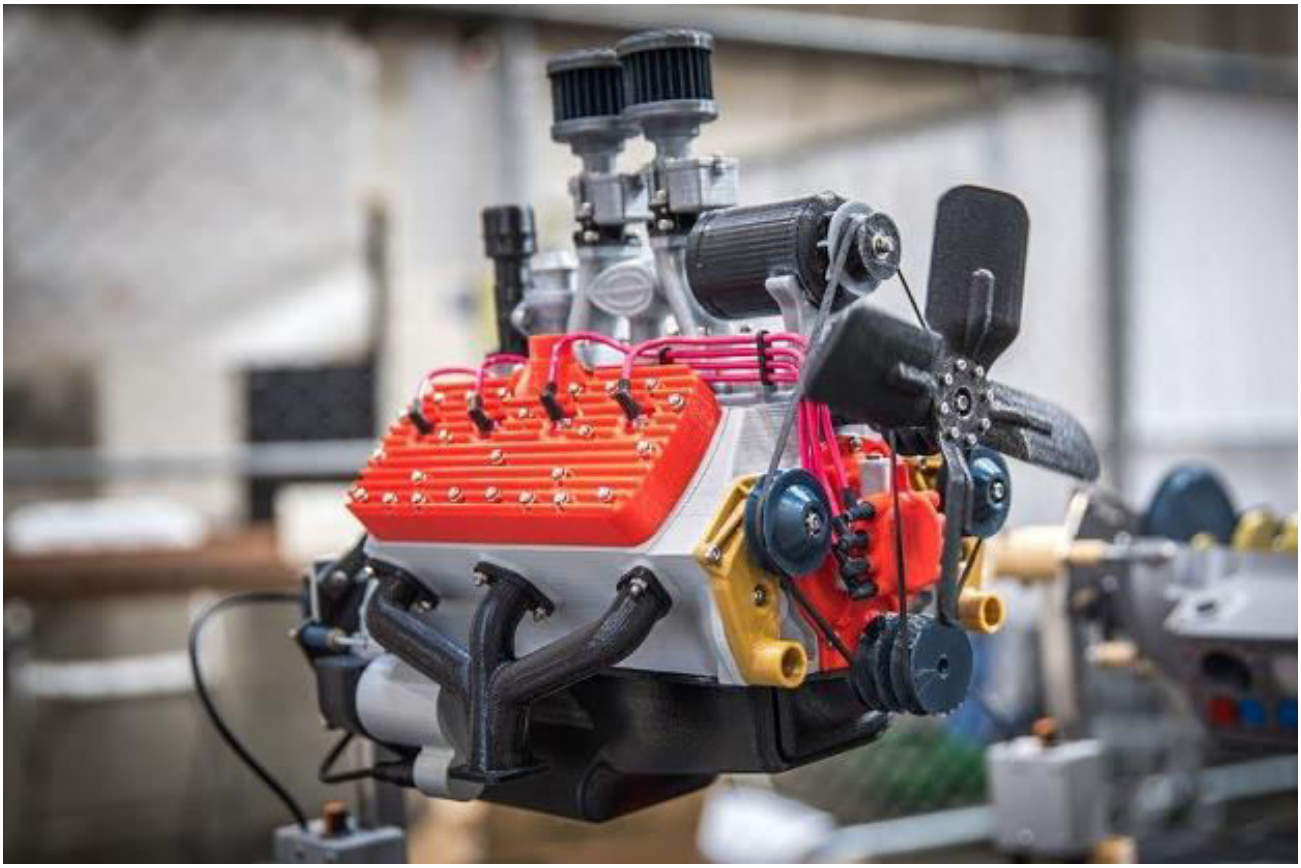

Model Curriculum

NOS Name: Foundation course in Flex Fuel Engine Design

NOS Code: ASC/N8120

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-2015/2145.0900
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.

- Designing of mechanical-electronic parts of FFV systems and Engine Management system
- Analysis of the effects of Ethanol blend ratios through CAE simulation
- Execution of physical testing of FFV parts and systems for design validation and performance

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/N8120 – Foundation course in Flex Fuel Engine Design– 1.0 NSQF Level – 5.5	**15:00**	**45:00**			**60:00**
Module 1: Prepare on Flex Fuel Vehicle (FFV) systems and Alternative Fuel Propulsion (AFP) markets	06:00	10:00			16:00
Module 2: Designing of FFV systems and FF Engine (FFE) Management systems	05:00	20:00			25:00
Module 3: Analysis of the effects of Ethanol blend ratios by simulating and testing	04:00	15:00			19:00
Total Duration	**15:00**	**45:00**			**60:00**

Module Details

Module 1: Prepare on Flex Fuel Vehicle (FFV) systems and Alternative Fuel Propulsion (AFP) markets

Mapped to ASC/N8120, v1.0

Terminal Outcomes:

- Describe the environmental and operational impact of FFV in the perspective of material and energy
- Illustrate the changes on mechanical-electronic parts of FFV sub-systems adapting to FF engine

Duration: *<06:00>*	**Duration**: *<10:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Identify the differences between gasoline and flex fuels. • Specify the changes in configuration between IC Engine & FF Engine. • Specify the changes in the fuel sources and refuelling infrastructure for FFV. • List the regulations for environmental protection from petroleum fuels. • Chart out the features in India for sourcing and dispensing Ethanol as propulsion fuel. • Describe the changes on parts of FFV sub-systems adapting to FF Engine. • Explain the flow of mass and energy in FFV.	• Illustrate the changes on mechanical parts of FFV sub-systems. • Model using CAD the layout of material and energy flow in FFV.
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	
CAD software (SolidWorks / Onshape / Nx-CAx), MS-PowerPoint	

Module 2: Designing of FFV systems and FF Engine (FFE) Management systems

Mapped to ASC/N8120, v1.0

Terminal Outcomes:

- Perform design and development of Flex Fuel Engine Management System
- Execute CAD modelling of mechanical parts and electronic systems adapted for FFE

Duration: *<05:00>*	**Duration**: *<20:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Explain the functionalities of mechanical assemblies controlled by electronic systems. • List the design requirements of FFV parts. • Detail the design elements of FFE parts to meet fuel efficiency and durability targets. • Prepare Design-SOR to develop ECU, sensor and solenoid in the E/E sub-system. • Perform Design Factor-of-Safety (FoS) calculation for lightweight, low-cost parts.	• Illustrate the FFV development process involving SMT, VI, VVD, Testing teams. • Tabulate the design specifications of mechanical parts specific to FFV. • Perform designing of sensors in the FFV exhaust per Model Based Engineering. • Draw the 2D orthographic views of ECUs in the fuel management system of FFV. • Develop 3D CAD model of parts in the air intake manifold of FFE. • Prepare Production Drawing with GD&T for the flex fuel storage system parts.
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	
• Electronic PD software (Matlab/Simulink, Octave, Python) • CAD software (SolidWorks / Onshape), MS-PowerPoint • Technical reference books, Case-study documents	

Module 3: Analysis of the effects of Ethanol blend ratios by simulating and testing

Mapped to ASC/N8120, v1.0

Terminal Outcomes:

- Perform the analysis of energy output as per varying blend ratios of ethanol
- Execute CAE simulations of FFE functionalities and performance correlating with physical test results

Duration: *<04:00>*	**Duration**: *<15:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Analyse the effect of ethanol blend ratios on FFE power & torque and fuel economy. • Describe the effect of flex fuel on varying ambient conditions, fuel quality and drive cycles. • List the testing methods across different validation phases of VPD for evaluation of electronic-mechanical systems in FFV. • Explain the calculations for robustness of mechanical parts that could be validated virtually by CAE for strength & durability.	• Illustrate the test set-up for Design Validation of electronic systems and mechanical parts in FFV exhaust system. • Chart the calibration maps of various blend ratios for FFE ECUs on spark timing, fuel injection timing & air-fuel ratio. • Tabulate a draft costing sheet for the Bill of Material typical to FFE. • Perform pre-processing, FEA and post-processing of thermal & durability simulation of FFE exhaust system parts.
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	
MS-PowerPoint, MS-Excel CAD software (SolidWorks / Onshape / Nx-CAx) CAE software (Ansys / HyperMesh) 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	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**
“Foundation course in Flex Fuel Engine Design, ASC/N8120 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**
"Foundation course in Flex Fuel Engine Design", ASC/N8120, 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%.

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
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