APPRENTICESHIP CURRICULUM (OPTIONAL TRADE)

Hydrocarbon Sector Skill Council

Green Hydrogen Plant Operator

Course Code: CO022400030

☒**NAPS** ☐**Non-NAPS**

NSQF Level: 4.5

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Course Details

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<tr><td>2.</td><td>Course Code</td><td>CO022400030</td></tr>
<tr><td>3.</td><td>Apprenticeship Training Duration:
(2 to 4 weeks of BT is embedded in this duration as per the requirement of the establishment)</td><td>Months: 12 months</td></tr>
<tr><td></td><td>Remarks</td><td></td></tr>
<tr><td>4.</td><td>Credit</td><td>40</td></tr>
<tr><td>5.</td><td>NSQF Level (Mandatory for NAPS)</td><td>4.5 NSQC Approval Date: 31-08-2023</td></tr>
<tr><td>6.</td><td>Related NSQF aligned qualification details</td><td>
<table>
<tr><th>S. No.</th><th>QP/ Qualification/ NOS Name (As applicable)</th><th>QP/ NOS Code & Version</th><th>NQR Code</th></tr>
<tr><td>1</td><td>Green Hydrogen Plant Operator</td><td>HYC/Q4001 & Version 1.0</td><td>QG-4.5-ES-00768-2023-V1-HSSCI</td></tr>
</table>
</td></tr>
<tr><td>7.</td><td>Brief Job Role Description</td><td>A Green Hydrogen Plant Operator is responsible for efficiently operating and maintaining a green hydrogen production facility. The person at this job oversees the operation of equipment like electrolysers, dryers, deoxy reactor, electrical heater, pump, compressors, and storage systems, ensuring smooth production processes. The person will monitor water purification process, Hydrogen, production rates, energy consumption, and system efficiencies, and make necessary adjustments to optimize output and minimize waste prioritizing the Safety and compliance. They collaborate with team members, maintain operational records, and contribute to process improvement initiatives.</td></tr>
<tr><td>8.</td><td>NCO-2015 Code & Occupation (Access the NCO 2015 volumes from:</td><td>NCO 2015/3134.0200, ISCO-08/3134</td></tr>
<tr><td>9.</td><td>Minimum Eligibility Criteria
(Educational and/ or Technical Qualification)</td><td>Completed 3-year Diploma after 10th
OR
Pursuing 3rd year of 3-year Diploma after 10th and continuing education
Or
12th grade pass with 1-year NTC/NAC</td></tr>
</table>

		Or 10th Grade pass with 2-year of NTC and 1-year of NAC OR 12th Grade pass with 1-year of relevant experience Or 10th Grade pass with 2-year of NTC and 1-year of relevant experience Or Previous relevant qualification of NSQF level 4 with 1.5 year of relevant experience
10.	**Entry Age for Apprenticeship**	18 Years
11.	**Any Licensing Requirements** (*wherever applicable*)	NA
12.	**Is the Job Role amenable to Persons with Disability**	**☐ Yes ☒ No** **If yes, check the applicable type of Disability** **☐ Locomotor Disability** **☐ Leprosy Cured Person** **☐ Cerebral Palsy** **☐ Dwarfism** **☐ Muscular Dystrophy** **☐ Acid Attack Victims** **☐ Blindness** **☐ Low Vision** **☐ Deaf** **☐ Hard of Hearing** **☐ Speech and Language Disability** **☐ Intellectual Disability** **☐ Specific Learning Disabilities** **☐ Autism Spectrum Disorder** **☐ Mental Illness** **☐ Multiple Sclerosis** **☐ Parkinson's Disease** **☐ Haemophilia** **☐ Thalassemia** **☐ Sickle Cell Disease** **☐ Multiple Disabilities**
13.	**Submitting Body Details**	**Name: Hydrocarbon Sector Skill Council**

		E-mail ID: ceo@hsscindia.in **Contact Number: 9872176558**
14.	**Certifying Body**	Hydrocarbon Sector Skills Council
15.	**Employment Avenues/Opportunities**	Oil & Gas sector
16.	**Career Progression**	Green Hydrogen Plant Supervisor
17.	**Trainer's Qualification & Experience:**	Completed 3 years of Diploma in engineering trade after 10th with 2 years of experience in relevant field and 1 year of training experience in relevant field. Or CITS Certified Trainers for relevant CITS course with 2 years of industry experience
18.	**Curriculum Creation Date**	21/02/2024
19.	**Curriculum Valid up to Date**	20/02/2027

Module Details

S. No	Module/NOS Name, Code, Version	Outcomes	Assessment Marks		Passing Percentage	
			Th.	Pr.	Th.	Pr.
1.	**NOS Name –** Hydrogen Safety, Security, and Health Management Procedures **NOS Code -** HYC/N4001 **Version –** 1.0	**Bridge Module -** Introduction to the Hydrocarbon Sector • Describe the oil and natural gas sector and its subsectors. • Explain the importance of Energy Transition in Oil & Gas Sector • Explain the importance of a green hydrogen in Energy Transition. • Explain the roles and responsibilities of green hydrogen plant operator. • Explain general discipline in the classroom (Do's & Don'ts) **Understanding Properties of Hydrogen from safety point of view & Safe handling of Hydrogen** • Describe the use protective clothing/equipment for specific tasks and work conditions • Explain the identify documents, location and people responsible for health and safety in the workplace • Demonstrate how to identify possible causes of risk or accident in the workplace due to hydrogen leak/fire • Describe the capability to accurately read and interpret data from sensing equipment used in hydrogen production processes • Explain the apply key safety parameters for handling hydrogen & oxygen	**35**	**60**	70	70

S. No	Module/NOS Name, Code, Version	Outcomes	Assessment Marks		Passing Percentage	
			Th.	Pr.	Th.	Pr.
		• Describe the assess hydrogen release pressure, hydrogen flame detection methods (h2 flame is colour less) • Demonstrate how to apply key safety requirements for electrical equipment's in green hydrogen • Explain the work as per functioning of hydrogen exhaust system • Describe the Inertization of system with nitrogen • Explain the identify hydrogen process hazard and assess risk • Explain the identify common safety signs, displayed in various areas • Describe the safe handling of lye solution (koh solution) • Describe the carry out safe working practices while dealing with hazards to ensure the safety of self and others • Explain the handle hydrogen ignition source management • Explain the standard practice for safe venting of hydrogen & oxygen, reference cga 5.5 & nfpa 2.0 for h2 venting and aiga021-19 for o2 vent • Describe the familiarization with Hydrogen Leak and flame detection system, Identification of Hydrogen Fire; use the various appropriate fire extinguishers on different types of fires correctly • Describe the measures to mitigate hydrogen fire, isolation of Hydrogen supply line and follow rescue techniques applied during fire hazard				

S. No	Module/NOS Name, Code, Version	Outcomes	Assessment Marks		Passing Percentage	
			Th.	Pr.	Th.	Pr.
		• Explain the follow good housekeeping practice in order to prevent fire hazards • Explain the list issues concerning the hydrogen safety in work place • Explain the have good understanding to maintain work areas and escape routes free from any hindrance • Describe the inform fire safety department about any near-miss incidents in the work place • Explain the follow the applicable laws, regulations and codes as per safety standard • Demonstrate how to prepare written accident/incident report and share with the concerned officer/department • Describe the provide appropriate first aid to victims in emergency situation • Explain the basic techniques of bandaging • Describe the respond promptly and appropriately to an accident • Describe the rescue activity during an accident in real or simulated environments • Explain the follow correct escape route during an emergency • Describe the correct method to rescue injured people and others during an emergency • Explain the familiarize with emergency protocols, including evacuation and shutdown procedures				

S. No	Module/NOS Name, Code, Version	Outcomes	Assessment Marks		Passing Percentage	
			Th.	Pr.	Th.	Pr.
2.	**NOS Name-** Operate and maintain hydrogen production equipment **NOS Code** - HYC/N4002 **Version -** 1.0	• Describe the identify different types of hydrogen production equipment • Explain the determine types of electrolyzes, its function and operating principles • Describe the determine types of compressors and its function and operating principles • Describe the determine types of purification systems and its respective functions and operating procedures • Describe the determine the functioning of water purification process • Explain the determine user interfaces, and instrumentation of each equipment. • Demonstrate using the safety protocols to be followed while operating the equipment • Describe the assist during routine inspections and checks of equipment, ensuring they are in good working condition • Explain the conduct routine maintenance tasks required for each equipment type, such as cleaning, lubrication • Demonstrate how to handle the component replacement of any equipment if needed • Explain the handle common issues and troubleshooting techniques specific to hydrogen production equipment, if needed • Describe the report malfunctioning of equipment to supervisor/manager	**25**	**40**		

S. No	Module/NOS Name, Code, Version	Outcomes	Assessment Marks		Passing Percentage	
			Th.	Pr.	Th.	Pr.
		• Explain the coordinate with Green Hydrogen production technician for repair of faulty equipment • Explain the troubleshooting & safe Hand over for maintenance of all equipment				
3.	**NOS Name-** Perform activities related to Green Hydrogen production process **NOS Code** - HYC/N4003 **Version -** 1.0	• Describe the determine the start, stop, adjust parameters, and monitor equipment performance to achieve optimal electrolysis • Explain the start and monitor the power supply system, which include renewable energy sources • Demonstrate monitoring and regulating the water supply to the electrolyser • Describe the control and monitor the water purification system, which involve filters, deionization units, or reverse osmosis systems, to maintain the required water quality • Explain the operate gas purification systems to remove impurities from the hydrogen gas • Describe the determine gas separation processes, such as pressure swing adsorption (psa) or membrane separation, used to obtain pure hydrogen gas • Explain the monitor storage tanks or cylinders to ensure proper storage conditions for the produced hydrogen gas. • Explain the report logs, finding and fault to the supervisor/manager • Describe the ensuring compliance with safety and quality standards during production of green hydrogen • Explain the report logs daily, report near miss, incidents, findings to the supervisor/manager.	**30**	**40**		

S. No	Module/NOS Name, Code, Version	Outcomes	Assessment Marks		Passing Percentage	
			Th.	Pr.	Th.	Pr.
		• Explain the ensuring compliance with safety and quality standards during production of green hydrogen • Describe the maintain & record of important parameters of electrolyser like electrolyte flow, temp, current, h2 flow rate, pressure parameters. • Describe the monitor proper periodic cip record also need to maintain & proper maintenance the rejected water from ro either through zero liquid discharge scheme. • Explain the apply generic standard operating procedures • Explain the apply basic knowledge of msds used for koh, h2, o2 • Describe the handle safe collection of laboratory samples • Describe the handle emergency actions, troubleshooting				
4.	**NOS Name**-Working effectively in a team **NOS Code** - HYC/N9301 **Version -** 6.0	**Effective team work** • Describe methods to communicate clearly with the colleagues, supervisor and reporting authorities • Explain how to share information in line with organizational requirements • Explain the importance of supporting and respecting colleagues and other members of the organization without any bias based on gender, culture, disability etc. • Demonstrate ways to handle interpersonal conflict at the workplace • Explain how to inform team members timely, if timelines can't be met	**20**	**30**		

S. No	Module/NOS Name, Code, Version	Outcomes	Assessment Marks		Passing Percentage	
			Th.	Pr.	Th.	Pr.
		• Describe ways/methods to resolve interpersonal conflict • Explain the importance of gender-neutral behavior while interacting with others				
3	**NOS Name-** Employability Skills **NOS Code** - D*GT/VSQ/N0102* **Version -** 1.0	• Introduction to Employability Skills • Constitutional Values – Citizenship • Becoming a Professional in the 21st Century • Basic English Skills • Communication Skills • Financial and Legal Literacy • Essential Digital Skills • Diversity & Inclusion • Career Development & Goal Setting • Customer Service • Getting Ready for Apprenticeship & Jobs	**20**	**30**		
	Total Marks		**130**	**200**	**70**	**70**

Glossary

Term	Description
Sector	Sector is a conglomeration of different business operations having similar business and interests. It may also be defined as a distinct subset of the economy whose components share similar characteristics andinterests.
Sub-sector	Sub-sector is derived from a further breakdown based on the characteristics and interests of its components.
Occupation	Occupation is a set of job roles, which perform similar/ related set of functions in an industry.
Job role	Job role defines a unique set of functions that together form a unique employment opportunity in an organization.
Occupational Standards (OS)	OS specify the standards of performance an individual must achieve when carrying out a function in theworkplace, together with the Knowledge and Understanding (KU) they need to meet that standard consistently. Occupational Standards are applicable both in the Indian and global contexts.
Performance Criteria (PC)	Performance Criteria (PC) are statements that together specify the standard of performance required when carrying out a task.
National Occupational Standards (NOS)	NOS are occupational standards which apply uniquely in the Indian context.
Qualifications Pack (QP)	QP comprises the set of OS, together with the educational, training and other criteria required toperform a job role. A QP is assigned a unique qualifications pack code.
Unit Code	Unit code is a unique identifier for an Occupational Standard, which is denoted by an 'N'
Unit Title	Unit title gives a clear overall statement about what the incumbent should be able to do.
Description	Description gives a short summary of the unit content. This would be helpful to anyone searching on adatabase to verify that this is the appropriate OS they are looking for.
Scope	Scope is a set of statements specifying the range of variables that an individual may have to deal with in carrying out the function which have a critical impact on quality of performance required.
Knowledge and Understanding (KU)	Knowledge and Understanding (KU) are statements that together specify the technical, generic, professional and organizational specific knowledge that an individual need in order to perform to the required standard.
Organizational Context	Organizational context includes the way the organization is structured and how it operates, including the extent of operative knowledge managers have of their relevant areas of responsibility.

Technical Knowledge	Technical knowledge is the specific knowledge needed to accomplish specific designated responsibilities.
Core Skills/Generic Skills (GS)	Core skills or Generic Skills (GS) are a group of skills that are the key to learning and working in today'sworld. These skills are typically needed in any work environment in today's world. These skills are typically needed in any work environment. In the context of the OS, these include communication-related skills that are applicable to most job roles.
Electives	Electives are NOS/set of NOS that are identified by the sector as contributive to specialization in a job role. There may be multiple electives within a QP for each specialized job role. Trainees must select atleast one elective for the successful completion of a QP with Electives.
Options	Options are NOS/set of NOS that are identified by the sector as additional skills. There may be multiple options within a QP. It is not mandatory to select any of the options to complete a QP with Options.

Acronyms

Acronym	Description
NOS	National Occupational Standard(s)
NSQF	National Skills Qualifications Framework
QP	Qualifications Pack
TVET	Technical and Vocational Education and Training
OS	Occupational Standard(s)
QP	Qualifications Pack
KU	Knowledge and understanding
GS	Generic Skills
DMA	Direct Marketing Agent
PNG	Piped Natural Gas
FAQ	Frequently Asked Questions
BP	Business Partner
KYC	Know Your Consumer
FAB	Feature Advantage Benefit

Annexure 1: Tools and Equipment

List of Tools and Equipment

The tools and equipment required are:

S. No.	Tool / Equipment Name	Specification
1	PPE	NA
2	Small size/demonstration units of transformer	NA
3	Rectifier	NA
4	Electrolyzer (Industry planted)	NA
5	solar power plant/Hydro Power Plant	NA
6	Multimeter	NA
7	Clampmeter	NA
8	Phase sequence meter	NA
9	Earth tester	NA
10	Frequency meter	NA
11	Pressure meter,"Hand driven Megger	NA
12	electronic pressure gauge	NA
13	IR Thermometer	NA
14	Barometer	NA
15	Mechanical Instruments (Double ended flat spanner, Double ended ring spanner, Wrenches, Combination pliers, Side cutting pliers, Nose pliers, Screw driver, Vanier calliper, hammer, Cutters, Tweezers, Stripping & Crimping Tools	NA
16	KOH concentration measuring tools	NA
17	gas	NA

Classroom Aids

The aids required to conduct sessions in the classroom are:

1	Projector
2	Computer/laptops
3	Internet connectivity
4	Whiteboard

Annexure 2: Assessment Strategy

This section includes the processes involved in identifying, gathering, and interpreting information to evaluate the apprentice on the requiredcompetencies of the program.

The overall assessment strategy and specific arrangements, which have put in place to ensure that assessment is always valid, reliable and fair and show that these are in line with the requirements of the NSQF.

The assessment of candidates/trainees will be on the basis on assessment outcome/assessment criteria of the Qualification. In the assessment criteria for each NOS marks have been defined for theoretical and practical skills, on which the candidate will be assessed. The emphasis is on 'learning-by-doing' and performance criteria is based on the practical demonstration of skills and knowledge.

Theory/Knowledge test – This section will test the trainee on his/her knowledge on the subject/trade. The test will be carried out online/offline with a set of random Question paper that include multiple choice questions in multilingual, True/False Statement, audio-video question etc. The Question Bank will be developed by Subject Matter Experts (SME) of the hydrocarbon sector and these questions again be vetted by the Industry Experts, each performance criteria have its marks for theory based on the level of question i.e. easy, medium and difficult.

Practical/Demonstration Test – This stage involves the face-to-face interaction between Assessor and each trainee. The practical knowledge will be tested through trade test which demonstrates the skill required for the job, by which assessor would be able to evaluate the trainee for his/her practical knowledge on respective Qualification.

To ensure the maximum possible consistency in the assessment by different assessors at different locations, orientation of the assessors is also required about the stages involved in the assessment and the assessor role in the assessment process. The assessor must have knowledge of the following concepts before assessment:

- Qualification Pack Structure
- Guidance for the assessor to conduct theory and practical assessments
- Guidance for trainees to be given by assessor before the start of the assessments.
- Guidance on assessments process, practical brief with steps of operations practical observation checklist

- Practical/Demonstration Test guidance for uniformity and consistency.
- Guidance on assessment evidence collection (signed attendance copy, verification of the authenticity of the candidate by checking the photo IDcard, Photographs-while assessment undergoing etc.)

The empaneled assessment agencies will be instructed to hire assessors with integrity, reliability and fairness. Each assessor shall sign a document withits assessment agency by which they commit themselves to comply with the rules of confidentiality and conflict of interest, independence from commercial and other interests that would compromise impartiality of the assessments. The assessment agencies are instructed to ideally have assessor with sufficient amount of relevant industry experience related to Qualification. The assessors will also have scrutinized and have to undergo orientation of assessment framework, competency-based assessments etc.

Annexure 3: Mode of Training

The following Modules/NOS may also be delivered online for which the resources are provided in the given table.

S. No.	Module Name/NOS Name (As Per Curriculum)	Name of Mapped Online Component	URL of Mapped Online Component
	NA	NA	NA

Infra requirement:

- **NA**