

QUALIFICATION FILE– Micro Credential

R&D aspects of Green Hydrogen Fuel applications

☒ Public ☐ Private

☒ Upskilling ☐ Dual/Flexi Qualification ☐ For ToT ☐ For ToA

☐ General ☐ Multi-skill (MS) ☐ Cross Sectoral (CS) ☒ Future Skills ☐ OEM

NCrF/NSQF Level: 6

Submitted By:

Hydrocarbon Sector Skill Council

Chief Executive Officer

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Table of Contents

Section 1: Basic Details..... 3

Section 2: Training Related..... 5

Section 3: Assessment Related 5

Section 4: Evidence of the need for the Qualification 5

Section 5: Annexure & Supporting Documents Check List 6

Annexure: Evidence of Level 6

Annexure: Tools and Equipment (Lab Set-Up) 8

Annexure: Industry Validations Summary* 9

Annexure: Training & Employment Details 10

Annexure: Detailed Assessment Criteria 11

Annexure: Assessment Strategy..... 15

Annexure: Acronym and Glossary 16

Section 1: Basic Details

1.	Micro Credential-Qualification Name	R&D aspects of Green Hydrogen Fuel applications																
2.	Sector/s	Hydrocarbon																
3.	National Qualification Register (NQR) Code & Version (Will be issued after NSQC approval)	NM-06-HY-03839-2025-V1-HSSC & V-1.0	4. NCrF/NSQF Level: 6															
5.	Brief Description of the Qualification	Individual at this micro-credential Course in Hydrogen Fuel (Research & Development) aims to impart sufficient knowledge to a candidate interested to pursue a career in green hydrogen research laboratory. The course will help you gain insight and awareness into the green hydrogen industry, value chain, various technologies associated with production, purification, storage, transportation & application of green hydrogen, and the associated research challenges and opportunities.																
6.	Eligibility Criteria for Entry for Student/Trainee/Learner/Employee	a. Entry Qualification & Relevant Experience: <table><tr><th>S. No.</th><th>Academic/Skill Qualification (with Specialization - if applicable)</th><th>Required Experience (with Specialization - if applicable)</th></tr><tr><td>1</td><td>Completed 4th year BE/B tech Engineering in Chemical/Industrial/ Petrochemical / Electrical Mechanical branch</td><td>1.5 years of relevant experience</td></tr><tr><td>2</td><td>Completed 3-Year UG Degree in Science (Mechanical/Chemistry/Physics)</td><td>3 years of relevant experience</td></tr><tr><td>3</td><td>Previous relevant Qualification of NSQF level 5.5</td><td>1.5 years of relevant experience</td></tr><tr><td>4</td><td>Previous relevant Qualification of NSQF level 5</td><td>3 years of relevant experience</td></tr></table> b. Age: 22		S. No.	Academic/Skill Qualification (with Specialization - if applicable)	Required Experience (with Specialization - if applicable)	1	Completed 4th year BE/B tech Engineering in Chemical/Industrial/ Petrochemical / Electrical Mechanical branch	1.5 years of relevant experience	2	Completed 3-Year UG Degree in Science (Mechanical/Chemistry/Physics)	3 years of relevant experience	3	Previous relevant Qualification of NSQF level 5.5	1.5 years of relevant experience	4	Previous relevant Qualification of NSQF level 5	3 years of relevant experience
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4	Previous relevant Qualification of NSQF level 5	3 years of relevant experience																
7.	Credits Assigned to this Qualification, Subject to Assessment (as per National Credit Framework (NCrF))	1	8. Common Cost Norm Category – Category (I)															
9.	Any Licensing requirements for Undertaking Training on This Qualification (wherever applicable)	NA																
10.	Expected Outcomes of the Micro Credential	Terminal learning outcomes are: • Introduction to the Hydrogen Technologies • Hydrogen Production Methods • Hydrogen Storage and Transportation • Hydrogen utilization technologies & Hydrogen Derivatives • Environmental benefits and challenges of hydrogen use • Economic Aspects and Market Trends																

		• Policies and Incentives Promoting Green Hydrogen • Technical and economic challenges in Green Hydrogen value chain (Production, Storage, Transportation and applications) • Possible R&D projects in green hydrogen and their significance • Visit to a green hydrogen R&D facility • Visit to various allied labs in the R&D facility linked to green hydrogen projects • Onsite training/short project in a green hydrogen R&D facility																		
11.	Training Duration by Modes of Training Delivery (<i>Specify Total Duration as per selected training delivery modes and as per requirement of the qualification</i>)	☒ Offline ☐ Online ☐ Blended <table border="1"> <thead> <tr> <th>Training Delivery Modes</th><th>Theory (Hours)</th><th>Practical (Hours)</th><th>OJT Mandatory (Hours)</th><th>OJT Recommended (Hours)</th><th>Total (Hours)</th></tr> </thead> <tbody> <tr> <td>Classroom (offline)</td><td>20</td><td>10</td><td></td><td>-</td><td>30</td></tr> <tr> <td>Online</td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table> <i>(Refer Blended Learning Annexure for details)</i>	Training Delivery Modes	Theory (Hours)	Practical (Hours)	OJT Mandatory (Hours)	OJT Recommended (Hours)	Total (Hours)	Classroom (offline)	20	10		-	30	Online					
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12.	Assessment Criteria	<table border="1"> <thead> <tr> <th>Theory (Marks)</th><th>Practical (Marks)</th><th>Project (Marks)</th><th>Viva (Marks)</th><th>Total (Marks)</th><th>Passing %age</th></tr> </thead> <tbody> <tr> <td>175</td><td>85</td><td></td><td>75</td><td>335</td><td>70</td></tr> </tbody> </table>	Theory (Marks)	Practical (Marks)	Project (Marks)	Viva (Marks)	Total (Marks)	Passing %age	175	85		75	335	70						
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175	85		75	335	70															
13.	Other Indian languages in which the Micro Credential will be implemented	Hindi																		
14.	Is similar Micro Credentials Qualification(s) available on NQR-if yes, justification for this qualification	☐ Yes ☒ No																		
15.	Is the Job Role Amenable to Persons with Disability	☐ Yes ☒ No If "Yes", specify applicable type of Disability:																		
16.	How Participation of Women will be Encouraged	This job is gender neutral and focus during training should be on enrolment of women in each batch. SSC will encourage the TP and other training bodies to enrol women candidates.																		
17.	Name and Contact Details of Submitting / Awarding Body SPOC <i>(In case of CS or MS, provide details of both Lead AB & Supporting ABs)</i>	Name: Mr. SK Bose Email: ceo@hsscindia.in Contact No.: +91 9871115360 Website: www.hsscindia.in																		
18.	Final Approval Date by NSQC: 18-02-2025	19. Validity Duration: Three Years from the date of Approval 20. Next Review Date: 17-02-2028																		

Section 2: Training Related

1.	Trainer's Qualification and experience in the relevant sector (in years) (as per NCVET guidelines)	Post Graduate Chemistry with 6 years relevant industry experience & 4 years training experience in relevant field
2.	Master Trainer's Qualification and experience in the relevant sector (in years) (as per NCVET guidelines)	Post Graduate Chemistry with 6 years relevant industry experience & 5 years training experience in relevant field
3.	Tools and Equipment Required for Training	☒ Yes ☐ No (If "Yes", details to be provided in Annexure)
4.	In Case of Revised Qualification, Details of Any Upskilling Required for Trainer	NA

Section 3: Assessment Related

	Assessor's Qualification and experience in relevant sector (in years) (as per NCVET guidelines)	Post Graduate Chemistry with 6 years relevant industry experience & 4 years training experience in relevant field
	Proctor's Qualification and experience in relevant sector (in years) (as per NCVET guidelines)	Post Graduate Chemistry with 6 years relevant industry experience & 4 years training experience in relevant field
	Lead Assessor's/Proctor's Qualification and experience in relevant sector (in years) (as per NCVET guidelines)	Post Graduate Chemistry with 6 years relevant industry experience & 5 years training experience in relevant field
	Assessment Mode (Specify the assessment mode)	Both – Online and Offline
	Tools and Equipment Required for Assessment	☒ Same as for training ☒ Yes ☐ No (details to be provided in Annexure-if it is different for Assessment)

Section 4: Evidence of the need for the Qualification

Provide Annexure/Supporting documents name.

1.	Latest Skill Gap Study (not older than 2 years) (Yes/No): Yes
2.	Latest Market Research Reports or any other source (not older than 2 years) (Yes/No): Yes
3.	Government /Industry initiatives/ requirement (Yes/No): Yes
4.	Number of Industry validation provided: 10 (Due to limited number of Industries available in Oil & Gas Sector; endorsed by MoPNG through Letter)
5.	Estimated nos. of persons to be trained and employed: R&D aspects of Green Hydrogen Fuel applications acquire in-depth knowledge and skills in this cutting-edge field. The curriculum covers the fundamentals of hydrogen production, storage, and utilization, along with the latest advancements in hydrogen fuel cell technology. Gain hands-on experience through laboratory work and collaborative projects, emphasizing practical applications in renewable energy and transportation. Explore the economic, environmental, and technical aspects of hydrogen as an alternative energy source. Upon completion, leverage this expertise to secure employment in research institutions, energy companies, or government agencies actively engaged in hydrogen-related projects. As a trained professional, contribute to the ongoing development of sustainable energy solutions, addressing global challenges and promoting a cleaner and more efficient energy landscape.

6.	Evidence of Concurrence/Consultation with Line Ministry/State Departments: <i>The Ministry of Petroleum & Natural Gas (MoPNG) which is the Line Ministry for Hydrocarbon Sector has been requested to accord the concurrence</i> If “No”, why:
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Section 5: Annexure & Supporting Documents Check List

Specify Annexure Name / Supporting document file name

1.	Annexure: NCrf/NSQF level justification based on NCrf level/NSQF descriptors (<i>Mandatory</i>)	Annexure: NCrf/NSQF level justification based on NCrf level/NSQF descriptors
2.	Annexure: List of tools and equipment relevant for qualification (<i>Mandatory, except in case of online course</i>)	Annexure: List of tools and equipment relevant for qualification
3.	Annexure: Detailed Assessment Criteria (<i>Mandatory</i>)	Annexure: Detailed Assessment Criteria
4.	Annexure: Assessment Strategy (<i>Mandatory</i>)	Annexure: Assessment Strategy
5.	Annexure: Blended Learning (<i>Mandatory, in case selected Mode of delivery is “Blended Learning”</i>)	Annexure: Offline Learning Mode
6.	Annexure: Multiple Entry-Exit Details (<i>Mandatory, in case qualification has multiple Entry-Exit</i>)	Annexure: NA
7.	Annexure: Acronym and Glossary (<i>Optional</i>)	Annexure: Acronym and Glossary
8.	Supporting Document: Model Curriculum (<i>Mandatory – Public view</i>)	Supporting Document: Model Curriculum
9.	Supporting Document: Career Progression (<i>Mandatory - Public view</i>)	Supporting Document: Career Progression – Occupational Map
10.	Supporting Document: Occupational Map (<i>Mandatory</i>)	Supporting Document: Occupational Map
11.	Supporting Document: Assessment SOP (<i>Mandatory</i>)	Supporting Document: Assessment SOP
12.	Any other document you wish to submit:	Any other document you wish to submit: NA

Annexure: Evidence of Level

NCrf/NSQF Level Descriptors	Key requirements of the job role/ outcome of the qualification	How the job role/ outcomes relate to the NCrf/NSQF level descriptor	NCrf/ NSQF Level
Professional Theoretical Knowledge/Process	Individual in the Advance Course in Hydrogen Fuel requires a deep understanding of electrochemistry, material science, and thermodynamics to develop efficient and sustainable hydrogen production and storage methods. Proficiency in theoretical concepts such as electrolysis, catalysts, and fuel cell technology are essential. The ability to apply this knowledge to innovate and optimize hydrogen-related processes is crucial for advancing clean energy solutions. Researchers must stay abreast of the latest theoretical developments to	• Possesses specialized knowledge of procedures employed in both routine and non-routine contexts. • Possesses specialized operational knowledge and understanding of the work • Has knowledge of collecting and interpreting the available information, drawing conclusions & communicating the same.	6

	contribute meaningfully to the field and address challenges in the utilization of hydrogen as a clean and renewable energy source.		
Professional and Technical Skills/ Expertise/ Professional Knowledge	Individual in the Advance Course in Hydrogen Fuel needs strong technical skills in areas such as electrochemistry, materials science, and thermodynamics to conduct in-depth analyses of hydrogen production and storage methods. Proficiency in using specialized equipment for experimentation and data analysis is essential. Programming skills for modeling and simulation, along with expertise in catalyst development and fuel cell technology, are crucial. Additionally, effective communication skills are required to disseminate research findings and collaborate with interdisciplinary teams. The ability to stay updated on emerging technologies and advancements in the field is vital for continuous innovation in sustainable hydrogen solutions.	• Possesses specialized professional and technical skills; displays clarity of professional knowledge and technical skills in broad range of activities/ tasks. • Can apply the required knowledge for successfully implementing or applying techniques/ processes in a specific field/ job role • The ability to gain, and where relevant apply a range of knowledge, skills and understanding • Possesses the required operational skills for the work/ job. Skill to deliver job/ work with the required precision and in the estimated timelines. • Capabilities of carrying out a choice of processes and procedures within the range of familiar / unfamiliar contexts.	6
Employment Readiness & Entrepreneurship Skills & Mind-set/Professional Skill	Advance Course in Hydrogen Fuel needs to have a capacity for interdisciplinary collaboration, as researchers often work in diverse teams. Networking and relationship-building skills are crucial for engaging with industry partners and securing funding for projects. Entrepreneurial acumen is necessary for translating research findings into viable applications and fostering commercialization. Adaptability and a proactive mindset are vital to navigate the dynamic landscape of clean energy innovation. Effective communication of scientific concepts to diverse stakeholders, including potential investors, is also key for successful entrepreneurship in the field of hydrogen fuel research.	• Have much broader Employability Skills including understanding of career planning, digital skills, financial and legal literacy. • Good Communication skills, both oral and written. • Advanced literacy and Numeracy skills • Can comfortably use most of the basic digital tools, has clear understanding of Financial and Digital literacy, Aadhaar and Mobile, uses digital payments etc. with proficiency • Good understanding of Constitutional values & Citizenship, inclusion and Diversity. • Very Good understanding of social political and work environment	6
Broad Learning Outcomes/Core Skill	Advance Course in Hydrogen Fuel to integrate knowledge from diverse disciplines, including chemistry, engineering, and environmental science. Researchers must demonstrate proficiency in experimental techniques, data analysis, and stay updated on emerging technologies. Critical thinking and problem-solving skills are essential to address complex challenges in hydrogen production and storage, contributing to advancements in sustainable energy solutions.	• The candidate must be able to carry out a specialized job/ work/ tasks in a familiar/ unfamiliar, predictable/ unpredictable, routine/ nonroutine, situation of multiple options/ choices • Focus on range of application of standard procedures or operations in production/services. • Able to identify/ anticipate the problems and possible range of solutions in production/services • Complex tasks are performed by himself without much instructions and supervision.	6

		• Apply related occupational safety & general hygiene norms and environmental aspects. • Applies range of well - developed technical skills with clarity of activities involving clear choices within familiar contexts. • Has knowledge and is able to continuously improve processes which the individual uses for concerned job roles • Has information of associated Risks with related job roles.	
Responsibility	Individual at this job role is responsible for advancing sustainable energy solutions by investigating and optimizing methods for hydrogen production, storage, and utilization. Their duties include conducting experiments, analyzing data, and staying abreast of technological advancements in areas such as fuel cells and catalyst development. Additionally, they collaborate with interdisciplinary teams, publish research findings, and contribute to the overall progress of clean energy initiatives.	The individual is majorly responsible for his own job and self-learning process which justifies the pegging of the QP at level 6 • Can perform all non-standard procedures and non-routine tasks with confidence.	6

Annexure: Tools and Equipment (Lab Set-Up)

List of Tools and Equipment

Batch Size: 30

S. No.	Tool / Equipment Name	Specification	Quantity for specified Batch size
1	Alkaline Electrolyzers Solid Oxide Fuel Cells (SOFC) Metal Hydride Storage Systems High-Pressure Hydrogen Storage Tanks Gas Chromatograph (GC) Mass Spectrometer Infrared (IR) Spectrometer Pressure Transducers Temperature Sensors Flow Sensors Level Sensors		NA

	Actuators Solar Simulators Wind Turbines Data Loggers and Recorders Modeling and Simulation Software Safety Cabinets Emergency Shutdown Systems Lab Glassware and Consumables Resources for Research and Learning		
2	Personal Protective Equipment (PPE): Safety helmet, safety glasses, ear protection, respiratory protection (if required), protective gloves, safety boots.		NA

Classroom Aids

The aids required to conduct sessions in the classroom are:

1. White / Black board and Projector
2. Digital Presentation
3. Computer/Laptop
4. Public Addressing System

Annexure: Industry Validations Summary*

Provide the summary information of all the industry validations in table. This is not required for OEM qualifications.

S. No	Organization Name	Representative Name	Designation	Contact Address	Contact Phone No	E-mail ID	LinkedIn Profile (if available)
1	OIL	Shri Jayant Barua	CEO		9435348638	jayantbarua@oilindia.in	
2	BPCL	Shri Vishwas Saxena	Dy. General Manager		9669320555	vishwassaxena@bharatpetroleum.in	
3	HPCL	Imtiyaz Arshad	CEO & Secretary		8332864450	iarshad@hpcl.in	
4	IOCL	Apurva Nagmote	DGM (Learning & Skill Development)		8373919522	nagmoteas@indianoil.in	
5	GAIL	Shri M. A. Qureshi	CM (Training)		9179061305	maqureshi@gail.co.in	
6	CPCL	Shri Ayyamuthu A	Assistant Manager (Personnel)		9732492888	ayyamuthu@cpcl.co.in	
7	CHT	Shri Kishore Kumar Bhimwal	Additional Director		9958798282	kishore.bhimwal@cht.gov.in	
8	MRPL	Shri Venkateswarlu Kumbha	Chief Manager (TS)		9035044404	venkat_kumbha@mrpl.co.in	
9	SOM Projects PVT. LTD.	Shri Kuldeep Kumar	Manager			spplusar@gmail.com	
10	EIL	Shri Tathagat Sahoo	SR Manager HR		9702088305	tathagat.sahoo@eil.co.in	

Annexure: Training & Employment Details

Training and Employment Projections: 1350

Year	Total Candidates		Women		People with Disability	
	Estimated Training #	Estimated Employment Opportunities	Estimated Training #	Estimated Employment Opportunities	Estimated Training #	Estimated Employment Opportunities
2024	350	Green Hydrogen is new in India, so training is given to develop future workforce. Training will be given tom college students	150	Green Hydrogen is new in India, so training is given to develop future workforce. Training will be given tom college students	20	Green Hydrogen is new in India, so training is given to develop future workforce. Training will be given tom college students
2025	450	Green Hydrogen is new in India, so training is given to develop future workforce. Training will be given tom college students	200	Green Hydrogen is new in India, so training is given to develop future workforce. Training will be given tom college students	20	Green Hydrogen is new in India, so training is given to develop future workforce. Training will be given tom college students
2026	550	Green Hydrogen is new in India, so training is given to develop future workforce. Training will be given tom college students	250	Green Hydrogen is new in India, so training is given to develop future workforce. Training will be given tom college students	20	Green Hydrogen is new in India, so training is given to develop future workforce. Training will be given tom college students

Data to be provided year-wise for next 3 years

Annexure: Blended Learning

Blended Learning Estimated Ratio & Recommended Tools:

Refer NCVET “Guidelines for Blended Learning for Vocational Education, Training & Skilling” available on:

<https://ncvet.gov.in/sites/default/files/Guidelines%20for%20Blended%20Learning%20for%20Vocational%20Education,%20Training%20&%20Skilling.pdf>

S. No.	Select the Components of the Qualification	List Recommended Tools – for all Selected Components	Offline : Online Ratio
1	☐ Theory/ Lectures - Imparting theoretical and conceptual knowledge		Offline
2	☐ Imparting Soft Skills, Life Skills, and Employability Skills /Mentorship to Learners		Offline

3	☐ Showing Practical Demonstrations to the learners		Offline
4	☐ Imparting Practical Hands-on Skills/ Lab Work/ workshop/ shop floor training		Offline
5	☐ Tutorials/ Assignments/ Drill/ Practice		Offline
6	☐ Proctored Monitoring/ Assessment/ Evaluation/ Examinations		Offline
7	☐ On the Job Training (OJT)/ Project Work Internship/ Apprenticeship Training		Offline

Annexure: Detailed Assessment Criteria

Detailed assessment criteria for each NOS/Module are as follows:

NOS/Module Name	Assessment Criteria for Performance Criteria/Learning Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Introduction to the Hydrogen Technologies and Hydrogen Production Methods	<i>Introduction to the Hydrogen Technologies</i>				
	PC1. understand hydrogen as an energy carrier	2	2		
	PC2. Identify the characteristics that make hydrogen suitable as an energy carrier	2	1		1
	PC3. identify the insight of the applications and significance of hydrogen in the energy sector.	2	1		1
	PC4. Identify key players and stakeholders in the hydrogen energy industry.	2	1		1
	PC5. check the physical and chemical properties of hydrogen.	2	1		1
	PC6. identify various milestones in the evolution of hydrogen technology	2	1		1
	<i>Hydrogen Production Methods</i>				5
	PC7. identify the principles of electrolysis and its role in hydrogen production.	2	1		
	PC8. Understand the use of different type of electrolysis methods such as water splitting technologies, alkaline, PEM, and SOEC etc.	2	1		1
	PC9. check the advantages and disadvantages of each electrolysis type.	2	1		1
	PC10. identify various type of reforming processes including biomass and natural gas etc.	2	1		1
	PC11. check the efficiency and environmental implications of different reforming methods.	2	1		1
	PC12. check the feasibility of reforming processes in hydrogen production.	1	1		1
	PC13. understand the concepts of solar-driven and wind-driven hydrogen production.	2	2		
	Total Marks	25	15	0	10
	<i>Hydrogen Storage and Transportation</i>				

Hydrogen Storage, Transportation and its utilization	PC1. identify the various hydrogen storage technologies including compressed gas, liquefaction and solid-state methods etc.	2	1		
	PC2. Identify the advantages, disadvantages and applications of different hydrogen storage techniques	2	1		1
	PC3. identify different modes of hydrogen transportation and their safety considerations	2	1		1
	PC4. Understand how to follow safety protocols and regulations for hydrogen transportation and its impact on environment	2	1		1
	PC5. Understand the functioning of hydrogen refueling stations and related infrastructure	2	1		1
	PC6. identify the challenges and solutions associated with the development and maintenance of hydrogen refueling infrastructure	2	1		1
	PC7. check the economic viability of hydrogen refueling station projects	2	1		
	<i>Hydrogen utilization technologies & Hydrogen Derivatives</i>				5
	PC8. identify the fuel cell technology including various types such as PEMFC, AFC, SOFC etc.	2	1		
	PC9. identify the working principles and applications of different fuel cell types	2	1		
	PC10. check the efficiency, advantages and limitations of various fuel cell technologies	2	1		1
	PC11. understand the combustion processes of hydrogen in engines.	2	1		1
	PC12. observe the performance and emissions characteristics of hydrogen-powered engines.	2	1		1
	PC13. identify the safety considerations and operational challenges associated with hydrogen combustion in engines.	2	1		1
	PC14. understand the applications of hydrogen in industrial processes such as ammonia production and methanol synthesis.	2	1		1
	PC15. check the economic aspects related to hydrogen use in industrial applications	2	1		
Total Marks		30	15	-	10
Environmental and Economic Impacts of Green Hydrogen	<i>Environmental benefits and challenges of hydrogen use.</i>				
	PC1. identify the environmental benefits and impact associated with the use of hydrogen as an energy carrier	2	1	-	1
	PC2. Check the environmental challenges and potential drawbacks of hydrogen utilization	2	1	-	1
	PC3. observe strategies to mitigate environmental challenges related to hydrogen use	2	1	-	1
	<i>Economic Aspects and Market Trends</i>			-	
	PC4. identify economic factors and principles relevant to the hydrogen industry including production costs, market dynamics and pricing trends	2	1	-	1
	PC5. observe current market trends and forecasts related to hydrogen technologies and application	2	1	-	1
	PC6. check the economic viability of hydrogen projects and initiatives in different sectors	2	1	-	1

	PC7. Identify maximizing economic benefits in hydrogen-related endeavors	2	1	-	1
	<i>Policies and Incentives Promoting Green Hydrogen</i>				
	PC8. read governmental policies and incentives that promote the development and use of green hydrogen	2	1		1
	PC9. check the impact of policies and incentives on the growth and adoption of green hydrogen technologies	2	1		1
	PC10. observe the effectiveness and efficiency of existing policies and suggest improvements if needed	2	1		1
Green Hydrogen Handling: Safety, regulations and industry ethics	Total Marks	20	10		10
	<i>Safety and regulations</i>				
	PC1. follow appropriate safety measures and protocols when handling, storing or transporting hydrogen	2	1	-	1
	PC2. Identify potential safety hazards and take proactive steps to mitigate risks	3	1	-	1
	PC3. Show competency in the use of safety equipment and personal protective gear when working with hydrogen	2	2	-	1
	PC4. Interpret and explain relevant laws and regulations pertaining to the production and use of green hydrogen.	2	1	-	1
	PC5. Communicate clearly and efficiently with team members and emergency services during an incident	2	1	-	1
	<i>Industry ethics</i>			-	
	PC6. understand the ethical principles and their application in the industry.	2	1	-	2
	PC7. Identify ethical dilemmas and conflicts of interest that may arise in the workplace.	2	1		1
	PC8. Communicate and promote ethical behavior within the organization.	2	1		1
	PC9. Respond appropriately to ethical violations or misconduct, including reporting procedures and resolution mechanisms	3	1		1
	Total Marks	20	10	-	10
Research and Development in Green Hydrogen-Challenges and opportunities	Technical and economic challenges in Green Hydrogen value chain				
	PC1. understand technological and economic limitations in different green hydrogen production pathways	2	1		1
	PC2. Understand challenges in currently available solar PV cell materials	2	1		
	PC3. Understand challenges in currently employed catalyst systems in electrolyzers	2	1		1
	PC4. Understand challenges in currently employed membrane systems in electrolyzers	2	1		1
	PC5. Understand impact of each component in an electrolyser on cost of hydrogen production	3	0		
	PC6. Understand challenges in other green hydrogen production pathways (Biomass gasification, waste to hydrogen, PEC splitting of water etc)	2	1		1

	PC7. understand technological and economic limitations in different hydrogen storage technologies	2	1		1
	PC8. Understand DoE targets for hydrogen storage	2	1		1
	PC9. Understand challenges in designing and development of hydrogen storage vessels and materials	2	1		1
	PC10. Understand challenges in transportation of hydrogen, particularly thru existing CNG pipelines	2	1		1
	PC11. Understand challenges in application of green hydrogen for mobility & stationary sectors, chemical sectors etc	2	1		1
	Possible R&D projects in Green hydrogen and their significance				
	PC12. Understand possible R&D projects in the area of green hydrogen production.	2	1		1
	PC13. Understand possible R&D projects in the area of green hydrogen storage.	2	1		1
	PC14. Understand possible R&D projects in the area of green hydrogen transportation	2	1		1
	PC15. Understand possible R&D projects in the area of green hydrogen application	2	1		1
	PC16. Understand R&D infrastructural requirements in green hydrogen area	2	1		1
	PC17. Understand basic principle and application of various analytical equipments required for green hydrogen R&D	2	0		1
	Total Marks	35	15	-	15
Visit to a Green Hydrogen R&D facility	<i>Visit to a green hydrogen R&D facility</i>				
	PC1. Understand a typical research infrastructure required to initiate research in hydrogen area	2	1		
	PC2. Understand research facilities & projects in catalyst development lab	2	1		1
	PC3. Understand research facilities & projects in storage material lab	2	1		1
	PC4. Understand research facilities & projects in hydrogen cylinder technology development lab	2	1		1
	PC5. Understand research facilities & projects in a Fuel Cell lab	2	1		1
	PC6. Understand research facilities & projects in new application development	2	1		1
	PC7. Understand research facilities & projects in a solar PV lab	2	1		1
	PC8. Understand research facilities & projects in biomass gasification lab	2	1		1
	PC9. Understand research facilities & projects in new production routes lab	2	1		1
	PC10. Understand research facilities & projects in Model & Simulation labs	2	1		1
	PC11. Understand working of various pilot facilities	2	1		1
	<i>Visit to various allied labs</i>				
	PC12. Understand other sophisticated analytical equipments required for green hydrogen R&D	2	1		1

	PC13. Understand application of these sophisticated equipments	2	0		1
	PC14. Understand research facilities & hydrogen projects in an engine lab	2	1		1
	PC15. Understand about IC engine vehicles running on direct hydrogen	2	1		1
	PC16. Understand about fuel cell vehicles running on hydrogen	2	1		1
	<i>Onsite training/short project in a green hydrogen R&D facility</i>				
	PC17. Understand typical R&D project stages	2	1		1
	PC18. Understand literature search	2	1		0
	PC19. Understand how to protect the research finding by patenting	2	1		1
	PC20. Understand and undertake a short project of 4-6 months duration in any of the above labs related to green hydrogen	2	1		1
	PC21. Understand how to compile the research finding	2	1		1
	PC22. Understand how to write the project dissertation and submit the same	3	0		1
	NOS Total	45	20	-	20
Grand Total		175	85	0	75

Annexure: Assessment Strategy

This section includes the processes involved in identifying, gathering, and interpreting information to evaluate the Candidate on the required competencies of the program.

1. Assessment System Overview:

- Batches assigned to the assessment agencies for conducting the assessment on SIDH or email
- Assessment agencies send the assessment confirmation to VTP/TC looping SSC
- Assessment agency deploys the ToA certified Assessor for executing the assessment
- HSSC monitors the assessment process & records

2. Testing Environment:

- Confirm that the centre is available at the same address as mentioned on SDMS or SIDH
- Check the duration of the training.
- Check the Assessment Start and End time to be as 10 a.m. and 5 p.m.
- 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 bank is created by the Subject Matter Experts (SME) of Hydrocarbon Sector are verified by the Industry Experts, each performance criteria have its marks for theory based on the level of question i.e., easy, medium and difficult.
- Questions are mapped to the specified assessment criteria
- Assessor must be ToA certified & trainer must be ToT Certified

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 crosschecking with candidate over audio/video call or physical visit
- Random audit of the batch

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

7. **On the Job:**

1. The evidence record of OHT will be done through organized Monitoring Reports
2. During the OJT, every trainee is required to fill the OJT monitoring report which is required to be signed by his/her supervisor and the HR of that company.
3. During assessment, each module will be assessed separately.
4. The candidate must score 60% in each module to successfully complete the OJT.
5. Tools of Assessment that will be used for assessing whether the candidate is having desired skills and etiquette of dealing with customers, understanding needs & requirements, assessing the customer and perform Soft Skills effectively:
 - Videos of Trainees during OJT
6. Assessment of each Module will ensure that the candidate is able to:
 - Effective engagement with the customers
 - Understand the working of various tools and equipment

Annexure: Acronym and Glossary

Acronym

Acronym	Description
AA	Assessment Agency
AB	Awarding Body
ISCO	International Standard Classification of Occupations
NCO	National Classification of Occupations
NCrF	National Credit Framework

NOS	National Occupational Standard(s)
NQR	National Qualification Register
NSQF	National Skills Qualifications Framework
OJT	On the Job Training

Glossary

Term	Description
National Occupational Standards (NOS)	NOS define the measurable performance outcomes required from an individual engaged in a particular task. They list down what an individual performing that task should know and also do.
Qualification	A formal outcome of an assessment and validation process which is obtained when a competent body determines that an individual has achieved learning outcomes to given standards
Qualification File	A Qualification File is a template designed to capture necessary information of a Qualification from the perspective of NSQF compliance. The Qualification File will be normally submitted by the awarding body for the qualification.
Sector	A grouping of professional activities on the basis of their main economic function, product, service or technology.
Long Term Training	Long-term skilling means any vocational training program undertaken for a year and above. https://ncvet.gov.in/sites/default/files/NCVET.pdf