



# Model Curriculum

**QP Name: Automotive Flex Fuel Design Engineer**

**QP Code: ASC/Q8105**

**QP Version: 1.0**

**NSQF Level: 5.5**

**Model Curriculum Version: 1.0**

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## Training Parameters

<b>Sector</b>	Automotive
<b>Sub-Sector</b>	Research and Development
<b>Occupation</b>	Automotive Product Designing
<b>Country</b>	India
<b>NSQF Level</b>	6
<b>Aligned to NCO/ISCO/ISIC Code</b>	NCO-2015/2145.0900
<b>Minimum Educational Qualification and Experience</b>	<p>3 years Diploma (Mechanical/Automobile/ Electrical / Electronics) after class 10th from recognized regulatory body with 3 years of relevant experience</p> <p>OR</p> <p>Pursuing 4th year of B.E./B.Tech in the relevant field and continuous education</p> <p>OR</p> <p>Certificate-NSQF (Electric Vehicle Product Design Engineer/ Automotive Prototype Manufacturing Lead Technician Level 5) with 2 Years of relevant experience</p> <p>** Knowledge of data collection process</p>
<b>Pre-Requisite License or Training</b>	NA
<b>Minimum Job Entry Age</b>	22 years
<b>Last Reviewed On</b>	28/02/2023
<b>Next Review Date</b>	28/02/2026
<b>NSQC Approval Date</b>	28/02/2023
<b>QP Version</b>	1.0
<b>Model Curriculum Creation Date</b>	28/02/2023
<b>Model Curriculum Valid Up to Date</b>	28/02/2026
<b>Model Curriculum Version</b>	1.0
<b>Minimum Duration of the Course</b>	630 Hours
<b>Maximum Duration of the Course</b>	630 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.

- Carry out designing of parts for fuel system
- Carry out designing engine management system
- Demonstrate Design of Experiments (DoE) methods to investigate the behaviour on various blends of flex fuel
- Perform calculation, design level simulation and test result analysis
- Implement safety practices.
- Use resources optimally to ensure less wastage and maximum conservation.

### 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>Bridge Module</b>					
Module 1: Introduction to the role of an Automotive Flex Fuel Design Engineer	5:00	0:00			5:00
<b>ASC/N9818: Manage work and resources (Research &amp; Development)</b> NOS Version No. – 1.0 NSQF Level – 5	<b>15:00</b>	<b>40:00</b>			<b>55:00</b>
Module 2: Manage work and resources according to safety and conservation standards	15:00	40:00			55:00
<b>DGT/VSQ/N0103</b> <b>Employability Skills (90 hours)</b> NOS Version No. – 1.0 NSQF Level – 6	<b>36:00</b>	<b>54:00</b>			<b>90:00</b>
Module 3: Introduction to Employability Skills	1:00	2:00			3:00
Module 4: Constitutional values - Citizenship	0.5:00	1:00			1.5:00
Module 5: Becoming a Professional in the 21st Century	2:00	3:00			5:00
Module 6: Basic English Skills	4:00	6:00			10:00
Module 7: Career Development & Goal Setting	1.5:00	2.5:00			4:00
Module 8: Communication Skills	4:00	6:00			10:00
Module 9: Diversity &	1:00	1.5:00			2.5:00

Inclusion					
Module 10: Financial and Legal Literacy	4:00	6:00			10:00
Module 11: Essential Digital Skills	8:00	12:00			20:00
Module 12: Entrepreneurship	3:00	4:00			7:00
Module 13: Customer Service	4:00	5:00			9:00
Module 14: Getting ready for apprenticeship & Jobs	3:00	5:00			8:00
<b>ASC/N8109– Design an Engine Management system NOS Version No. –1.0 NSQF Level – 5.5</b>	<b>60:00</b>	<b>60:00</b>	<b>60:00</b>		<b>180:00</b>
Module 15: Assess the Flex Fuel system requirements	05:00	10:00	05:00		20:00
Module 16: Design parts for fuel system on CAD software	20:00	20:00	20:00		60:00
Module 17: Develop Design Statement of Requirement (D-SOR) for the development of Engine-Fuel-Exhaust systems	15:00	15:00	15:00		45:00
Module 18: Integrate parts to sub-assemblies and validate the system level functionality and performance	20:00	15:00	20:00		55:00
<b>ASC/N8110 - Conduct Design of Experiments (DoE) methods to investigate the behavior on various blends of flex fuel NOS Version No. –1.0 NSQF Level – 5.5</b>	<b>45:00</b>	<b>55:00</b>	<b>50:00</b>		<b>150:00</b>
Module 19: Analyse conditions of operation of FFV & its systems	15:00	20:00	15:00		50:00
Module 20: Develop DoE and evaluate the FFV Engine Management	30:00	35:00	35:00		100:00
<b>ASC/N8111 – Perform calculation, design level simulation and test result analysis NOS Version No. –1.0 NSQF Level – 5.5</b>	<b>50:00</b>	<b>54:00</b>	<b>46:00</b>		<b>150:00</b>
Module 21: Identify testing requirement and the process	10:00	10:00	10:00		30:00
Module 22: Conduct CAE tests for assessing vehicle performance and durability	40:00	44:00	36:00		120:00
<b>Total Duration</b>	<b>216:00</b>	<b>258:00</b>	<b>156:00</b>		<b>630:00</b>

# Module Details

## Module 1: Introduction to the role of an Automotive Flex Fuel Engine Designer

### *Bridge module*

#### Terminal Outcomes:

- Discuss the role and responsibilities of an Automotive Flex Fuel Engine Designer.

Duration: <05:00>	Duration: <00:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>• List the role and responsibilities of an Automotive Flex Fuel Engine Designer.</li> <li>• Discuss the job opportunities for an Automotive Flex Fuel Engine Designer in the automobile industry.</li> <li>• Explain about Indian automobile manufacturing market.</li> <li>• List various automobile Original Equipment Manufacturers (OEMs) and different products/ models manufactured by them.</li> <li>• Discuss flex fuel design standards and procedures followed in the company.</li> </ul>	
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	

## Module 2: Manage work and resources according to safety and conservation standards

### Mapped to ASC/N9818, v1.0

#### Terminal Outcomes:

- Employ appropriate ways to maintain safe and secure working environment
- Apply material and energy conservation practices at the workplace.

Duration: <15:00>	Duration: <40:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>• Discuss organisational procedures for health, safety and security and individual role and responsibilities related to the same.</li> <li>• List the potential workplace related risks, threats and hazards, their causes and preventions.</li> <li>• List personal protective equipment like safety gloves, glasses, shoes and mask used at the workplace.</li> <li>• List various types of fire extinguisher.</li> <li>• Identify various safety boards/ signs placed on the shop floor.</li> <li>• Explain 5S standards, procedures and policies followed at workplace.</li> <li>• Discuss organisational procedures to deal with emergencies and accidents at the workplace and importance of following them.</li> <li>• State the importance of conducting safety drills or training sessions.</li> <li>• Explain the process of filling daily check sheet for reporting to the concerned authorities about improvements done and risks identified.</li> <li>• Discuss how and when to report about potential hazards identified in the workplace and limits of responsibility for dealing with them.</li> <li>• Outline the importance of keeping workplace, equipment, restrooms etc. clean and sanitised.</li> <li>• Explain the importance of following hygiene and sanitation regulations developed by organisation at the workplace.</li> <li>• Discuss the importance of maintaining the availability of running water, hand wash and alcohol-based sanitizers at the</li> </ul>	<ul style="list-style-type: none"> <li>• Apply appropriate ways to implement safety practices to ensure safety of people at the workplace.</li> <li>• Display the correct way of wearing and disposing PPE.</li> <li>• Demonstrate the use of fire extinguisher.</li> <li>• Demonstrate how to provide first aid procedure in case of emergencies.</li> <li>• Demonstrate how to evacuate the workplace in case of an emergency.</li> <li>• Employ various techniques for checking malfunctions in the machines with the support of maintenance team and as per Standard Operating Procedures (SOP).</li> <li>• Demonstrate to arrange tools/ equipment/ fasteners/ spare parts into proper trays, cabinets, lockers as mentioned in the 5S guidelines/work instructions.</li> <li>• Apply appropriate ways to organise safety drills or training sessions for others on the identified risks and safety practices.</li> <li>• Prepare a report about the health, safety and security breaches.</li> <li>• Apply appropriate ways to check that workplace, equipment, restrooms etc. are cleaned and sanitised.</li> <li>• Role play a situation to brief the team about the hygiene and sanitation regulations developed by organisation.</li> <li>• Demonstrate the correct way of washing hands using soap and water and alcohol-based hand rubs.</li> <li>• Apply appropriate methods to support the employees to cope with stress, anxiety etc.</li> <li>• Demonstrate proper waste collection and disposal mechanism depending upon types of waste.</li> </ul>



<p>workplace.</p> <ul style="list-style-type: none"> <li>• Discuss the significance of conforming to basic hygiene practices such as washing hands, using alcohol based hand sanitizers or soap.</li> <li>• Recall ways of reporting advanced hygiene and sanitation issues to the concerned authorities.</li> <li>• Elucidate various stress and anxiety management techniques.</li> <li>• Discuss the significance of greening.</li> <li>• Classify different categories of waste for the purpose of segregation.</li> <li>• Differentiate between recyclable and non-recyclable waste.</li> <li>• Discuss various methods of waste collection and disposal.</li> <li>• List the various materials used at the workplace.</li> <li>• Explain organisational recommended norms for storage of tools, equipment and material.</li> <li>• Discuss the importance of efficient utilisation of material and water.</li> <li>• Explain basics of electricity and prevalent energy efficient devices.</li> <li>• Explain the processes to optimize usage of material and energy/electricity.</li> <li>• Enlist common practices for conserving electricity at workplace.</li> </ul>	<ul style="list-style-type: none"> <li>• Perform the steps involved in storage of tools, equipment and material after completion of work.</li> <li>• Employ appropriate ways to resolve malfunctioning (fumes/ sparks/ emission/ vibration/ noise) and lapse in maintenance of equipment as per requirements.</li> <li>• Perform the steps to prepare a sample material and energy audit reports.</li> <li>• Employ practices for efficient utilization of material and energy/electricity.</li> </ul>
<p><b>Classroom Aids:</b></p>	
<p>Whiteboard, marker pen, projector</p>	
<p><b>Tools, Equipment and Other Requirements</b></p>	
<ul style="list-style-type: none"> <li>• Housekeeping material: Cleaning agents, cleaning cloth, waste container, dust pan and brush set, liquid soap, hand towel, fire extinguisher</li> <li>• Safety gears: Safety shoes, ear plug, goggles, gloves, helmet, first-aid kit</li> </ul>	



## Module 3: Introduction to Employability Skills

### Mapped to DGT/VSQ/N0103

#### Terminal Outcomes:

- Discuss about Employability Skills in meeting the job requirements

<b>Duration: &lt;1:00&gt;</b>	<b>Duration: &lt;2:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Outline the importance of Employability Skills for the current job market and future of work</li> </ul>	<ul style="list-style-type: none"> <li>• List different learning and employability related GOI and private portals and their usage</li> <li>• Research and prepare a note on different industries, trends, required skills and the available opportunities</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	

## Module 4: Constitutional values - Citizenship

### Mapped to DGT/VSQ/N0103

#### Terminal Outcomes:

- Discuss about constitutional values to be followed to become a responsible citizen

<b>Duration:</b> <0.5:00>	<b>Duration:</b> <1:00>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Explain constitutional values, civic rights, duties, citizenship, responsibility towards society etc. that are required to be followed to become a responsible citizen.</li> </ul>	<ul style="list-style-type: none"> <li>• Practice different environmentally sustainable practices</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	

## Module 5: Becoming a Professional in the 21st Century

### Mapped to DGT/VSQ/N0103

#### Terminal Outcomes:

- Demonstrate professional skills required in 21<sup>st</sup> century

<b>Duration: &lt;2:00&gt;</b>	<b>Duration: &lt;3:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Discuss 21st century skills required for employment</li> </ul>	<ul style="list-style-type: none"> <li>• Highlight the importance of practicing 21st century skills like Self-Awareness, Behavior Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn etc. in personal or professional life</li> <li>• Create a pathway for adopting a continuous learning mindset for personal and professional development</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	

## Module 6: Basic English Skills

### Mapped to DGT/VSQ/N0103

#### Terminal Outcomes:

- Practice basic English speaking.

<b>Duration: &lt;4:00&gt;</b>	<b>Duration: &lt;6:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Describe basic communication skills</li> <li>• Discuss ways to read and interpret text written in basic English</li> </ul>	<ul style="list-style-type: none"> <li>• Show how to use basic English sentences for everyday conversation in different contexts, in person and over the telephone</li> <li>• Read and understand text written in basic English</li> <li>• Write a short note/paragraph / letter/e - mail using correct basic English</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	

## Module 7: Career Development & Goal Setting

### Mapped to DGT/VSQ/N0103

#### Terminal Outcomes:

- Demonstrate Career Development & Goal Setting skills.

<b>Duration:</b> <1.5:00>	<b>Duration:</b> <2.5:00>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Identify well-defined short- and long-term goals</li> </ul>	<ul style="list-style-type: none"> <li>• Create a career development plan</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	

## Module 8: Communication Skills

### Mapped to DGT/VSQ/N0103

#### Terminal Outcomes:

- Practice basic communication skills.

<b>Duration:</b> <4:00>	<b>Duration:</b> <6:00>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Explain the importance of communication etiquette including active listening for effective communication</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate how to communicate effectively using verbal and nonverbal communication etiquette</li> <li>• Write a brief note/paragraph on a familiar topic</li> <li>• Role play a situation on how to work collaboratively with others in a team</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	

## Module 9: Diversity & Inclusion

### Mapped to DGT/VSQ/N0103

#### Terminal Outcomes:

- Describe PwD and gender sensitisation.

<b>Duration:</b> <1:00>	<b>Duration:</b> <1.5:00>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Discuss the significance of reporting sexual harassment issues in time</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate how to behave, communicate, and conduct oneself appropriately with all genders and PwD</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	



## Module 10: Financial and Legal Literacy

### Mapped to DGT/VSQ/N0103

#### Terminal Outcomes:

- Describe ways of managing expenses, income, and savings.

<b>Duration: &lt;4:00&gt;</b>	<b>Duration: &lt;6:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>Discuss various financial institutions, products, and services</li> <li>Explain the common components of salary such as Basic, PF, Allowances (HRA, TA, DA, etc.), tax deductions</li> <li>Discuss the legal rights, laws, and aids</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrate how to conduct offline and online financial transactions, safely and securely and check passbook/statement</li> <li>Calculate income and expenditure for budgeting</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	

## Module 11: Essential Digital Skills

### Mapped to DGT/VSQ/N0103

#### Terminal Outcomes:

- Demonstrate procedure of operating digital devices and associated applications safely.

<b>Duration: &lt;8:00&gt;</b>	<b>Duration: &lt;12:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Describe the role of digital technology in day-to-day life and the workplace</li> <li>• Discuss the significance of displaying responsible online behavior while using various social media platforms</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate how to operate digital devices and use the associated applications and features, safely and securely</li> <li>• Demonstrate how to connect devices securely to internet using different means</li> <li>• Follow the dos and don'ts of cyber security to protect against cyber crimes</li> <li>• Create an e-mail id and follow e- mail etiquette to exchange e -mails</li> <li>• Show how to create documents, spreadsheets and presentations using appropriate applications</li> <li>• Utilize virtual collaboration tools to work effectively</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	

## Module 12: Entrepreneurship

### Mapped to DGT/VSQ/N0103

#### Terminal Outcomes:

- Describe opportunities as an entrepreneur.

<b>Duration: &lt;3:00&gt;</b>	<b>Duration: &lt;4:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Explain the types of entrepreneurship and enterprises</li> <li>• Discuss how to identify opportunities for potential business, sources of funding and associated financial and legal risks with its mitigation plan</li> <li>• Describe the 4Ps of Marketing-Product, Price, Place and Promotion and apply them as per requirement</li> </ul>	<ul style="list-style-type: none"> <li>• Create a sample business plan, for the selected business opportunity</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	

## Module 13: Customer Service

### Mapped to DGT/VSQ/N0103

#### Terminal Outcomes:

- Describe ways of maintaining customer.

<b>Duration:</b> <4:00>	<b>Duration:</b> <5:00>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Classify different types of customers</li> <li>• Discuss various tools used to collect customer feedback</li> <li>• Discuss the significance of maintaining hygiene and dressing appropriately</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate how to identify customer needs and respond to them in a professional manner</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	

## Module 14: Getting ready for apprenticeship & Jobs

### Mapped to DGT/VSQ/N0103

#### Terminal Outcomes:

- Describe ways of preparing for apprenticeship & jobs appropriately.

<b>Duration: &lt;3:00&gt;</b>	<b>Duration: &lt;5:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>Discuss the significance of maintaining hygiene and dressing appropriately for an interview</li> <li>List the steps for searching and registering for apprenticeship opportunities</li> </ul>	<ul style="list-style-type: none"> <li>Draft a professional Curriculum Vitae (CV)</li> <li>Use various offline and online job search sources to find and apply for jobs</li> <li>Role play a mock interview</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	

## Module 15: Assess the Flex Fuel system requirements

### Mapped to ASC/N8109, v1.0

#### Terminal Outcomes:

- Perform steps to assess the Flex Fuel system requirements.

<b>Duration: &lt;05:00&gt;</b>	<b>Duration: &lt;10:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Describe technical functionalities of FFV and EMS parts &amp; sub-assemblies.</li> <li>• Describe processes involved in the development of FFV and its deployment in target markets.</li> <li>• Discuss market trends, consumer preferences, government / agency statutory norms, customer feedback.</li> <li>• Describe different types of Flex Fuel Vehicle (FFV) systems available in the market.</li> <li>• Describe Vehicle Development Plan (VDP).</li> <li>• List the parts and systems in the engine assembly, fuel &amp; exhaust systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Apply appropriate ways to analyse the effects of Flex Fuel blending ratios on the vehicle (per VDP) in the standpoint of EMS design modifications</li> <li>• Apply appropriate ways to estimate the engineering effort &amp; cost of design modifications</li> <li>• Show how to identify the risks involved in inappropriate usage of Flex Fuel blends</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	
PCs/Laptops, Internet with Wi-Fi (Min2 Mbps Dedicated) Engine assembly, fuel & exhaust systems, sample VDP	

## Module 16: Design parts for fuel system on CAD software

### Mapped to ASC/N8109, v1.0

#### Terminal Outcomes:

- Perform the steps to carry out 3D modelling of fuel system parts in CAD software.
- Perform the steps to prepare 2D drawing of fuel system parts in CAD software.

<b>Duration: &lt;20:00&gt;</b>	<b>Duration: &lt;20:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• List various designing software like CATIA, Auto-CAD, Unigraphics etc. required during the designing process.</li> <li>• List the design requirement in terms of material used for making the component, packaging and other requirements to decide the dimensions, measurements and tolerances of the aggregate/ component.</li> <li>• Elaborate draughting standards and techniques- e.g. ANSI series IS/ ISO.</li> <li>• List technical drawing practices as per the company standards.</li> <li>• Describe drawings and modelling techniques like 2D and 3D.</li> <li>• Elaborate different type of views generated in engineering drawings.</li> <li>• Describe limits, fits, GD&amp;T etc.</li> <li>• Describe CAD programming and drafting.</li> <li>• List the steps to be performed for creating 3D model of product in CAD software.</li> <li>• Describe various CAD techniques available in the CAD software and required or designing of product 3D model.</li> <li>• List the steps to be performed for testing the feasibility of product with the customer requirements by conducting simulation/ packaging study.</li> <li>• List the steps to be performed for creating 2D drawing of product in CAD software.</li> <li>• Describe Tolerance Analysis sheet and how to interpret it.</li> </ul>	<ul style="list-style-type: none"> <li>• Show how to select the designing software like CATIA, Auto-CAD, Unigraphics etc. for creating the designs and models.</li> <li>• Demonstrate the use of designing software.</li> <li>• Show how to prepare a rough sketch of product according to it.</li> <li>• Apply appropriate procedure of setting required units and dimension parameters in the CAD file.</li> <li>• Demonstrate how to insert sketches, scanned images, diagrams, signs or symbols etc. in a CAD file.</li> <li>• Prepare a sample 3D model of product by applying appropriate CAD techniques.</li> <li>• Demonstrate how to draw layouts and various views of drawing in CAD software as per the relationship between components and assemblies.</li> <li>• Apply appropriate way of filling colours symbols etc. to highlight areas in the drawing.</li> <li>• Perform steps to test the 3D model through simulation/ packaging study and check the feasibility of product with the customer requirements.</li> <li>• Prepare a sample 2D drawing of product in CAD software.</li> <li>• Apply appropriate ways for maintaining and taking backup of CAD files and records of related information by following organisational guidelines.</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	
<ul style="list-style-type: none"> <li>• Drafting tools, MS office, designing software like CATIA, Auto-CAD, Unigraphics</li> <li>• Handbook, job orders and Technical Reference Books.</li> </ul>	



## Module 17: Develop Design Statement of Requirement (D-SOR) for the development of Engine-Fuel-Exhaust systems

*Mapped to ASC/N8109, v1.0*

### Terminal Outcomes:

- Perform steps to develop Design Statement of Requirement (D-SOR) for the development of Engine-Fuel-Exhaust systems.

<b>Duration:</b> <15:00>	<b>Duration:</b> <15:00>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• List the parts and systems in the engine assembly, fuel &amp; exhaust systems.</li> <li>• Describe FMEA (Failure Modes &amp; Effects Analysis) of Flex Fuel blend proportions and misuse / abuse.</li> <li>• Describe the parts undergoing design modification such as Black-box, Gray-box, White-box.</li> <li>• Discuss supplier integration level and its impacts on the VDP imperatives – QCT (Quality-Cost-Time).</li> <li>• Describe supply chain of alternate fuels.</li> <li>• Discuss the impact of Flex Fuel blend ratios and Regulatory standards on environment &amp; Safety compliance norms.</li> <li>• Describe development cycle time (Design-Proto-DV/PV-PPAP).</li> <li>• Describe PPAP (Production Part Approval Process).</li> </ul>	<ul style="list-style-type: none"> <li>• Show how to identify the Tier-1 suppliers for the design development as per VDP stipulations</li> <li>• Show how to segregate the sub-assemblies (Engine-Fuel-Exhaust) and parts (Mechanical, Electronic) in the standpoint of development cycle time (Design-Proto-DV/PV-PPAP]</li> <li>• Show how to detail the design in the D-SOR released to vendors in the perspective of Cost-Quality-Time stipulated by the VDP</li> <li>• Apply appropriate ways to evaluate the quality of parts &amp; sub-assemblies sourced from vendors and their functional performance through PPAP (Production Part Approval Process)</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	
PCs/Laptops, Internet with Wi-Fi (Min2 Mbps Dedicated) Engine assembly, fuel & exhaust systems, sample VDP	

## Module 18: Integrate parts to sub-assemblies and validate the system level functionality and performance

*Mapped to ASC/N8109, v1.0*

### Terminal Outcomes:

- Perform steps to integrate parts to sub-assemblies and validate the system level functionality and performance.

<b>Duration: &lt;20:00&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>• Describe functioning of various parts of EMS i.e. Fuel injector, Fuel rail, Mass Air Flow (MAF) sensor, Manifold Absolute Pressure (MAP) sensor, O<sub>2</sub> sensor, Throttle Body Position sensor (TPS), Temperature sensor, etc.</li> <li>• List the steps to be performed for integration of parts &amp; sub-assemblies with the rest of the engine assembly and Intake-Exhaust-Fuel systems.</li> <li>• Describe DRBTR (Design Review Based on Test Results) for the parts &amp; sub-assemblies.</li> <li>• List key players in markets worldwide for fuels &amp; additives and Tier-1/2 suppliers</li> <li>• Describe serviceability aspects involved in FFV MRO (Maintenance-Repair-Overhaul) and Re-cycling.</li> </ul>	<ul style="list-style-type: none"> <li>• Apply appropriate ways to analyse the discrete performance of critical parts in the EMS.</li> <li>• Demonstrate procedure of integration of parts &amp; sub-assemblies with the rest of the engine assembly and Intake-Exhaust-Fuel systems.</li> <li>• Apply appropriate ways to monitor the tests of engine on dynamometer and vehicle under pre-defined conditions.</li> <li>• Apply appropriate ways to analyse the performance of each part for normal &amp; extraordinary operating conditions.</li> <li>• Apply appropriate ways to analyse the test results and report the output to the vendors and relevant person.</li> <li>• Show how to conduct DRBTR (Design Review Based on Test Results) for the parts &amp; sub-assemblies engineered for the FFV VDP.</li> <li>• Show how to modify D-SOR to effect the changes desired.</li> <li>• Apply appropriate ways to monitor design re-development and DV tests associated with each part.</li> <li>• Show how to conduct PPAP for each of the vendor developed parts / products</li> <li>• Demonstrate procedure of releasing the design of parts for other processes.</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	
PCs/Laptops, Internet with Wi-Fi (Min2 Mbps Dedicated) Engine assembly, fuel & exhaust systems, sample VDP	

## Module 19: Analyse conditions of operation of FFV & its systems

### Mapped to ASC/N8109, v1.0

#### Terminal Outcomes:

- Perform steps to analyse conditions of operation of FFV & its systems.

<b>Duration: &lt;15:00&gt;</b>	<b>Duration: &lt;20:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• List Hardware, Software, Load-cases, Competitor data, Benchmark values, Consumer-statistics for Simulations</li> <li>• Discuss Ethanol sourcing channels, Sustainability factors, Storage challenges, Blend ratios, Fuel properties, etc</li> <li>• Describe Emission regulations, Statutory compliance audits, Energy/Water/Carbon footprint, Penalties / Compensations, Insurance liabilities, Carbon credits, Warranty claims, Customer satisfaction indices, Emerging market trends and intangible benefits of alternate fuel usage.</li> <li>• Describe various measurement parameters i.e. Temperature, Pressure, Flow, Noise, RPM, BHP, Torque, SFC, Emissions (% , PPM), Vibration, Voltage, Current, Cycles (injection, ignition, valve-opening, scavenging), MAF, MAP, Throttle position, Timing, etc. and their impact.</li> <li>• Describe various running conditions i.e. full-throttle, cruising, accelerating, jerky, null-throttle, etc.</li> <li>• Describe various idling conditions i.e. corrosion, clogging, phase-change, etc.</li> <li>• List various critical parts i.e. ECU, Microprocessors, Sensors, Regulators, Injector, Fuel rail, Manifold, EGR system, FlexStart, Catalytic converter etc. and non-critical parts i.e. fuel line, exhaust pipe, engine parts, filters, tubes / pipes, valves / orifices, connectors / joineries of fuel system.</li> </ul>	<ul style="list-style-type: none"> <li>• Prepare list of all possible operating conditions and accidental / abusive situations of Flex Fuel blending.</li> <li>• Prepare list of all measurement parameters during running &amp; idling conditions</li> <li>• Apply appropriate ways to study all possible driving patterns, traffic conditions, fuel quality ranges, test stipulations, compliance standards, emerging trends, simulation options.</li> <li>• Apply appropriate ways to analyse possible design solutions for critical parts. and non-critical parts.</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	
PCs/Laptops, Internet with Wi-Fi (Min2 Mbps Dedicated) Engine assembly, fuel & exhaust systems, sample VDP	

## Module 20: Develop DoE and evaluate the FFV Engine Management

### Mapped to ASC/N8110, v1.0

#### Terminal Outcomes:

- Perform steps to develop DoE and evaluate the FFV Engine Management.

Duration: <30:00>	Duration: <35:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>• Describe DoE workflow i.e. Define – Design – Experiment – Optimise.</li> <li>• Describe Experiment set-up, Workbench, Test labs, Chassis dynos, Material test labs, Metrology labs, Quality inspection labs</li> <li>• Describe electro-mechanical functions, Structural designs, Bio-mimicking themes, Digital data processing, Re-cycling objectives and User/Consumer/Customer preferences, VPD techniques, VDP imperatives.</li> <li>• Describe vehicle performance criteria, Engine management factors.</li> <li>• List monitoring equipment, Test rigs, measuring devices, Index/Go-NoGo parameters.</li> <li>• Describe Hardware-in-Loop (HiL).</li> <li>• List various software i.e. CAE / Mathematic-modelling, AVL-Cruise, AVL-Boost, GT-Power, MATLAB-Simulink, Ansys, HyperStudy etc. required.</li> <li>• Discuss various drive cycles i.e. NEDC / New European Drive Cycle, CADC / Common Artemis Driving Cycle, WLTC / World harmonized Light-duty vehicle Test Cycle.</li> <li>• Discuss various design life conditions i.e. normal-life, extended-life, reusability / recyclability) and test/drive conditions i.e. correct/ normal, extreme/ unusual, abusive/accidental.</li> </ul>	<ul style="list-style-type: none"> <li>• Show how to develop Design of Experiments (DoE) workflow for fuel system.</li> <li>• Show how to define physical test sequence of parts on HiL bench.</li> <li>• Prepare Analysis (CAE / Mathematic-modelling) software (AVL-Cruise, AVL-Boost, GT-Power, MATLAB-Simulink, Ansys, HyperStudy) and Boundary conditions for simulation of operating &amp; impossible conditions</li> <li>• Apply appropriate ways to assess the effects of chosen combinations on Functioning, Performing, Enduring, Reconditioning.</li> <li>• Prepare a list of Flex Fuel combinations (Ratios, Octane number, Calorific value, etc.).</li> <li>• Show how to study the resulting performance of vehicle and quality of emissions as per variations in design variables and different service conditions.</li> <li>• Show how to conduct experiments to analyse all possible combinations (Fuel, Engine, Loading conditions) and to predict performance of the FFV.</li> <li>• Apply appropriate ways to analyse FFV performance under all Drive Cycles, design life conditions and test/drive conditions.</li> <li>• Show how to optimise systems accordingly.</li> <li>• Demonstrate procedure of finalising and releasing the design of parts as per user-trials, DV/ PV/ PPV-tests, Homologation/ QC-audits, Simulations.</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	
PCs/Laptops, Internet with Wi-Fi (Min2 Mbps Dedicated) Engine assembly, fuel & exhaust systems, sample VDP	

## Module 21: Identify testing requirement and the process

### Mapped to ASC/N8111, v1.0

#### Terminal Outcomes:

- Show how to identify testing requirement and the process.

<b>Duration: &lt;10:00&gt;</b>	<b>Duration: &lt;10:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Describe Actual Test Process (ATB)</li> <li>• Define principles of various loads (structural, fatigue, stress, thermal and dynamic)</li> <li>• Describe international and national test standards for performance, durability etc. for vehicles (representative) and major systems such as Engine, Transmission, Brakes, clutch, steering etc.</li> <li>• Describe the system of analysis, simulation and hypothesis involved.</li> </ul>	<ul style="list-style-type: none"> <li>• Create a test checklist provided by the cross functional team</li> <li>• Demonstrate various types of tests to be performed in the computer simulated environment</li> <li>• Show how to select the testing methodology, process and test parameters required</li> <li>• Show how to establish various data parameters for test results</li> <li>• Practice various load in CAE</li> <li>• Apply principles learnt for a case each in stress and thermal simulation</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	
Computer Workstation with Analysis Software like Pro Mechanics, Nast ran, Matlab, Simi link etc., Help manuals, Sample Design templates for practice	

## Module 22: Conduct CAE tests for assessing vehicle performance and durability

### Mapped to ASC/N8111, v1.0

#### Terminal Outcomes:

- Perform steps to conduct CAE tests for assessing vehicle performance and durability.

<b>Duration: &lt;40:00&gt;</b>	<b>Duration: &lt;44:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• List testing tool required for testing</li> <li>• Illustrate the operation of software and documentation systems</li> <li>• List steps for model creation, loading and analysis of case study models</li> <li>• List steps for modeling and simulation using a computer software</li> <li>• List steps for fatigue, stress, structural and thermal analysis for automotive structure by using a computer software</li> <li>• List steps for Noise, Vibration and Harshness (NVH) analysis for Engine/ Brakes as per design limitation through simulation</li> </ul>	<ul style="list-style-type: none"> <li>• Practice basic modules of software</li> <li>• Perform model creation, loading and analysis of case study models</li> <li>• Practice modeling and simulation using a computer software</li> <li>• Perform fatigue, stress, structural and thermal analysis for automotive structure by using a computer software</li> <li>• Perform Noise, Vibration and Harshness (NVH) analysis for Engine/ Brakes as per design limitation through simulation</li> <li>• Maintain database and documentation of software</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	
Computer Workstation with Analysis Software like Pro Mechanics, Nast ran, Matlab, Simi link etc., Help manuals, Sample Design templates for practice	

# 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/ Electrical/ Electronics	4	Mechanical/ Automobile/ Electronics/ Instrumentation	1	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
B.E/B.Tech	Mechanical/Automobile/ Electrical/ Electronics	5	Mechanical/ Automobile/ Electronics/ Instrumentation	0	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
Diploma	Mechanical/Automobile/ Electrical/ Electronics	3	Mechanical/ Automobile/ Electronics	1	Mechanical/ Automobile/ Electronics	NA
Diploma	Mechanical/Automobile/ Electrical/ Electronics	4	Mechanical/ Automobile/ Electronics	0	Mechanical/ Automobile/ Electronics	NA
M.E/M.Tech	Mechanical/Automobile/ Electrical/ Electronics	2	Mechanical/Automobile/ Electrical/ Electronics	1	Mechanical/Automobile/ Electrical/ Electronics	NA
M.E/M.Tech	Mechanical/Automobile/ Electrical/ Electronics	3	Mechanical/Automobile/ Electrical/ Electronics	0	Mechanical/Automobile/ Electrical/ Electronics	NA

Trainer Certification	
Domain Certification	Platform Certification
“Automotive Flex Fuel Engine Designer, ASC/Q8105, version 1.0”. Minimum accepted score is 80%.	Trainer is certified for the job role “Trainer” (VET and Skills); mapped to QP: “MEP/Q2601, V2.0” with minimum score of 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/ Electrical/ Electronics	5	Mechanical/ Automobile/ Electronics/ Instrumentation	1	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
B.E/B.Tech	Mechanical/Automobile/ Electrical/ Electronics	6	Mechanical/ Automobile/ Electronics/ Instrumentation	0	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
Diploma	Mechanical/Automobile/ Electrical/ Electronics	4	Mechanical/ Automobile/ Electronics	1	Mechanical/ Automobile/ Electronics	NA
Diploma	Mechanical/Automobile/ Electrical/ Electronics	5	Mechanical/ Automobile/ Electronics	0	Mechanical/ Automobile/ Electronics	NA
M.E/M.Tech	Mechanical/Automobile/ Electrical/ Electronics	3	Mechanical/Automobile/ Electrical/ Electronics	1	Mechanical/Automobile/ Electrical/ Electronics	NA
M.E/M.Tech	Mechanical/Automobile/ Electrical/ Electronics	4	Mechanical/Automobile/ Electrical/ Electronics	0	Mechanical/Automobile/ Electrical/ Electronics	NA

Assessor Certification	
Domain Certification	Platform Certification
“Automotive Flex Fuel Engine Designer, ASC/Q8105, version 1.0”. Minimum accepted score is 80%.	Assessor is certified for the job role “Assessor” (VET and Skills); mapped to QP: “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

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

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