Model Curriculum

NOS Name: Fundamentals of Connected Vehicle (V2X) Technology

NOS Code: ASC/N8117

NOS Version: 1.0

NSQF Level: 5.5

Model Curriculum Version: 1.0

Table of Contents

Training Parameters

Sector	Automotive
Sub-Sector	Research & Development
Occupation	Automotive Product Designing
Country	India
NSQF Level	5.5
Aligned to NCO/ISCO/ISIC Code	NCO-2015/2144.0801
Minimum Educational Qualification and Experience	UG Diploma in relevant field with 1.5 Years of Relevant experience OR 3rd year of UG Degree in relevant field OR Diploma after 10th in relevant field with 3 Years of Relevant experience
Pre-Requisite License or Training	
Minimum Job Entry Age	18 years
Last Reviewed On	15/03/2024
Next Review Date	15/03/2027
NSQC Approval Date	15/03/2024
QP Version	1.0
Model Curriculum Creation Date	15/03/2024
Model Curriculum Valid Up to Date	15/03/2027
Model Curriculum Version	1.0
Minimum Duration of the Course	60 Hours 00 Minutes
Maximum Duration of the Course	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.

● Development of connected vehicles & smart infrastructure and electronics designing skills

● Design of hardware for connecting digitally vehicle with things around and software development skills

● Execution of design-development-validation of electronic hardware & software safe from errors, bugs & cyber attacks.

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
ASC/N8117 – Fundamentals of Connected Vehicle (V2X) Technology – 1.0 NSQF Level – 5.5	15:00	45:00			60:00
Module 1: Prepare on connected vehicle technology (V2X) and automation in transportation	04:00	12:00			16:00
Module 2: Designing of smart system in vehicles and for traffic management solutions	07:00	25:00			32:00
Module 3: Analysis of the inherent hazards of connected vehicles and the risk mitigation process	04:00	08:00			12:00
Total Duration	15:00	45:00			60:00

Module Details

Module 1: Prepare on connected vehicle technology (V2X) and automation in transportation

Mapped to ASC/N8117, v1.0

Terminal Outcomes:

- Describe the social and operational impact of V2X in the perspective of driving and traffic
- Illustrate the changes on electronic units of connected vehicles and the traffic infrastructure

Duration: <04:00>	Duration: <12:00>
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Identify the dynamically functional systems in vehicle chassis-body-interior. • Specify the changes in electronic units between regular and connected vehicles. • Detail the types of information shared between vehicle and smart infrastructure. • Enlist the V2X technology features of all standard things around connected vehicle. • Describe the emerging trends in protocols for digital communication. • Chart out the V2X technology tools and its advantages in vehicle engineering. • Detail the flow of data in entirety in V2V communication.	• Illustrate the interconnected hardware in V2V communication at city-centre street. • Model using.Matlab software the flow of digital data between vehicle and things around (infra, cloud, device, network, etc).
Classroom Aids:	
Whiteboard, marker pen, projector, Internet	
Tools, Equipment and Other Requirements	
Matlab, MS-PowerPoint	

Module 2: Designing of smart system in vehicles and for traffic management solutions

Mapped to ASC/N8117, v1.0

Terminal Outcomes:

● Perform design and development of V2X system connecting vehicle to vehicle-infrastructure-device-network

● Execute the system programming for remote repairing of vehicle by an automated on-board diagnostics

Duration: <07:00>	Duration: <25:00>
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Explain the configurations of electronic hardware in connected vehicles and smart systems around. • Prepare the flow chart of software algorithms that creates, controls, corrects connectivity for smart mobility. • Detail the technology aided systems like computer vision, LIDAR, informatics and GPS that are deployed in smart mobility. • Prepare a list of applications of Internet of Vehicles (IoV), embedded systems & ECU in vehicle operation / traffic management. • Detail the operation of systems in compliance to safety standards – error-free, bug-free, risk-free mode. • Illustrate the advanced diagnostic systems layout - on-board diagnostics, remote-repair and digital-twin.	• Illustrate the electronic hardware configuration key for a connected vehicle. • Develop the software algorithm for vehicle to pedestrian connectivity. • Illustrate the network of electronic hardware in a vehicle and transportation infrastructure associated with lane changing. • Demonstrate the working of IoV using MS PowerPoint animation. • Develop the software for error-free operation of car self-driven into a public parking area. • Depict the layout of the digital-twin of a 4-wheeler under repairing of headlight bulb.
Classroom Aids:	
Whiteboard, marker pen, projector, Internet	
Tools, Equipment and Other Requirements	
• NI LabView toolkit, Broadband for Cloud based FOSS, Matlab, C++ software, MS-PowerPoint • Technical reference books, Case-study documents	

Module 3: Analysis of the inherent hazards of connected vehicles and the risk mitigation process

Mapped to ASC/N8117, v1.0

Terminal Outcomes:

- Perform the analysis of design possibilities to meet the industry & government standards on V2X
- Execute risk mitigation steps in the virtual process of design & development of connected vehicle

Duration: *<04:00>*	**Duration**: *<08:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Analyse the effect of critical risks of V2X technology. • Enlist the automotive safety protocols included in AUTOSAR, ISO-26262, IEEE, IS & SAE for V2X. • Illustrate the sensitive systems in vehicle to demonstrate the effect of errors. • Explain solutions for risk mitigation in PE of interconnected transportation network.	• Illustrate the process flow for virtual vehicle engineering comprising the risk mitigation solution for hacking V2X software. • Develop embedded software in 2-wheeler for reading-out loud the direction boards on road.
Classroom Aids:	
Whiteboard, marker pen, projector, Internet	
Tools, Equipment and Other Requirements	
Matlab, C++ software, MS-PowerPoint, MS-Excel LMS licence, Technical reference books, Case-study documents	

Annexure

Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	**Specialization**	**Relevant Industry Experience**		**Training Experience**		**Remarks**
		Years	*Specialization*	*Years*	*Specialization*	
B.E/B.Tech	Electronics/Instrumentation	3	Electronics/ Instrumentation	1	Electronics /Automobile	NA
B.E/B.Tech	Electronics/Instrumentation	4	Designing hardware	0	Assessment	NA
Diploma	(Mechanical/Automobile)	5	System development	0	Assessment	NA
Diploma	(Mechanical/Automobile)	6	System validation	0	Assessment	NA

Trainer Certification	
Domain Certification	**Platform Certification**
"Fundamentals of Connected Vehicle (V2X) Technology , ASC/N8117, 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	Electronics/Electrical/Automobile	4	Electronics/ Electrical/ Automobile	1	Electronics/ Electrical/ Automobile	NA
B.E/B.Tech	Electronics/Electrical/Automobile	5	Designing hardware / Developing software	1	Assessment	NA
Diploma	Electronics/Electrical/Automobile	6	System development	2	Assessment	NA
Diploma	Electronics/Electrical/Automobile	7	System validation	2	Assessment	NA

Assessor Certification	
Domain Certification	**Platform Certification**
"Fundamentals of Connected Vehicle (V2X) Technology , ASC/N8117, version 1.0". Minimum accepted score is 80%.	Recommended that the Accessor is certified for the job role "Assessor (VET and Skills)", Mapped to Qualification Pack: MEP/Q2701, V2.0" Minimum accepted score is 80%.

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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

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 Outcome	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 task. It is the ability to work, or produce a tangible work output by applying cognitive, affective or psychomotor skills.
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

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