Model Curriculum

QP Name: VLSI Design Engineer

QP Code: ELE/Q1201

QP Version: 3.0

NSQF Level: 5

Model Curriculum Version: 3.0

Electronics Sector Skills Council of India || 155, 2nd Floor, ESC House, Okhla Industrial Area - Phase 3, New Delhi – 110020

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Training Parameters

Sector	Electronics
Sub-Sector	Semiconductor & Components
Occupation	Product - S&C
Country	India
NSQF Level	5
Aligned to NCO/ISCO/ISIC Code	NCO-2015/2152.0501
Minimum Educational Qualification and Experience	Diploma (after 10th (Electrical/Electronics)) with 1 Year of experience relevant experience OR 12th grade pass with 1 year NTC/ NAC with 1 Year of experience relevant experience OR 12th grade Pass with 2 Years of experience relevant experience OR Previous relevant Qualification of NSQF Level (4) with 3 Years of experience relevant experience OR 10th grade pass with 4 Years of experience relevant experience
Pre-Requisite License or Training	VLSI design
Minimum Job Entry Age	21 Years
Last Reviewed On	24.02.2022
Next Review Date	24.02.2025
NSQC Approval Date	24.02.2022
QP Version	3.0
Model Curriculum Creation Date	24.02.2022
Model Curriculum Valid Up to Date	24.02.2025
Model Curriculum Version	3.0
Maximum Duration of the Course	780 Hours

Program Overview

This section summarizes the end objectives of the program along with its duration.

Training Outcomes

At the end of the program, the learner should have acquired the listed knowledge and skills.

- Memorize the basic concepts of system designing and computer architecture.
- Perform designing of function of SOC module of IC.
- Achieve productivity and quality standards for the correct specification output.
- Interact and coordinate with the supervisor and colleagues etc.
- Follow safe and healthy work practices.

Compulsory Modules

The table lists the modules and their duration corresponding to the Compulsory NOS of the QP.

NOS and Module Details	Theory Duration	Practical Duration	On-the-Job Training Duration (Mandatory)	On-the-Job Training Duration (Recommended)	Total Duration
Bridge Module	**41:00**	**49:00**	**00:00**	**00:00**	**90:00**
Module 1: Introduction to the role of VLSI Design Engineer	41:00	49:00	00:00	00:00	90:00
ELE/N1201: Develop function design of SOC module	**160:00**	**230:00**	**210:00**	**00:00**	**600:00**
Module 2: Basics of system designing	50:00	80:00	90:00	00:00	220:00
Module 3: Develop function design of SOC module	110:00	150:00	120:00	00:00	380:00
ELE/N1002 – Apply Health and Safety Practices at the Workplace	**15:00**	**15:00**	**0:00**	**00:00**	**30:00**
Module 4: Basic Health and Safety Practices	15:00	15:00	0:00	00:00	30:00
DGT/VSQ/N0102- Employability Skills (60 Hours)	**24:00**	**36:00**	**00:00**	**00:00**	**60:00**
Module 5: Employability Skills (60 Hours)	24:00	36:00	00:00	00:00	60:00
Total Duration	**240:00**	**330:00**	**210:00**	**00:00**	**780:00**

Module Details

Module 1: Introduction to the role of VLSI Design Engineer
Bridge module

Terminal Outcomes:

- List the role and responsibilities of a VLSI Design Engineer.

Duration: *41:00*	Duration: *49:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
- Describe the size and scope of the electronics industry and its various sub-sectors. - Discuss the various opportunities for a VLSI Design Engineer in the electronics industry. - Define the basics of electronics and related concepts. - Discuss the role and responsibilities of a VLSI Design Engineer. - Discuss organisational policies on incentives, delivery standards, personnel management and public relations (PR).	- To tackle the issues of various multiple design stages AI Technique are used in VLSI Design Automation - Familiarization with the Coding used
Classroom Aids:	
Laptop, white board, marker, projector	
Tools, Equipment and Other Requirements	
NA	

Module 2: Basics of system designing

Mapped to ELE/N1201

Terminal Outcomes:

- Recall the basics of digital electronics and computer architecture.

Duration: 50:00	Duration: 80:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Recall basics of system-on-chip design and digital electronics. • Elucidate the concept of circuit • Illustrate ASIC and FPGA circuit designs. • Elaborate ways to analyse the requirements of ASIC and FPGA circuit designs. • Describe basics of computer architecture and semiconductor physics. • Illustrate the layout of CMOS circuit. • List the components of a CMOS integrated circuit such as transistors, diodes, triodes etc. • Recall basics of high level computer languages such as C, C++. • Describe the application of the chip and end product.	• Demonstrate the functioning of components of CMOS integrated circuit in the system. • Demonstrate the basic procedure of developing layout of a CMOS integrated circuit as per the requirements. • Demonstrate the use of computer languages such as C, C++ in system designing.
Classroom Aids:	
Whiteboard, marker pen, computer or laptop attached to LCD projector, scanner, computer speakers	
Tools, Equipment and Other Requirements	
Server, switch, leased line, UPS, air Conditioning, server software, system software, Cadence/Synopsys/Mentor Design Suite , xManager or VNC Viewer	

Module 3: Develop function design of SOC module

Mapped to ELE/N1201

Terminal Outcomes:

- Identify the requirements for designing function of SOC module.
- Perform steps to carry out designing of function of SOC module.

Duration: *110:00*	Duration: *150:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Describe the work flow of the company's SOC function designing process. • Discuss the information derived from work schedules, different activities and project requirements by interacting with the lead engineer and other departments. • Describe types of circuit design i.e. digital design and analogue design. • Elaborate ways to analyse the project requirements based on the type of circuit design. • Describe the design factors such as design cycle time, expense and custom design requirements for selecting the design type. • Describe function of system architecture and its components memory, microcontroller, microprocessor, memory blocks, timers and oscillators, interfaces and power management. • List the steps to be perform for preparing the system for designing the SOC module function. • Discuss the selection criteria of languages for designing such as Hardware Design Language (HDL) i.e. Verilog, VHDL and high level language i.e. C, C++. • Describe IP core block and its use in design. • List tools, software and applications required for designing. • List the steps to be perform for planning and designing the function of SOC module. • Describe different types of design as per sections in VLSI processor such as high level design, operative part design, control part design, memory design and others. • Describe how to design the logic for the system including structuring of blocks, interconnection pattern, structure of data path and its control sequences.	• Show how to plan the work activities based on the work flow and deliverables. • Demonstrate the appropriate procedure of receiving circuit design from functional / logic design team. • Show how to select the design type with the consideration of design factors. • Apply appropriate ways to inspect the complete system architecture. • Show how to segregate the partitions in the SOC module blocks and define the function of each block. • Demonstrate use of tools, software, applications and computer languages required for designing work. • Show how to select the appropriate coding for designing the module. • Role play a situation to co-ordinate with different design teams for specifying and designing the function of system blocks as per the requirement. • Show how to specify the external interfaces, behavioural requirements for the design and tasks to be performed by the module of the chip. • Demonstrate use of HDL for writing the hardware description of IC. • Show how to build a simulated model, e.g. VHDL model for ASIC design as per the system specification. • Demonstrate procedure for specifying the different types of design as per sections in VLSI processor. • Demonstrate procedure of designing the logic for the system. • Role play a situation to coordinate with back end department of physical design and design for test engineers for making changes in the system design on the basis

• Elaborate ways to analyse the coding and verification results of design. • Discuss the importance of recording the observed outcomes and its use in rejecting the defective device. • Discuss the documents needed to be maintained after completion of work.	of verification process results and system requirement. • Prepare a sample report to document the designing results and work completion status for the Lead Engineer.

Classroom Aids:

Whiteboard, marker pen, computer or laptop attached to LCD projector, scanner, computer speakers

Tools, Equipment and Other Requirements

Server, switch, leased line, UPS, air Conditioning, server software, system software

Module 4: Basic Health and Safety Practices
Mapped to ELE/N1002

Terminal Outcomes:

- Apply health and safety practices at the workplace.

Duration: *15:00*	Duration: *15:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Discuss job-site hazards, risks and accidents. • Explain the organizational safety procedures for maintaining electrical safety, handling tools and hazardous materials. • Elaborate electronic waste disposal procedures. • Describe the process of disposal of hazardous waste • List the name and location of concerned people, documents and equipment for maintaining health and safety in the workplace. • Describe how to interpret warning signs while accessing sensitive work areas. • Explain the importance of good housekeeping. • Describe the importance of maintaining appropriate postures while lifting heavy objects. • List the types of fire and fire extinguishers. • Explain the importance of efficient utilisation of water, electricity and other resources. • List the common sources of pollution and ways to minimize it. • Describe the concept of waste management and methods of disposing hazardous waste. • Explain various warning and safety signs. • Describe different ways of preventing accidents at the	• Demonstrate the use of protective equipment suitable as per tasks and work conditions. • Prepare a report to inform the relevant authorities about any abnormal situation/behaviour of any equipment/system. • Administer first aid in case of a minor accident. • Demonstrate the steps to free a person from electrocution safely. • Administer Cardiopulmonary Resuscitation (CPR). • Demonstrate the application of defined emergency procedures such as raising alarm, safe/efficient, evacuation, moving injured people, etc. • Prepare a sample incident report. • Use a fire extinguisher in case of a fire incident. • Demonstrate the correct method of lifting and handling heavy objects.
Classroom Aids	
Training kit (Trainer guide, Presentations), White board, Marker, projector, laptop, flipchart.	
Tools, Equipment and Other Requirements	
Personal Protection Equipment: safety glasses, head protection, rubber gloves, safety footwear, warning signs and tapes, fire extinguisher, first aid kit, fire extinguishers and warning signs.	

Module 5: Employability Skills (60 Hours)
Mapped to DGT/VSQ/N0102

Terminal Outcomes:

- Discuss about Employability Skills in meeting the job requirements
- Describe opportunities as an entrepreneur.
- Describe ways of preparing for apprenticeship & Jobs appropriately.

Duration: 24:00	Duration: 36:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
- Explain constitutional values, civic rights, responsibility towards society to become a responsible citizen - Discuss 21st century skills - Explain use of basic English phrases and sentences. - Demonstrate how to communicate in a well-behaved manner - Demonstrate how to work with others - Demonstrate how to operate digital devices - Discuss the significance of Internet and Computer/ Laptops - Discuss the need for identifying business opportunities - Discuss about types of customers. - Discuss on creation of biodata - Discuss about apprenticeship and opportunities related to it.	- List different learning and employability related GOI and private portals and their usage - Show how to practice different environmentally sustainable practices. - Exhibit 21st century skills like Self-Awareness, Behavior Skills, time management, etc. - Show how to use basic English sentences for everyday conversation in different contexts, in person and over the telephone - Demonstrate how to communicate in a well-mannered way with others. - Demonstrate how to communicate effectively using verbal and nonverbal communication etiquette - Utilize virtual collaboration tools to work effectively - Demonstrate how to maintain hygiene and dressing appropriately. - Perform a mock interview
Classroom Aids	
Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop	
Tools, Equipment and Other Requirements	
Computer, UPS, Scanner, Computer Tables, LCD Projector, Computer Chairs, White Board OR Computer Lab	

Module 6: On-the-Job Training
Mapped to VLSI Design Engineer

Mandatory Duration: *210:00*	Recommended Duration: *00:00*
Location: On Site	

Terminal Outcomes

1. Explain the fundamental concepts of electronics and electronics components

2. Select the appropriate coding for designing the module.

3. Co-ordinate with different design teams for specifying and designing the function of system blocks.

4. Specify the external interfaces, behavioural requirements for the design and tasks to be performed by the module of the chip.

5. Use HDL for writing the hardware description of IC.

6. Build a simulated model, e.g. VHDL model for ASIC design as per the system specification.

7. Identify the requirements for designing function of SOC module.

8. Perform designing of function of SOC module

9. Interact and coordinate with supervisor and colleagues

10. Work as per the given timeline and quality standards

11. Maintain a safe, healthy and secure work environment

Annexure

Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training Experience		Remarks
		Years	Specialization	Years	Specialization	
Diploma/ Graduate / Certified in relevant CITS Trade	Electronics	3	VLSI Design Engineer	2	Trainer	

Trainer Certification	
Domain Certification	Platform Certification
"VLSI Design Engineer, ELE/Q1201, version 3.0". Minimum accepted score is 80%.	Recommended that the Trainer is certified for the **VLSI Design Engineer** "Trainer (VET and Skills)", mapped to the Qualification Pack: "MEP/Q2601, V2.0", with minimum score of 80%

Assessor Requirements

Assessor Prerequisites						
Minimum Educational Qualification	**Specialization**	**Relevant Industry Experience**		**Training/Assessment Experience**		**Remarks**
		Years	*Specialization*	*Years*	*Specialization*	
Diploma/ Graduate / Certified in relevant CITS Trade	Electronics	5	VLSI Design Engineer	2	Assessor	

Assessor Certification	
Domain Certification	**Platform Certification**
"VLSI Design Engineer, ELE/Q1201, version 3.0". Minimum accepted score is 80%.	Recommended that the Assessor is certified for the **VLSI Design Engineer** "Assessor (VET and Skills)", mapped to the Qualification Pack: "MEP/Q2701, V2.0", with minimum score of 80%

Assessment Strategy

1. Assessment System Overview:
   - Batches assigned to the assessment agencies for conducting the assessment on SDMS/SIP or email
   - Assessment agencies send the assessment confirmation to VTP/TC looping SSC
   - Assessment agency deploys the ToA certified Assessor for executing the assessment
   - SSC monitors the assessment process & records

2. Testing Environment:
   - Confirm that the centre is available at the same address as mentioned on SDMS or SIP
   - Check the duration of the training.
   - Check the Assessment Start and End time to be as 10 a.m. and 5 p.m.
   - If the batch size is more than 30, then there should be 2 Assessors.
   - Check that the allotted time to the candidates to complete Theory & Practical Assessment is correct.
   - Check the mode of assessment—Online (TAB/Computer) or Offline (OMR/PP).
   - Confirm the number of TABs on the ground are correct to execute the Assessment smoothly.
   - Check the availability of the Lab Equipment for the particular Job Role.

3. Assessment Quality Assurance levels / Framework:
   - Question papers created by the Subject Matter Experts (SME)
   - Question papers created by the SME verified by the other subject Matter Experts
   - Questions are mapped with NOS and PC
   - Question papers are prepared considering that level 1 to 3 are for the unskilled & semi-skilled individuals, and level 4 and above are for the skilled, supervisor & higher management
   - Assessor must be ToA certified & trainer must be ToT Certified
   - Assessment agency must follow the assessment guidelines to conduct the assessment

4. Types of evidence or evidence-gathering protocol:
   - Time-stamped & geotagged reporting of the assessor from assessment location
   - Centre photographs with signboards and scheme specific branding
   - Biometric or manual attendance sheet (stamped by TP) of the trainees during the training period
   - Time-stamped & geotagged assessment (Theory + Viva + Practical) photographs & videos

5. Method of verification or validation:
   - Surprise visit to the assessment location
   - Random audit of the batch
   - Random audit of any candidate

6. Method for assessment documentation, archiving, and access
   - Hard copies of the documents are stored
   - Soft copies of the documents & photographs of the assessment are uploaded / accessed from Cloud Storage
   - Soft copies of the documents & photographs of the assessment are stored in the Hard Drives

References

Glossary

Sector	Sector is a conglomeration of different business operations having similar business and interests. It may also be defined as a distinct subset of the economy whose components share similar characteristics and interests.
Sub-sector	Sub-sector is derived from a further breakdown based on the characteristics and interests of its components.
Occupation	Occupation is a set of job roles, which perform similar/ related set of functions in an industry.
Job role	Job role defines a unique set of functions that together form a unique employment opportunity in an organisation.
Occupational Standards (OS)	OS specify the standards of performance an individual must achieve when carrying out a function in the workplace, together with the Knowledge and Understanding (KU) they need to meet that standard consistently. Occupational Standards are applicable both in the Indian and global contexts.
Performance Criteria (PC)	Performance Criteria (PC) are statements that together specify the standard of performance required when carrying out a task.
National Occupational Standards (NOS)	NOS are occupational standards which apply uniquely in the Indian context.
Qualifications Pack (QP)	QP comprises the set of OS, together with the educational, training and other criteria required to perform a job role. A QP is assigned a unique qualifications pack code.
Unit Code	Unit code is a unique identifier for an Occupational Standard, which is denoted by an 'N'
Unit Title	Unit title gives a clear overall statement about what the incumbent should be able to do.
Description	Description gives a short summary of the unit content. This would be helpful to anyone searching on a database to verify that this is the appropriate OS they are looking for.
Scope	Scope is a set of statements specifying the range of variables that an individual may have to deal with in carrying out the function which have a critical impact on quality of performance required.

Knowledge and Understanding (KU)	Knowledge and Understanding (KU) are statements which together specify the technical, generic, professional and organisational specific knowledge that an individual needs in order to perform to the required standard.
Organisational Context	Organisational context includes the way the organisation is structured and how it operates, including the extent of operative knowledge managers have of their relevant areas of responsibility.
Technical Knowledge	Technical knowledge is the specific knowledge needed to accomplish specific designated responsibilities.
Core Skills/ Generic Skills (GS)	Core skills or Generic Skills (GS) are a group of skills that are the key to learning and working in today's world. These skills are typically needed in any work environment in today's world. These skills are typically needed in any work environment. In the context of the OS, these include communication related skills that are applicable to most job roles.
Electives	Electives are NOS/set of NOS that are identified by the sector as contributive to specialization in a job role. There may be multiple electives within a QP for each specialized job role. Trainees must select at least one elective for the successful completion of a QP with Electives.
Options	Options are NOS/set of NOS that are identified by the sector as additional skills. There may be multiple options within a QP. It is not mandatory to select any of the options to complete a QP with Options.

Acronyms and Abbreviations

NOS	National Occupational Standard(s)
NSQF	National Skills Qualifications Framework
QP	Qualifications Pack
TVET	Technical and Vocational Education and Training
IPR	Intellectual Property Rights