इलेक्ट्रॉनिकी एवं सूचना प्रौद्योगिकी मंत्रालय
MINISTRY OF ELECTRONICS AND INFORMATION TECHNOLOGY
सत्यमेव जयते

रा.इ.सू.प्रौ.सं NIELIT

NATIONAL INSTITUTE OF ELECTRONICS & INFORMATION TECHNOLOGY NOIDA

CHIP DESIGN ASSOCIATE
(O-LEVEL 'CHIP DESIGN')
(ONLINE MODE)

INFORMATION BROCHURE

NATIONAL INSTITUTE OF ELECTRONICS AND INFORMATION TECHNOLOGY, NOIDA

Name of Group: Centre of Excellence in Chip Design at NIELIT NOIDA

Name of Course: Chip Design Associate (O-Level 'Chip Design') (Online Mode)

Objective: The objective of the O-Level Chip Design program is to equip participants with the essential knowledge and practical skills required to excel in Physical Design and FPGA Emulation. The curriculum is designed to align closely with current industry standards, ensuring that learners are well-prepared and highly suitable for roles across the VLSI and semiconductor industry

Program Duration: 4 hrs per day/450 hours/3 months

Components:
- Theory: 100 Hours
- Practical: 140 Hours
- Employability Skills: 60 Hours
- OJT (Mandatory): 150 Hours

Course Fees:
- ₹24,700/- for General / OBC candidates
- ₹200/- for SC / ST candidates (Fee Waiver applicable)

Examination fees to be paid seperately by all the candidates (General / OBC / SC/ ST)

Note: For availing the SC/ST fee waiver, candidates must complete Aadhaar-based biometric authentication in person mode at NIELIT Centre of Excellence, Noida.

Mode of Delivery: Online mode

Eligibility:

- B.Tech / M.Tech – pursuing or completed in relevant fields
- B.Sc / M.Sc – In Electronics, Computer Science, IT, or related disciplines
- Polytechnic Diploma – in Electronics, Computer Science, IT, or allied branches.
- ITI – in Electronics, Computer Science, or IT disciplines.
- 12th (PCM) – eligible upon qualifying a Screening Test.

Note: Research Scholars, Faculty members and Industry professionals can also enroll in the course

Prerequisites: - NONE

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Detailed Syllabus of the Course

Module 1 (NOS1): VLSI Design Fundamentals

1. Introduction to VLSI Design
·Overview of VLSI technology and its significance
·Introduction to VLSI design flow: Front-end and Back-end

2. CMOS Transistor Theory
·Fundamentals of MOSFET operation
·MOSFET characteristics and modeling
·MOSFET scaling trends and technology advancements

3. CMOS Inverter Characteristics
·CMOS inverter operation and voltage transfer characteristics
·Noise margin analysis and power consumption considerations
·Inverter sizing and optimization techniques

4. CMOS Logic Design
·Introduction to basic logic gates: AND, OR, NAND, NOR
·Combinational logic design using CMOS technology
·Designing complex logic functions using CMOS logic gates

5. Transistor Level Schematics and Layouts
·Transistor level design techniques
·Schematic design and layout considerations
·Design rules, metal layers, and interconnect routing

6. On-Chip Wire Modeling
·Introduction to on-chip interconnects
·Wire parasitics and their impact on circuit performance
·Modeling and simulation of on-chip wires

7. Bonding Diagram, Packaging, and Assembly
·Overview of packaging technologies and assembly processes
·Bonding diagram design and considerations
·Packaging trends and challenges

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8. Gate Delays and Logical Effort
·Gate delay modeling and estimation
·Introduction to logical effort analysis
·Determining the best delay-power trade-off for logic gates using P/N ratio

9. Combinational Logic Circuit Critical Path Optimization
·Identifying critical paths in combinational circuits
·Gate sizing and logic restructuring techniques
·Timing optimization for improved performance

10. Timing in Sequential Circuits
·Introduction to sequential circuits: flip-flops, registers
·Setup and hold time analysis
·Sequential circuit timing considerations and optimization techniques

Module 2 (NOS2): Verilog RTL coding for Synthesis

1. Introduction to VLSI Design (2 hours)
·Overview of VLSI technology and its applications
·Introduction to the VLSI design flow

2. RTL Design Methodology (4 hours)
·Basics of Register Transfer Level (RTL) design
·Overview of RTL design process and methodology
·Introduction to Hardware Description Languages (HDLs) such as Verilog or VHDL

3. Digital Logic Design Principles (4 hours)
·Combinational and sequential logic design concepts
·Boolean algebra and logic gates
·Flip-flops, registers, and state machines

4. RTL Design Using HDL (6 hours)
·Introduction to Verilog syntax and constructs
·Designing combinational and sequential logic using HDL
·Writing RTL code for basic digital circuits

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5. RTL Simulation and Verification (6 hours)
·Functional verification techniques for RTL designs
·Introduction to test benches and testbench development
·Simulation and debugging of RTL designs

6. Timing Constraints and Analysis (4 hours)
·Introduction to timing constraints in RTL design
·Timing analysis and optimization techniques
·Setup and hold time violations and resolution

Practical Component:

1. RTL Design and Implementation Labs (40 hours)
·Hands-on lab exercises to reinforce RTL design concepts
·Designing and implementing digital circuits using HDL
·Simulating and verifying the functionality of RTL designs

2. Design Synthesis and Optimization Labs (15 hours)
·Introduction to synthesis tools and libraries
·Synthesizing RTL designs for target technologies
·Optimizing design for area, power, and performance

3. Timing Analysis and Closure Labs (10 hours)
·Timing analysis using industry-standard tools
·Constraint development and application
·Timing closure techniques to meet design requirements

Module 3(NOS3): Static Timing Analysis of VLSI Circuits

Overview of VLSI STA
Introduction to Timing Analysis, Combinational circuit timing- races and hazards, sequential circuit timing-set up and hold timing, maximum frequency of operation, Practical Examples of Setup and Hold time Violations and its solution. Timing constraints for synthesis. Circuit synthesis and timing analysis.

Timing performance
Techniques to improve timing performance, including pipeline, retiming etc. clock skew, open loop and closed loop timing. Block level and chip level timing analysis.

STA using EDA tools
Static timing analysis using EDA tools. Timing analysis after synthesis and place and route, Timing report analysis. ECO flow and sign off checks. Timing closure.

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Module 4(NOS4): FPGA Architecture and Programming

Introduction to FPGAs:
·Overview of Field-Programmable Gate Arrays (FPGAs) and their applications
·Advantages of using FPGAs in digital design

FPGA Architecture and Components:
·Understanding the internal architecture of FPGAs
·Basic components of an FPGA: Look-Up Tables (LUTs), flip-flops, interconnects, etc.
·Introduction to FPGA families and resources

1Hardware Description Languages (HDLs):
·Introduction to HDLs: Verilog
·Syntax and data types in HDL
·Writing RTL code for FPGAs

FPGA Design Flow:
·Overview of the FPGA design flow and methodology
·Design entry, synthesis, placement, routing, and bitstream generation
·Introduction to design constraints

FPGA Design Optimization Techniques:
·Timing constraints and analysis in FPGA designs
·Pipelining, retiming, and other optimization techniques
·Trade-offs between area, power, and performance

FPGA Verification and Debugging:
·Introduction to FPGA simulation and verification
·Writing testbenches and test vectors
·Debugging techniques for FPGA designs

Module 5 (NOS5): Employability Skills

Constitutional Values – Citizenship
·Explain constitutional values, including civic rights and duties, citizenship, res ponsibility towards society, and personal values and ethics such as honesty, integrity, caring, and respecting others that are required to become a responsible citizen.
·Demonstrate how to practice different environmentally sustainable practices.

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Becoming a Professional in the 21st Century
·Discuss relevant 21st-century skills required for employment.
·Highlight the importance of practicing 21st-century skills like Self-Awareness, Behavior Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn, etc., in personal or professional life.
·Create a pathway for adopting a continuous learning mindset for personal and professional development.

Basic English Skills
·Show how to use basic English sentences for everyday conversation in different contexts, in person and over the telephone.
·Read and understand text written in basic English.
·Write a short note/paragraph/letter/e-mail using correct basic English.

Career Development & Goal Setting
·Create a career development plan.
·Identify well-defined short- and long-term goals.

Communication Skills
·Demonstrate how to communicate effectively using verbal and nonverbal communication etiquette.
·Write a brief note/paragraph on a familiar topic.
·Explain the importance of communication etiquette, including active listening for effective communication.
·Role-play a situation on how to work collaboratively with others in a team.

Diversity and Inclusion
·Demonstrate how to behave, communicate, and conduct appropriately with all genders and PwD.
·Discuss the significance of escalating sexual harassment issues as per the POSH act.

Financial and Legal Literacy
·Discuss various financial institutions, products, and services.
·Demonstrate how to conduct offline and online financial transactions safely and securely and check passbook/statement.
·Explain the common components of salary such as Basic, PF, Allowances (HRA, TA, DA, etc.), tax deductions.
·Calculate income and expenditure for budgeting.
·Discuss legal rights, laws, and aids.

Essential Digital Skills
·Describe the role of digital technology in day-to-day life and the workplace.
·Demonstrate how to operate digital devices and use the associated applications and features safely and securely.

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·Demonstrate how to connect devices securely to the internet using different means.
·Follow the dos and don'ts of cybersecurity to protect against cybercrimes.
·Discuss the significance of displaying responsible online behavior while using various social media platforms.
·Create an email id and follow email etiquette to exchange emails.
·Show how to create documents, presentations using appropriate applications.
·Utilize virtual collaboration tools to work effectively.

Entrepreneurship
·Explain the types of entrepreneurship and enterprises.
·Discuss how to identify opportunities for potential business, sources of funding, and associated financial and legal risks with its mitigation plan.
·Describe the 4Ps of Marketing-Product, Price, Place, and Promotion and apply them as per requirement.
·Create a sample business plan for the selected business opportunity.

Customer Service
·Classify different types of customers.
·Demonstrate how to identify customer needs and respond to them in a professional manner.
·Discuss various tools used to collect customer feedback.
·Discuss the significance of maintaining hygiene and dressing appropriately.

Getting ready for Apprenticeship & Jobs
·Draft a professional Curriculum Vitae (CV).
·Use various offline and online job search sources to find and apply for jobs.
·Discuss the significance of maintaining hygiene and dressing in an interview.
·Role-play a mock interview.
·List the steps for searching and registering for apprenticeship opportunities.

Mode of Payment: Fees can be paid either by debit/credit card or in any online mode.

For any queries and more details please contact on **01202973975/9811295181/9616534572**

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Course Venue: Online

NIELIT NOIDA, IETE NOIDA Centre Building, PS-1D, Behind Brahampurtra Shopping Complex Sector 29, Noida, Uttar Pradesh 201301

Registration Link:

https://regn.nielitvte.edu.in

or

Through Android App "**NIELIT Kaushal Setu**"

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