems

Prof. Anil Kottantharayii

Bank of Baroda Circular Economy, Green Energy & Sustainability Chair Professor, Electrical Engineering; FNAE; SMIEEE

Research Interests

- Silicon solar cells
- Applications of graphene in electronic devices
- CMOS device physics, design and modelling
- Radiation effects on MOS devices
- Electrical characterization
- Materials for advanced CMOS devices and solar cells
- Gate oxide reliability and hot-carrier effects

Prof. Saurabh Lodha

P. K. Kelkar Chair Professor, Electrical Engineering, IIT Bombay
Professor-in-charge, IIT-OSU Frontier Research Center, Senior Member, IEEE, Fellow, INAE

Research Interests

- 2D materials and devices
- Wide bandgap (SiC and Gallium oxide) power devices
- Metal-semiconductor interfaces
- Molecular devices
- CMOS process integration and device physics

Prof. Sandip Mondal

Assistant Professor (Grade-I), IIT-Bombay, Department of Electrical Engineering

Research Interests

- The physics and technology of semiconductor devices
- Neuromorphic Engineering for Artificial Intelligence, Materials & devices for brain-inspired computing.
- Flash memory technology – Floating gate, SONOS, Charge trapping materials
- Flexible electronics using cost-effective solution-processed semiconductor and dielectrics

Prof. Pradeep R. Nair

Professor, Dept of Electrical Engineering, Indian Institute of Technology Bombay, Mumbai India

Research Interests

- Solar energy conversion - Perovskite solar cells, Perovskite/Si Tandem solar cells, Green Hydrogen
- Light emitting diodes and Photodetectors.
- Semiconductor device physics and reliability.
- Biosensors and Biophysics.

Prof. D.K. Sharma

Prof. Dinesh K. Sharma was a Professor in the Department of Electrical Engineering IIT Bombay from 1991 and after retirement he is currently a visiting professor in the same Department. Prof. Sharma's expertise covers a wide range from semiconductor devices to integrated circuits & systems.

Research Interests

- MOS device modeling VLSI design and technology. Microelectronics – technology and device characterisation mixed signal design

Prof Maryam Shojaei Baghini

Professor, Electrical Engineering

Research Interests

- Circuit & system design and integration for intelligent sensing, processing, and problem solving
- Data Analytics and Signal Processing
- High-frequency integrated circuit design for various applications
- Analog/Mixed-signal VLSI design (AI/ML domain applications, circuits and systems for Neuromorphic applications, LV, LP and LE for healthcare, bio-inspired circuits and systems, I/O, highly-precise circuits & systems, instrumentation, energy harvesting and more)

Prof. Rahul Singh

Professor, Electrical Engineering

Research Interests

- Analog/RF/millimeter-wave integrated circuits, systems, and architectures
- IC design for emerging communication technologies
- Digital/mixed-signal calibration techniques for RF transceivers

Prof. Laxmeesha Somappa

Assistant Professor, Electrical Engineering

Research Interests

- Analog, Digital & Mixed-Signal IC Design
- Biomedical Circuits & Systems
- Neuromodulation System on Chips
- Sensor Interface Circuits & Sensor networks.
- Oversampled Data Converters
- MEMS Interface & Readout Circuits & Systems
- Finite rate of Innovation & Sub-Nyquist Sampling, Compressed Sensing

Prof. Dipankar Saha

Professor, IIT Bombay

Research Interests

- Microelectronics New Device Physics Semiconductor Spintronics Spin injection, transport and detection in III-V systems Device Reliability

Prof. Swaroop Ganguly

Associate, Electrical Engineering

Research Interests

- Quantum biomimetics: electronic devices inspired by quantum biology
- Heterostructure transistors for next-generation logic, high-speed and high-power applications

Eligibility

Candidates fulfilling the below criteria are eligible for the ePGD:

B. Tech, B. E., M. Tech and M. E. Degree holders from a recognized college/university/institute with the following degrees:

- Electronics, and/or VLSI and/or Communication and/or Instrumentation Engineering, Electrical Engineering, Biomedical Engineering

Note: Final say on eligibility lies with the EE department.

Registration Process

The application process organized and led by Simplilearn consists of three steps. Selected candidates will receive an offer letter, which they must accept by paying the fee.

Submit an Application

Interested candidates can apply for e-Postgraduate Diploma by completing a simple online application form.

Application Review

A group of admissions counselors will analyze your application after you submit them to ascertain your qualifications and interest in the course.

Registration

The selected candidates will receive an offer letter to join the course. They must pay the registration fee to secure their seat and complete the registration.

Talk to an Admissions Counselor

Our dedicated admissions counselors are ready to assist with any questions or concerns about this course.
Our team is available to:

- Guide you through the application process
- Discuss financing options
- Offer detailed insights into the curriculum, learning outcomes, and more

About IIT Bombay

IIT Bombay is an autonomous institute and deemed university governed by a board of governors, chaired by the president of India. The institute offers innovative short-term courses, continuing education, and distance learning. Faculty members have received prestigious awards, including the Shanti Swaroop Bhatnagar and Padma honors.

IIT Bombay was established in the year 1957 and the Department of Electrical Engineering (EE) has been one of its major departments from the inception of this institute. The facilities in the department are among the best in India, and in certain specialized areas compete with leading international universities. It is one of the largest departments in the institute in terms of the number of faculty members, students enrolled and research funding. The department has made rapid strides during the last decade in all spheres of education and research

India's Top Ranked University

QS World University Ranking 2025

#3

NIRF India Engineering Rankings 2024

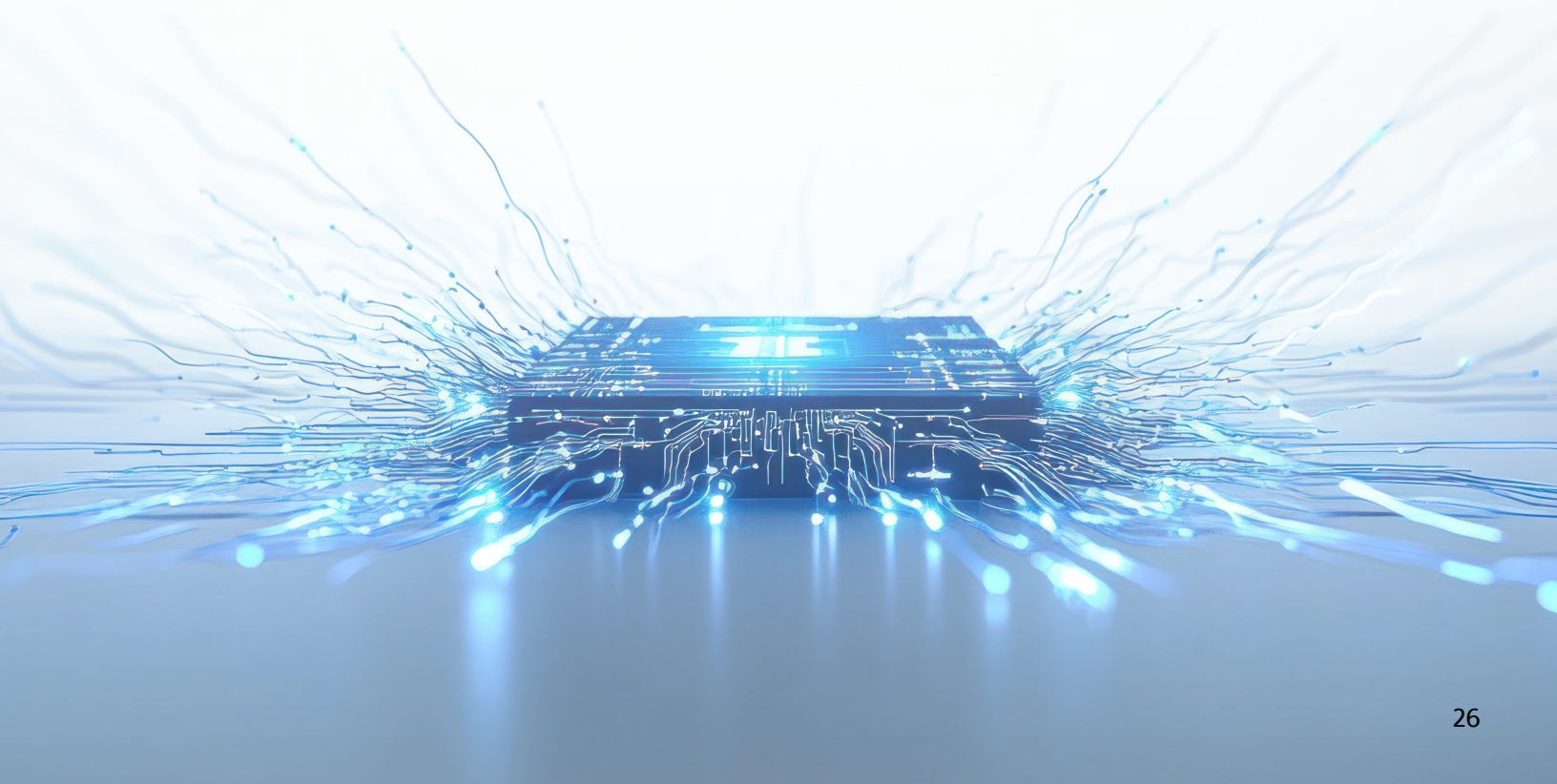
#45

QS World University Ranking in Engineering in Technology, 2024

About Simplilearn

Founded in 2010 and based in Plano, Texas, and Bangalore, India, Simplilearn, a Blackstone portfolio company, is a global leader in digital upskilling. It enables learners worldwide and offers access to world-class training to individuals and businesses worldwide.

Simplilearn offers 1,500+ live classes each month across 150+ countries, impacting over 8 million learners globally. The programs are designed and delivered with world-renowned universities, top corporations, and leading industry bodies via live online classes featuring top industry practitioners, sought-after trainers, and global leaders. From college students and early career professionals to managers, executives, small businesses, and big corporations, Simplilearn's role-based, skill-focused, industry-recognized, and globally relevant training programs are ideal upskilling solutions for diverse career or business goals.



For More Details:

Check course details on: https://www.simplilearn.com/iit-bombay-epgd-in-integrated-circuit-design-course

Contact us: degreeprograms@simplilearn.in (or) epgd.icd@eo.iitb.ac.in

simplilearn

USA

Simplilearn Americas, Inc.
5851 Legacy Circle,
6th Floor, Plano, TX 75024,
United States
Phone No: +1-844-532-7688

INDIA

Simplilearn Solutions Pvt Ltd.
53/1 C, Manoj Arcade, 24th Main Rd,
Sector 2, HSR Layout,
Bengaluru - 560102,
Karnataka, India
Phone No: 1800-212-7688

For more information, please visit:
www.simplilearn.com