



# Model Curriculum

**NOS Name: Fundamentals of Automotive Functional Safety Design**

**NOS Code: ASC/N8116**

**NOS Version: 1.0**

**NSQF Level: 5.5**

**Model Curriculum Version: 1.0**

## Table of Contents

Training Parameters.....	3
Program Overview	4
Training Outcomes	4
Compulsory Modules	4
Module 1: Introduction to CAD modelling software	5
Module 2: Carry out object scanning, reverse engineering and designing of modified component	6
Module 3: Develop product prototype by 3D printing	7
Annexure	9
Trainer Requirements	9
Assessor Requirements	10
Assessment Strategy	11
References	12
Glossary	12
Acronyms and Abbreviations	13

## Training Parameters

<b>Sector</b>	Automotive
<b>Sub-Sector</b>	Research & Development
<b>Occupation</b>	Automotive Product Designing
<b>Country</b>	India
<b>NSQF Level</b>	5.5
<b>Aligned to NCO/ISCO/ISIC Code</b>	NCO-2015/2144.0301
<b>Minimum Educational Qualification and Experience</b>	UG Diploma in relevant field with 1.5 Years of Relevant experience OR 3 <sup>rd</sup> year of UG Degree in relevant field OR Diploma after 10th in relevant field with 3 Years of Relevant experience
<b>Pre-Requisite License or Training</b>	
<b>Minimum Job Entry Age</b>	18 years
<b>Last Reviewed On</b>	15/03/2024
<b>Next Review Date</b>	15/03/2027
<b>NSQC Approval Date</b>	15/03/2024
<b>QP Version</b>	1.0
<b>Model Curriculum Creation Date</b>	15/03/2024
<b>Model Curriculum Valid Up to Date</b>	15/03/2027
<b>Model Curriculum Version</b>	1.0
<b>Minimum Duration of the Course</b>	60 Hours 00 Minutes
<b>Maximum Duration of the Course</b>	60 Hours 00 Minutes

## 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.

- Carry out functional safety related design and analysis on Mechanical & Electronic systems
- Perform CAE simulations conforming to functional safety standards on mechanical parts
- Execute testing of vehicle parts and systems critical for functions safety

### 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
<b>ASC/N8116 – Fundamentals of Automotive Functional Safety Design – 1.0</b> <b>NSQF Level – 5.5</b>	<b>15:00</b>	<b>45:00</b>			<b>60:00</b>
Module 1: Gather information from various sources of Automotive R&D associated with the functional safety of vehicles	08:00	00:00			08:00
Module 2: Carry-out functional safety related design and analysis on Electrical/Electronic systems of automobiles	05:00	15:00			20:00
Module 3: Perform CAE simulations (FEA, CFD, MBD) conforming to functional safety standards on mechanical parts before releasing final designs and production drawings (CAD 3D & 2D)	02:00	30:00			32:00
<b>Total Duration</b>	<b>15:00</b>	<b>45:00</b>			<b>60:00</b>

# Module Details

**Module 1: Gather information from various sources of Automotive R&D associated with the functional safety of vehicles**

*Mapped to ASC/N8116, v1.0*

<b>Duration:</b> <08:00>	<b>Duration:</b> <00:00>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>List the applicable safety regulations.</li> <li>Detail the functional safety goals for Product Engineering.</li> <li>Explain the design targets for functional safety related parts of vehicle sub-systems</li> <li>Elaborate the Vehicle Integration goals for crash safety and performance.</li> <li>Detail the SMT goals for functional safety of parts in Chassis, PT, Body, HVAC, E/E.</li> <li>Identify the technologies aiding design for functional safety regulations/standards – Crash (BNCAP), Emission (BS-6), Electronic / Software (AUTOSAR) Energy (FAME), Roadworthiness (CMVR), Noise (ARAI).</li> </ul>	<ul style="list-style-type: none"> <li>N/A.</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	
E-learning / LMS software, Presentation slides	

## Module 2: Carry-out functional safety related design and analysis on Electrical/Electronic systems of automobiles

*Mapped to ASC/N8116, v1.0*

### Terminal Outcomes:

- Perform Model Based Engineering (MBE) of Electrical/Electronic (E/E) part/system of automobiles
- Execute designing of fail-safe systems and safe-to-fail products in the E/E vehicle sub-system

<b>Duration: &lt;05:00&gt;</b>	<b>Duration: &lt;15:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• List the areas of functioning - operating - automating of safety critical E/E system.</li> <li>• Design the E/E safety systems for safety, reliability, durability, repeatability.</li> <li>• Detail Design Statement of Requirement (SOR) elements on functional safety.</li> <li>• Enlist risks &amp; hazards in use-misuse-abuse of the vehicle.</li> <li>• Explain Design Failure Mode Effects Analysis (FMEA) per ISO-26262/AUTOSAR.</li> </ul>	<ul style="list-style-type: none"> <li>• Develop Design Statement of Requirement (D-SOR) for E/E part crucial on safety.</li> <li>• Prepare Design Failure Mode Effects Analysis (D-FMEA) sheet for E/E system and list down safety requirements compliance in the VDP of the vehicle.</li> <li>• Demonstrate Production Part Approval Process (PPAP) on Body Control Module.</li> <li>• Prepare SIL-HIL-Testing-Trial scheme of design verification of Wiper system.</li> <li>• Illustrate the design validation progression of the Lane changing alert system in cars.</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	
<ul style="list-style-type: none"> <li>• Electronic PD software (Matlab/Simulink, Octave, Python)</li> <li>• Technical reference books, Case-study documents</li> </ul>	



## Module 3: Perform CAE simulations (FEA, CFD, MBD) conforming to functional safety standards on mechanical parts before releasing final designs and production drawings (CAD 3D & 2D)

*Mapped to ASC/N8116, v1.0*

### Terminal Outcomes:

- Perform the steps to analyse the design of automotive components critical for functional safety
- Demonstrate CAE post-processing activities like test-simulation correlation, design modification, etc.

Duration: <02:00>	Duration: <30:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>• Perform FE modelling of parts integrating, loads &amp; restraints, connections, materials.</li> <li>• List the load cases for safety simulations.</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate FE model quality checking.</li> <li>• Illustrate the simulation load cases critical on design-for-safety in brake assembly.</li> <li>• Perform FEA on the PowerTrain part Inlet manifold for air flow dynamics.</li> <li>• Analyse design Strength Factor of Safety of front axle beam of truck.</li> <li>• Modify CAD model of steering wheel re-designed as per crash test result analysis.</li> <li>• Develop the presentation report for design finalisation of ECU for emission control.</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	
CAD software (SolidWorks / Onshape / Nx-CAx), CAE software (Ansys / HyperMesh), LMS licence	



# Annexure

## Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training Experience		Remarks
		Years	Specialization	Years	Specialization	
B.E/B.Tech	Mechanical/Automobile	3	Mechanical / Automobile / Electronics	1	Mechanical / Automobile / Electronics	NA
B.E/B.Tech	Mechanical/Automobile	4	Mechanical / Automobile / Electronics	0	Mechanical / Automobile / Electronics	NA
Diploma	Mechanical/Automobile	7	Mechanical / Automobile / Electronics	1	Mechanical / Automobile / Electronics	NA
Diploma	Mechanical/Automobile	8	Mechanical / Automobile / Electronics	0	Mechanical / Automobile / Electronics	NA

Trainer Certification	
Domain Certification	Platform Certification
"Fundamentals of Automotive Functional Safety Design, ASC/N8116, version 1.0". Minimum accepted score is 80%.	"Recommended that the trainer is certified for the job role "Trainer (VET and Skills)", Mapped to Qualification Pack: MEP/Q2601, V2.0" Minimum accepted score is 80%."

## Assessor Requirements

Assessor Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training Experience		Remarks
		Years	Specialization	Years	Specialization	
B.E/B.Tech	Mechanical/ Automobile	4	Mechanical / Automobile / Electronics	1	Mechanical / Automobile / Electronics	NA
B.E/B.Tech	Mechanical/ Automobile	5	Mechanical / Automobile / Electronics	0	Mechanical / Automobile / Electronics	NA
Diploma	Mechanical/ Automobile	8	Mechanical / Automobile / Electronics	1	Mechanical / Automobile / Electronics	NA
Diploma	Mechanical/ Automobile	9	Mechanical / Automobile / Electronics	0	Mechanical / Automobile / Electronics	NA

Assessor Certification	
Domain Certification	Platform Certification
“Fundamentals of Automotive Functional Safety Design, ASC/N8116, version 1.0”. Minimum accepted score is 80%.	Recommended that the Assessor is certified for the job role “Assessor (VET and Skills)”, Mapped to Qualification Pack: MEP/Q2701, V2.0” Minimum accepted score is 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 & geo-tagged 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 & geo-tagged 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

Term	Description
<b>Declarative Knowledge</b>	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.
<b>Key Learning Outcome</b>	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).
<b>OJT (M)</b>	On-the-job training (Mandatory); trainees are mandated to complete specified hours of training on site
<b>OJT (R)</b>	On-the-job training (Recommended); trainees are recommended the specified hours of training on site
<b>Procedural Knowledge</b>	Procedural knowledge addresses how to do something, or how to perform a task. It is the ability to work, or produce a tangible work output by applying cognitive, affective or psychomotor skills.
<b>Training Outcome</b>	Training outcome is a statement of what a learner will know, understand and be able to do upon the completion of the training.
<b>Terminal Outcome</b>	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

NOS	National Occupational Standard(s)
NSQF	National Skills Qualifications Framework
QP	Qualifications Pack
TVET	Technical and Vocational Education and Training
SOP	Standard Operating Procedure
WI	Work Instructions
PPE	Personal Protective equipment

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