Model Curriculum

QP Name: Failure Analysis & Reliability Engineer

QP Code: ELE/Q0121

QP Version: 2.0

NSQF Level: 5

Model Curriculum Version: 2.0

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	Quality Assurance
Country	India
NSQF Level	5
Aligned to NCO/ISCO/ISIC Code	NCO-2015/7543.0803
Minimum Educational Qualification and Experience	Diploma (After 10 (Electronics/Mechanical)) with 1 Year of relevant experience OR 12th grade pass with 1 year NTC/ NAC with 1 Year of relevant experience OR 12th grade Pass with 2 Years of relevant experience OR Previous relevant Qualification of NSQF Level (4) with 3 Years of relevant experience OR 10th grade pass with 4 Years of relevant experience
Pre-Requisite License or Training	NA
Minimum Job Entry Age	18 Years
Last Reviewed On	31.03.2022
Next Review Date	31.03.2025
NSQC Approval Date	31.03.2022
QP Version	2.0
Model Curriculum Creation Date	31.03.2022
Model Curriculum Valid Up to Date	31.03.2025
Model Curriculum Version	2.0
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:

- Describe the process of Semiconductor Manufacturing, Assembly, Testing & Packaging evaluating customer requirements and computer issues.
- Demonstrate the evaluation process of customer requirements and semiconductors processing.
- Demonstrate the uses of all standards related to Failure Analysis & Reliability Engineer
- Demonstrate the process of Implementation of all Microscope Handling and Processes
- Demonstrate various practices to be followed to maintain health and safety at work.

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	**21:00**	**39:00**	**00:00**	**00:00**	**60:00**
Module 1: Introduction of Failure Analysis & Reliability	21:00	39:00	00:00	00:00	60:00
ELE/N0160 Operate Chemical Related Process	**30:00**	**30:00**	**30:00**	**00:00**	**90:00**
Module 2: Operate Chemical Process	30:00	30:00	30:00	00:00	90:00
ELE/N0161 Operate Optical Micro Scope and X Ray Machine	**30:00**	**30:00**	**30:00**	**00:00**	**90:00**
Module 3: Operate Optical Micro Scope and X Ray Machine	30:00	30:00	30:00	00:00	90:00

ELE/N0162 Operate SEM, CSEM & FIB	**30:00**	**30:00**	**30:00**	**00:00**	**90:00**
Module 4: Operate SEM, CSEM & FIB	30:00	30:00	30:00	00:00	90:00
ELE/N0163 Understanding of Full Failure Analysis of Flow	**30:00**	**30:00**	**30:00**	**00:00**	**90:00**
Module 5: Understanding of Full Failure Analysis Flow	30:00	30:00	30:00	00:00	90:00
ELE/N0164 Process Preparation and Guidance to the Process Engineer	**30:00**	**60:00**	**30:00**	**00:00**	**120:00**
Module 6: Prepare Report & Provide Guidance to the process Engineer	30:00	60:00	30:00	00:00	120:00
ELE/N0165 Reliability Flow & Testing	**30:00**	**60:00**	**60:00**	**00:00**	**150:00**
Module 7: Test the Reliability Flow	30:00	60:00	60:00	00:00	150:00
ELE/N1002 Apply Health and Safety Practices at Workplace	**15:00**	**15:00**	**00:00**	**00:00**	**30:00**
Module 8: Apply health and Safety Practices at Workplace	15:00	15:00	00:00	00:00	30:00
DGT/VSQ/N0102- Employability Skills (60 Hours)	**24:00**	**36:00**	**00:00**	**00:00**	**60:00**
Module 9: 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 of Failure Analysis & Reliability Engineer

Bridge Module

Terminal Outcomes:

- State the role and responsibilities of a Failure Analysis and Reliability Engineer

Duration: 21:00	Duration: 39:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Describe the size and scope of the electronics industry and its sub-sectors. • Discuss the role and responsibilities of a Failure Analysis and Reliability Engineer. • Describe various employment opportunities for a Failure Analysis and Reliability Engineer.	• Awareness of the various issues and Quality checks in the Assembly • Quality Assurance of the product and components in the Assembly • Factory Acceptance Testing of the product and components in the Assembly
Classroom Aids	
Training Kit - Trainer guide, Presentations, Whiteboard, Marker, projector, laptop	
Tools, Equipment and Other Requirements	
NA	

Module 2: Operate Chemical Process

Mapped to ELE/N0160

Terminal Outcomes:

- State the role and responsibilities of a Failure Analysis and Reliability Engineer

Duration: 30:00	Duration: 30:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Understand polishing machine • X Section Procedure • Grinding Paper knowledge • Procedure of Manual De-Cap • Safety Procedure to Avoid any mishappening (How to use Chemicals)	• Chemical Slurry usage procedure • Laser De-Cap Machine Operation • Define, document and guide operators for recipe • Use Yield Tracking Using SPC or Statistical System
Classroom Aids	
Training Kit - Trainer guide, Presentations, Whiteboard, Marker, projector, laptop	
Tools, Equipment and Other Requirements	
Failure Analysis	

Module 3: Operate Optical Micro Scope and X Ray Machine

Mapped to ELE/N0161

Terminal Outcomes:

- Describe the process of standard implementations for Failure Analysis and Reliability Process Flow
- Demonstrate the process of verification all Parameters

Duration: 30:00	Duration: 30:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Understand Microscope and its accessories (Lenses etc) • How to Fix Minor Errors • Generate recipes/Programs to do automatic measurement • Understand X Ray and its accessories (Lenses etc) • How to do Inspects wires, metal layers, passive component's issues etc • How to Operate X Ray Machine	• How to do measurements • How to calibrate • How to analyze the data • How to do Inspects wires, metal layers, passive component's issues
Classroom Aids	
Training kit (Trainer guide, Presentations). Whiteboard, Marker, projector, laptop	
Tools, Equipment and Other Requirements	
Micro Scope and X Ray Machine	

Module 4: Operate SEM, CSEM & FIB

Mapped to ELE/N0162

- Describe the process of Operate SEM, CSEM & FIB.
- Demonstrate the process of SEM & CSEM
- Demonstrate the process of cost and Productivity Improvement

Duration: 30:00	Duration: 30:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Understand the SEM Basic Principles • How to do sample analysis and measurement • How to do EDX • Understand the CSAM Basic Principles (Sound Waves Reflections, Deflections, Transmissions etc) • Understand the FIB Basic Principles • Prepare procedure and document	• Generate diagrams of Each Test • Analysis of Spec. data and Diagram • feed test pad locations to System. • Integration of Test and Prober • Give Test commands prober • Teach/Train Operators & Technicians
Classroom Aids	
Training kit (Trainer guide, Presentations). Whiteboard, Marker, projector, laptop	
Tools, Equipment and Other Requirements	
Failure Analysis Flow	

Module 5: Understanding of Full Failure Analysis Flow

Mapped to ELE/N0163

Terminal Outcomes:

- Knowledge about all tools and equipment's useful Which are required for The Failure Analysis and Reliability
- Knowledge about all tools and equipment's useful for Failure Analysis and to implement Quality Standards

Duration: 30:00	Duration: 30:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Use of Electrical Tools such as Prober, Small Tester, Multimeters • Verification of failures • Hands on Experience on Non-Destructive failure analysis tools • Make standard operating procedure & Documents • Make presentation in such a way that help process engineers to optimize process to reduce failures • Perform all the steps with efficiency & accuracy	• Make flow and documented • Full knowledge of product testing pad • Perform all the steps with efficiency & accuracy
Classroom Aids	
Training kit (Trainer guide, Presentations)	
Tools, Equipment and Other Requirements	
Equipment's related to Failure Analysis	

Module 6: Prepare Report & Provide Guidance to the process Engineer

Mapped to ELE/N0164

Terminal Outcomes:

- Knowledge about all tools and equipment's useful Which are required for The Failure Analysis and Reliability
- Knowledge about all tools and equipment's useful for Failure Analysis and to implement Quality Standards

Duration: 30:00	Duration: 60:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Good Understanding of Chip packaging process flow • Failure Analysis Categories, Definitions should be clear • Related Physical failure to electrical failures • Define all failures based on defined categories • Try to make sure that each failure relates to process with accuracy • Present the report to all process engineers and explain the failures	• Make flow and documented • Full knowledge of product testing pad • Perform all the steps with efficiency & accuracy
Classroom Aids	
Training kit (Trainer guide, Presentations)	
Tools, Equipment and Other Requirements	
Equipment's related to Failure Analysis	

Module 7: Test the Reliability Flow

Mapped to ELE/N0165

Terminal Outcomes:

- Knowledge about all tools and equipment's useful Which are required for The Failure Analysis and Reliability
- Knowledge about all tools and equipment's useful for Failure Analysis and to implement Quality Standards

Duration: 30:00	Duration: 60:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Get customers reliability requirements • Verification of failures • If any failure do PFA and continue reliability for rest • Calculate DPPM and Life of product • Good understanding of international reliability standards such as JEDEC • Understand the PCN's & ECN's reliability requirements	• Make flow and documented • Full knowledge of product testing pad • Perform all the steps with efficiency & accuracy • If any failure do PFA and continue reliability for rest
Classroom Aids	
Training kit (Trainer guide, Presentations)	
Tools, Equipment and Other Requirements	
Equipment's related to Failure Analysis	

Module 8: Apply work and health 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 the 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 workplace.	• Demonstrate the use of protective equipment suitable as per tasks and work conditions. • Report any abnormal situation/behaviour of any equipment/system to the relevant authorities. • 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)	
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 9: 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 workeffectively • 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 10: On-the-Job Training

Mapped to Failure Analysis and Reliability Engineer

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

Terminal Outcomes

1. Explain the functions of a Failure Analysis in Semiconductors.
2. List the preliminary tasks involved in the repair and maintenance of a Tools and Equipment's
3. Demonstrate how to perform preliminary checks on a computer and its peripherals.
4. Perform steps to inspect the computer and its peripherals to identify defective modules/ components.
5. Perform repair and maintenance activities as per the Service Level Agreement (SLA).
6. Perform steps to test the functioning of Wafer Test & Sort after repair.
7. Communicate product and service-related information to the customer.
8. Employ appropriate practices to interact and coordinate with supervisor and colleagues.
9. Perform assigned work within the turnaround time and as per the defined quality standards.
10. Demonstrate how to maintain a healthy, safe and secure working environment.

Annexure

Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	**Specialization**	**Relevant Industry Experience**		**Training Experience**		**Remarks**
		Years	***Specialization***	***Years***	***Specialization***	
Diploma/ Degree/ ITI/ Certified in relevant CITS Trade	Electrical/Electronics/ Mechanical	2	Quality Management - Electronics	1	Electronics	

Trainer Certification	
Domain Certification	**Platform Certification**
"Failure Analysis and Reliability Engineer, ELE/Q0121, version 2.0". Minimum accepted score is 80%.	Recommended that the Trainer is certified for the **Failure Analysis and Reliability 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/ Degree/ ITI/ Certified in relevant CITS Trade	Electrical/Electronics/ Mechanical	3	Quality Management - Electronics	1	Electronics	

Assessor Certification	
Domain Certification	**Platform Certification**
"Failure Analysis and Reliability Engineer, ELE/Q0121, version 2.0". Minimum accepted score is 80%.	Recommended that the Assessor is certified for the **Failure Analysis and Reliability 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
    - The assessment agency deploys the ToA certified Assessor for executing the assessment
    - SSC monitors the assessment process & records
2. Testing Environment

    To ensure a conducive environment for conducting a test, the trainer will:
    - 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 10 a.m. and 5 p.m. respectively
    - Ensure there are 2 Assessors if the batch size is more than 30.
    - 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
    - The assessor must be ToA certified and the trainer must be ToT Certified
    - The 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:

    To verify the details submitted by the training centre, the assessor will undertake:
    - A surprise visit to the assessment location
    - A random audit of the batch
    - A random audit of any candidate
6. Method for assessment documentation, archiving, and access

    To protect the assessment papers and information, the assessor will ensure:
    - 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 on the Hard drive

References

Glossary

Term	Description
Declarative knowledge	Declarative knowledge refers to facts, concepts and principles that need to be known and/or understood in order to accomplish a task or to solve a problem.
Key Learning	Key learning outcome is the statement of what a learner needs to know, understand and be able to do in order to achieve the terminal outcomes. A set of key learning outcomes will make up the training outcomes. Training outcome is specified in terms of knowledge, understanding (theory) and skills (practical application).
OJT (M)	On-the-job training (Mandatory); trainees are mandated to complete specified hours of training on site
OJT (R)	On-the-job training (Recommended); trainees are recommended the specified hours of training on site
Procedural Knowledge	Procedural knowledge addresses how to do something, or how to perform a
Training Outcome	Training outcome is a statement of what a learner will know, understand and be able to do **upon the completion of the training**.
Terminal Outcome	Terminal outcome is a statement of what a learner will know, understand and be able to do **upon the completion of a module.** A set of terminal outcomes help to achieve the training outcome.

Acronyms and Abbreviations

Term	Description
DC	Direct Current
ISO	International Organization for Standardization
NCO	National Occupational Standards
NOS	National Skills Qualification Committee
NSQF	National Skills Qualification Framework
OJT	On-the-Job Training
OMR	Optical Mark Recognition
PC	Performance Criteria
PwD	Persons with Disabilities
QP	Qualification Pack
SDMS	Skill Development & Management System
SIP	Skill India Portal
SME	Small and Medium Enterprises
SOP	Standard Operating Procedure
SSC	Sector Skill Council
TC	Trainer Certificate
ToA	Training of Assessors
ToT	Training of Trainers
TP	Training Provider