National Competency Standards
for
"Associate Engineer in Metallurgy and Metal casting"
Level-5

National Vocational and Technical Training Commission (NAVTTC), Government of Pakistan

ACKNOWLEDGEMENT

National Vocational and Technical Training Commission (NAVTTC) extends its gratitude and appreciation to representatives of business, industry, academia, government agencies, provincial TEVTAs, sector skill councils and trade associations who spared time and extended their expertise for the development of National Vocational Qualifications for the trade of **Metallurgy and metal casting.** This work would not have been possible without the technical support of the above personnel.

NAVTTC initiated development of CBT&A based qualifications for 200 traditional / hi-tech trades under the Prime **Minister's Hunarmand Pakistan Program,** focusing on Development & Standardization of 200 Technical & Vocational Education & Training (TVET) Qualifications. NAVTTC efforts have received full support from the Ministry of Federal Education and Professional Training, which highly facilitated progress under this initiative.

It may not be out of place to mention here that all the experts of Industry, Academia and TVET experts of TEVTAs, BTEs and PVTC work diligently for making this qualification worthy and error free for which all credit goes to them. However, NAVTTC accepts the responsibility of all the errors and omissions still prevailing in the qualification document.

It is also noteworthy that development of Skill Standards is a dynamic and ongoing process, and the developed skill standards needs periodic review and updating owing to the constant technological advancements, development in scientific knowledge, and growing experience of implementation at the grass root level as well as the demand of industry. NAVTTC will ensure to keep the qualifications abreast with the changing demands of both national and international job markets.

Dr. Nasir Khan,
Executive Director,
NAVTTC

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1. Introduction

Metallurgy and metal casting is a manufacturing process. A liquid metal is somehow delivered into a mold (usually by a crucible) that contains a negative impression (i.e., a three dimensional negative image) of the intended shape in a process. The metal is poured into the mold through a hollow channel called a sprue. The metal and mold are then cooled, and the metal part (the casting) is extracted. Casting is most often used for making complex shapes that would be difficult or uneconomical to make by other methods.

Casting processes have been known for thousands of years, and have been widely used for sculpture (especially in bronze), jewelry in precious metals, and weapons and tools. Traditional techniques include lost-wax casting (which may be further divided into centrifugal casting and vacuum assist direct pour casting), plaster mold casting and sand casting.

The modern casting process is subdivided into two main categories: expendable and non-expendable casting. It is further broken down by the mold material, such as sand or metal, and pouring method, such as gravity, vacuum, or low pressure.

Being cognizant of this fact, National Vocational & Technical Training Commission (NAVTTC) developed competency standards for metallurgy and metal casting under National Vocational Qualifications Framework (NVQF). These competency standards have been developed by a Qualifications Development Committee (QDC) and validated by the Qualifications Validation Committee (QVC) having representation from the leading development houses and research labs of the country.

2. Purpose of the Qualification

The competency based NVQ has been developed to train the unskilled men and women of Pakistan on the technical and entrepreneurial skills to be employed / self-employed and inevitably set sustainable impact on their lives by enhancing their livelihood income.

The purpose of these qualifications is to set professional standards for upcoming experts, who will serve as key elements enhancing quality of Pakistan's manufacturing sector. The specific objectives of developing these qualifications are as under:

- Improve the professional competencies of individual in metallurgy and metal casting
- Capacitate the local community and trainers in modern CBT trainings, methodologies and processes as envisaged under NVQF
- Provide flexible pathways and progressions in metallurgy and metal casting
- Enable the trainees to perform their duties in efficient manner
- Establish a standardized and sustainable system of training in Pakistan
- Enabling the youth with greater employment opportunities

3. Date of Validation

The level 5 metallurgy and metal casting qualification has been validated on 12 to 16 January, 2021 at PITAC, Lahore, by the qualification validation committee (QVC) members.

4. Date of Review

The level 5 Computer networking and cloud computing qualification has been reviewed on 12-16 January,2021 by the qualification validation committee (QVC) members.

5. Codes of Qualifications

The International Standard Classification of Education (ISCED) is a framework for assembling, compiling and analyzing cross-nationally comparable statistics on education and training. ISCED codes for these qualifications are assigned as follows:

ISCED Classification	
Code	**Description**
1	2nd Level National Certificate of level-5 Qualification, in "Metallurgy and Metal casting"
2	3rd Level National Certificate of level-5 Qualification, in "Metallurgy and Metal casting"
3	4th Level National Certificate of level-5 Qualification, in "Metallurgy and Metal casting"
4	5th Level National Certificate of level-5 Qualification, in "Metallurgy and Metal casting"

6. Members of Qualification Development Committee

The following members participated in the qualification development process at PITAC, Lahore.

Date: 18 to 22 December 2020

S#	Name	Designation
1.	Muhammad Yasir	Deputy Director, NAVTTC
2.	Engr. Farooq Iftikhar	Jr.Engineer,PITMAEM Lahore
3.	Engr.Umer Farooq	Instructor P-TEVTA Swedish college, Gujrat
4.	Engr.Noman	Jr.Engineer PCSIR,Lahore
5.	Engr.Rashid Bashir	PCSIR,Lahore
6.	Engr.Salman Khalid Ch.	Assistant Director PITAC,Lahore
7.	Engr.Amina Irfan	Lecturer,UOL Lahore
8.	Engr.Asad Malik	Assistant director, PITAC Lahore
9.	Engr.Saba Sadiq	DACUM FACILITATOR,UOL Islamabad
10.		
11.		
12.		
13.		
14.		
15.		

7. Members of Qualification Validation Committee

The following members participated in the qualification development process at PITAC, Lahore.

Date:

S#	Name	Designation
1.	Muhammad Yasir	Deputy Director, NAVTTC
2.	Engr. Farooq Iftikhar	Jr.Engineer,PITMAEM Lahore
3.	Engr.Sohail	Instructor P-TEVTA Swedish college, Gujrat
4.	Engr.Noman	Jr.Engineer PCSIR,Lahore
5.	Engr.Rashid Bashir	PCSIR,Lahore
6.	Engr.Salman Khalid Ch.	Assistant Director PITAC,Lahore
7.	Engr.Saba Sadiq	DACUM FACILITATOR, Islamabad
8.		
9.		
10.		
11.		

8. Entry Requirements

Entry requirement for this level 5 qualification would be matric and certification of level 4 in metallurgy and metal casting.

9. Regulation of the Qualification and schedule of units

Not applicable

10. Summary of Competency Standards

Sr. No	Occupation	Competency Standards	NVQF Level	Category	Estimated Contact Hr.			Credit Hr.
					Th.	Pr.	Total	
Technicain in metallurgy and metal casting-LEVEL 2								
1	**Manual Drawing Expert**	Perform Basic Manual Drawing	2	**Technical**	4	24	28	2.8
		Construct different Engineering Curves.			6	30	36	3.6
		Construct multi-view drawings			6	30	36	3.6
		Total			16	84	100	10
2	**Basic Machining Operator**	Perform metal/bench work	2	**Technical**	2	12	14	1.4
		Perform cutting on Metal Circular/Power Heck Saw			2	6	8	0.8
		Perform Grinding operation			2	9	11	1.1
		Perform Basic Lathe Machine Operations			4	21	25	2.5
		Perform Drilling Machine Operations			2	9	11	1.1
		Perform Shaper, Planar and Slotter Machining Operations			2	18	20	2
		Perform Milling Operations			3	18	21	2.1
		Total			17	93	110	11
3	**Health and Safety Officer**	Perform basic safety practices	2	**Technical**	10	15	25	2.5
		Apply basic Occupational Health & Safety regulations			10	15	25	2.5
		Total			20	30	50	5
4	**Raw Material Inspector**	Carry out inspection and receiving of raw material	2	**Technical**	9	21	24	2.4
		Perform Raw Material Sampling			9	21	28	2.8
		Total			18	42	60	6
5	**Assistant Pattern Maker**	Operate general wood working machines	2	**Technical**	9	15	24	2.4
		Manufacture Wooden Pattern			6	15	21	2.1
		Manufacture polymer pattern			4	15	19	1.9
		Maintain tools and equipment			3	3	6	0.6
		Total			22	48	70	7

6	**Assistant Molder**	Prepare sand mold for casting	**2**	**Technical**	10	24	34	3.4
		Perform core making			5	21	26	2.6
		Total			15	45	60	6
7	**Assistant Caster**	Maintain Safe Work Environment	**2**	**Technical**	4	9	13	1.3
		Perform Sand Casting			8	21	29	2.8
		Perform Gravity Die Casting			7	21	28	2.8
		Total			19	51	70	7
8	**Fettling Operator**	Fettle and trim metal casting	**2**	Technical	2	9	11	1.1
		Perform surface cleaning by sand blasting			4	12	16	1.6
		Perform shot blasting			5	15	20	2
		Perform cutting and grinding operations			3	9	12	1.2
		Perform basic welding operations			6	15	21	2.1
		Total			20	60	80	8
Total(Level 2)								
Assistant foremen in metallurgy and metal casting-LEVEL 3								
1	**Pattern Designer**	Manage graphic user interface	**3**	Technical	11	9	20	
		Develop 2D drawings			6	18	24	
		Develop 3D pattern design			8	18	26	
		Total			25	45	70	
2	**Pattern Maker**	Manufacture match plate gated pattern	**3**	**Technical**	8	21	20	
		Manufacture Pattern on CNC router			8	33	20	
		Total			16	54	70	
3	**Melter**	Work Safely with Molten Metal	**3**	**Technical**	6	6	12	1.6
		Melt Ferrous Material (Cast Steel) in Induction Furnace			8	24	32	2
		Melt Ferrous Material (Cast Iron) in Cupola Furnace			8	24	32	2
		Melt Non-Ferrous Material in Pit Furnace			6	18	24	2
		Total			28	72	100	7.6
4	**Molder**	Operate molding machines	**3**	Technical	7	33	30	1.5
		Operate core making machines			5	15	30	1.5
		Total			12	48	60	6
5	**Furnace operator**	Operate Non-Electric Melting Furnaces	**3**	Technical	10	30	40	4
		Operate Electric Melting Furnaces			10	30	40	4
		Total			20	60	80	8
6	**Caster**	Operate Pressure Die Casting	**3**	Technical	10	30	40	3
		Perform Centrifugal Casting Process			13	27	40	3
		Total			23	57	80	3
7	**Assistant Heat Treatment Technician**	Perform quenching, annealing and normalizing process	**3**	Technical	10	30	40	
		Perform Heat Treatment of Non-Ferrous Materials			10	30	40	
		Total			20	60	80	
8	**Basic computer operator**	Install/Use system software	**3**	Generic	4	9	13	
		Install / Use Application Software			3	9	12	
		Draft office document			4	12	16	

		Perform web browsing and manage emails			3	6	9	
		Total			14	36	50	
Foremen in metallurgy and metal casting-LEVEL 4								
1	**Soft skills**	Manage the meetings	**4**	Generic	5	15	20	2
		Manage workforce planning			5	15	20	2
		Undertake project work			5	15	20	2
		Identify and communicate trends in career development			5	15	20	2
		Apply interpersonal skills			5	15	20	2
		Work safely in an office environment			5	15	20	2
		Maintain professionalism in workplace			5	15	20	2
		Total			35	105	140	14
2	**Senior Caster**	Perform Shell Mold Casting	**4**	Technical	19	81	100	
		Perform Investment Casting			19	81	100	
		Total			38	162	200	
3	**Heat treatment technician**	Perform stress relieving, austempering and martempering	**4**	Technical	24	51	75	
		Perform Case Hardening process			21	54	75	
		Total			45	105	150	
4	**Destructive Testing Technician**	Perform Hardness Tests	**4**	Technical	8	30	38	
		Perform Impact Tests			6	24	30	
		Perform Mechanical Testing on Universal Testing Machine			16	48	64	
		Perform Torsion Test and Fatigue test			8	30	38	
		Total			38	132	170	
5	**Jr.Metallographic technician**	Perform Sectioning, Cutting and Rough Grinding	**4**	**Technical**	9	24	33	
		Perform Mounting Operation			9	24	33	
		Perform Fine Grinding Operation			15	24	39	
		Perform Fine Polishing Operation			`15	30	30	
		Total			33	102	135	
6	**Jr.Surface coating technican**	Perform Galvanizing Coating	**4**	**Technical**	11	24	35	
		Perform Conversion Coating (Anodizing)			11	24	35	
		Perform Electrochemical Coating (Electroplating)			10	30	40	
		Perform Electrochemical Coating (Electrolesis Electroplating)			10	30	40	
		Total			42	108	150	
7	**Metal forming technician**	Perform forging process	**4**	Technical	8	27	35	3
		Perform extrusion process			6	24	30	3
		Perform wire drawing and deep drawing process			6	24	30	3
		Perform rolling process			8	27	35	3
		Total			28	102	130	12
8	**Assistant QC Inspector**	Perform inspection	**4**	Technical	9	21	30	
		Select and control inspection process and procedures			9	21	30	
		Ensure calibration			9	21	30	

		Total			27	63	90	
Associate Engineer in metallurgy and metal casting-LEVEL 5								
1	**Sr.Metallography Technician**	Perform Etching Operation	**5**	Technical	18	36	54	2
		Perform Microscopic Examination Operation			21	45	66	2
		Total			39	81	150	12
2	**QC Inspector**	Conduct process and product capability analysis	**5**	Technical	10	30		2
		Perform advanced statistical quality control			10	30		2
		Total			20	60	100	9
3	**Non Destructive Testing Technician**	Perform dye penetrant, magnetic and ultrasonic test	**5**	Technical	15	45	60	9
		Perform radiography and eddy current test			12	36	48	3
		Total			78	81	200	3
4	**Service Coating Technician**	Perform Vapor Deposition Coatings (PVD)	**5**	Technical	15	24	39	3
		Perform Vapor Deposition Coatings (CVD)			15	24	39	3
		Perform Thermal Spray Coatings (Plasma)			12	24	36	3
		Perform Thermal Spray Coatings (Electric Arc Value)			12	24	36	
		Perform Thermal Spray Coatings (LVOF)			12	24	36	
		Total			66	120	150	15
7	**Powder Metallurgy**	Handle Powder for required process	**5**	Technical	12	24	36	1.5
		Perform Consolidation Operation			12	24	36	1.5
		Perform Sintering Operation			18	24	42	1.5
		Perform Finishing Operations			12	24	36	1.5
		Total			54	96	150	6
8	**Entrepreneur**	Develop Project Proposal	**5**	Generic	6	9	15	1.5
		Apply management and communication techniques			3	9	12	1.2
		Create human resource management plan			3	9	12	1.2
		Develop project management plan			3	9	12	1.2
		Develop sales plan			6	9	15	1.5
		Conduct research for customer needs and satisfaction			3	6	9	0.9
		Manage finances			4	9	13	1.3
		Identify and resolve problems			4	9	13	1.3
		Create/Manage profile on Non-traditional Freelancing Platform			4	9	13	1.3
		Create/Manage profile on a Traditional Freelance Platform			3	9	12	1.2
		Write professional proposals for freelance projects			3	9	12	1.2
		Develop communication skills			3	9	12	1.2
		Total			45	105	150	15

11. Levelling and Packaging of the Qualification

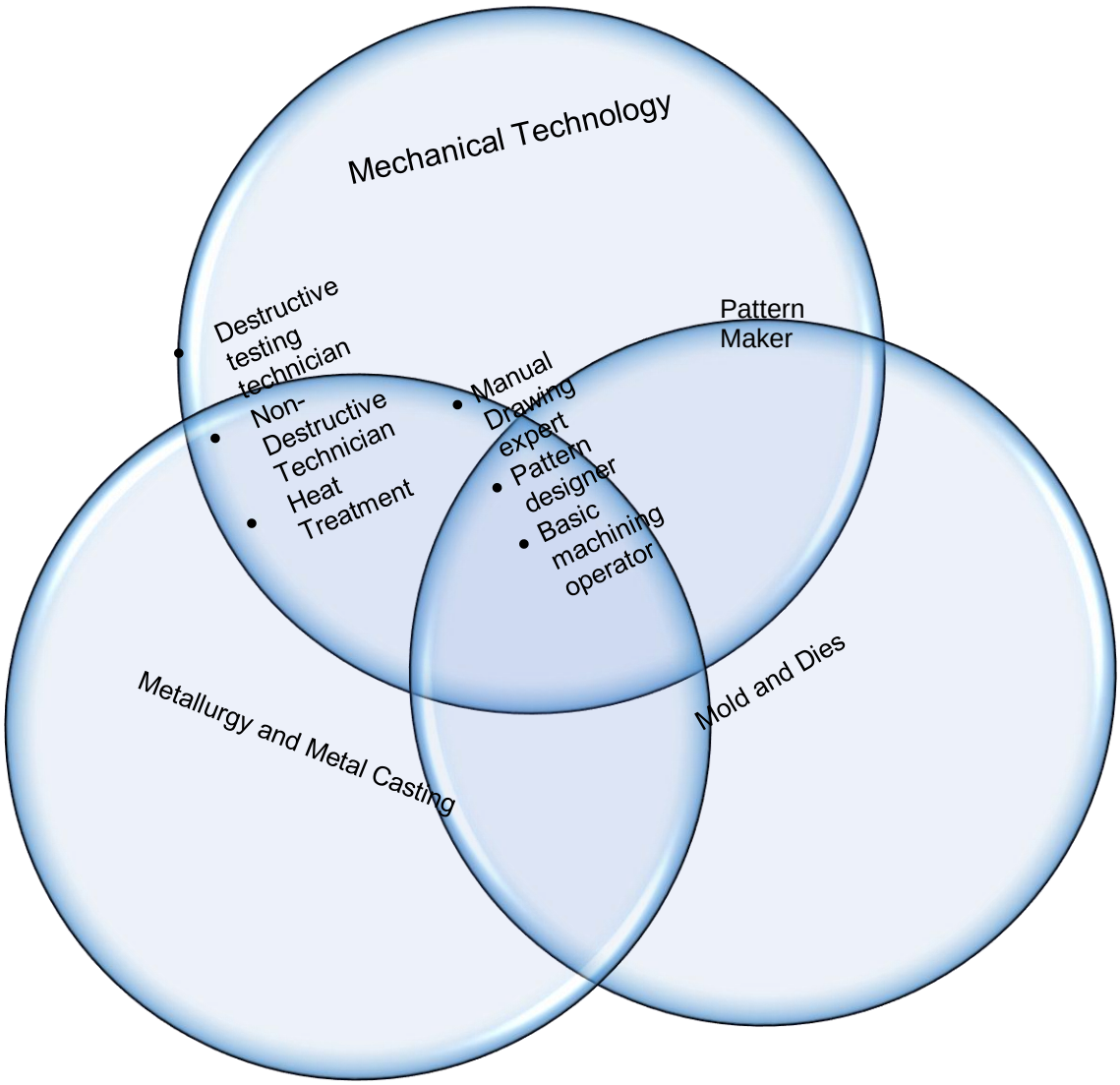
Sr.	Occupation	Duties/Competency Standards
	Level 2 **Technician in metallurgy and metal casting**	
1	**Manual Drawing Expert**	1. Perform Basic Manual Drawing 2. Construct different Engineering Curves. 3. Construct multi-view drawings
2	**Basic Machining Operator**	4. Perform metal/bench work 5. Perform cutting on Metal Circular/Power Heck Saw 6. Perform Grinding operation 7. Perform Basic Lathe Machine Operations 8. Perform Drilling Machine Operations 9. Perform Shaper, Planar and Slotter Machining Operations 10. Perform Milling Operations
3	**Health and Safety Officer**	11. Perform basic safety practices 12. Apply basic Occupational Health & Safety regulations
4	**Raw Material Inspector**	13. Carry out inspection and receiving of raw material 14. Perform raw material sampling
5	**Assistant Pattern Maker**	15. Operate general wood working machines 16. Manufacture Wooden Pattern 17. Manufacture match plate gated pattern 18. Maintain tools and equipment
6	**Assistant Molder**	19. Prepare sand mold for casting 20. Perform core making
7	**Assistant Caster**	21. Maintain Safe Work Environment 22. Perform Sand Casting 23. Perform Gravity Die Casting
8	**Fettling Operator**	24. Fettle and trim metal casting 25. Perform surface cleaning by sand blasting 26. Perform shot blasting 27. Perform cutting and grinding operations 28. Perform basic welding operations
	Level 3 **Assistant foremen in metallurgy and metal casting**	
9	**Pattern Designer**	29. Manage graphic user interface 30. Develop 2D drawings 31. Develop 3D pattern design

10	**Pattern Maker**	32. Manufacture Polymer Pattern 33. Manufacture Pattern on CNC router
11	**Melter**	34. Work Safely with Molten Metal 35. Melt Ferrous Material (Cast Steel) in Induction Furnace 36. Melt Ferrous Material (Cast Iron) in Cupola Furnace 37. Melt Non-Ferrous Material in Pit Furnace
12	**Molder**	38. Operate molding machines 39. Operate core making machines
13	**Furnace operator**	40. Operate Non-Electric Melting Furnaces 41. Operate Electric Melting Furnaces
14	**Caster**	42. Operate Pressure Die Casting 43. Perform Centrifugal Casting Process
15	**Assistant Heat Treatment Technician**	44. Perform quenching, annealing and normalizing process 45. Perform Heat Treatment of Non-Ferrous Materials
16	**Basic computer operator**	46. Install/Use system software 47. Install / Use Application Software 48. Draft office document 49. Perform web browsing and manage emails
Level 4 Foremen in metallurgy and metal casting		
17	**Soft Skills**	50. Manage the meetings 51. Manage workforce planning 52. Undertake project work 53. Identify and communicate trends in career development 54. Apply interpersonal skills 55. Work safely in an office environment 56. Maintain professionalism in the workplace
18	**Senior Caster**	57. Perform Shell Mold Casting 58. Perform Investment Casting
19	**Heat treatment technician**	59. Perform stress relieving, austempering and martempering 60. Perform Case Hardening process
20	**Destructive Testing Technician**	61. Perform Hardness Tests 62. Perform Impact Tests 63. Perform Mechanical Testing on Universal Testing Machine 64. Perform Torsion Test and Fatigue test

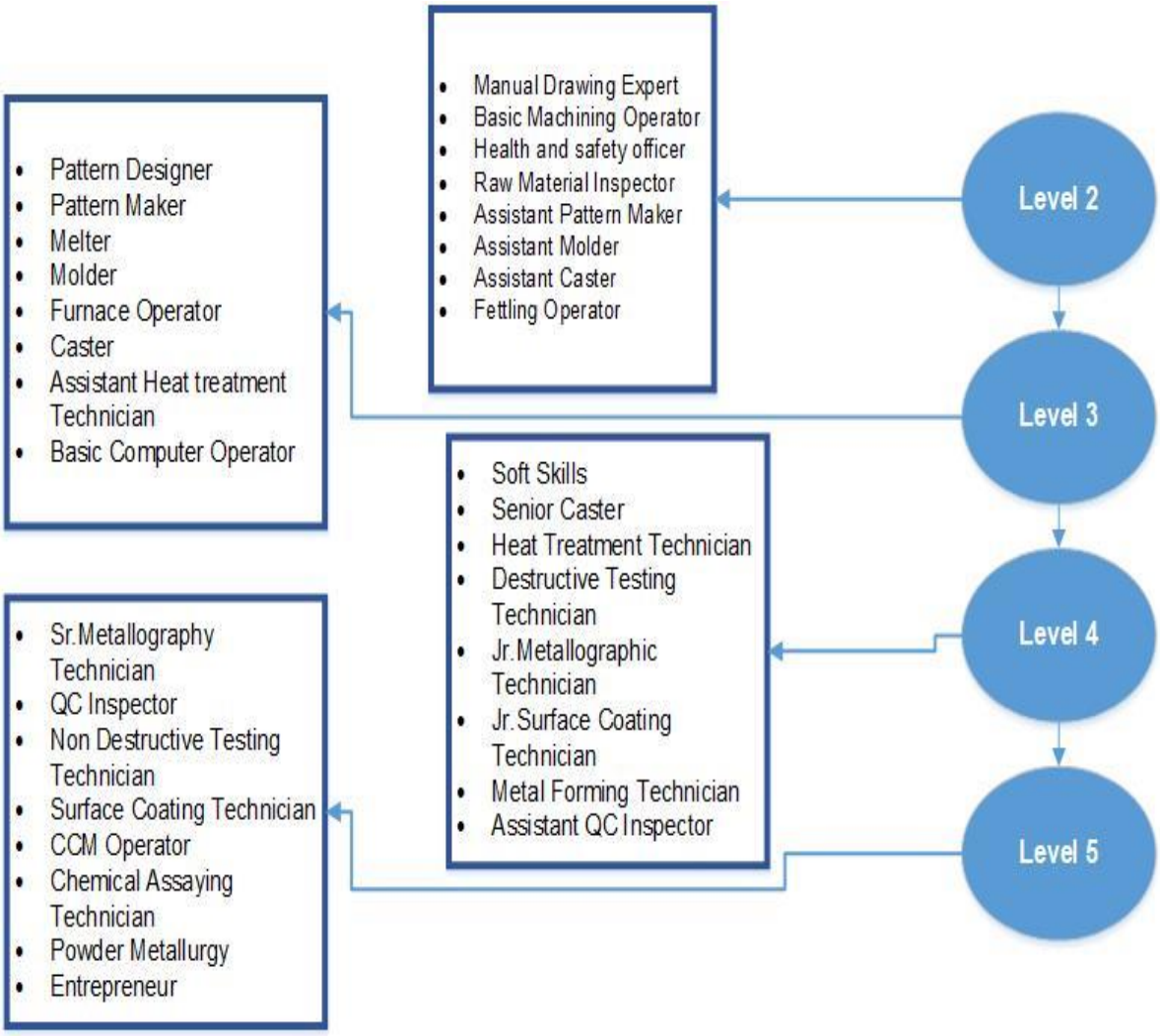
21	**Jr.Metallographic technician**	65. Perform Sectioning, Cutting and Rough Grinding 66. Perform Mounting Operation 67. Perform Fine Grinding Operation 68. Perform Fine Polishing Operation
22	**Jr.Surface coating technician**	69. Perform Galvanizing Coating 70. Perform Conversion Coating (Anodizing) 71. Perform Electrochemical Coating (Electroplating) 72. Perform Electrochemical Coating (Electrolesis Electroplating)
23	**Metal forming technician**	73. Perform forging process 74. Perform extrusion process 75. Perform wire drawing and deep drawing process 76. Perform rolling process
24	**Assistant QC Inspector**	77. Perform inspection 78. Select and control inspection process and procedures 79. Ensure calibration
Level 5 Associate Engineer in metallurgy and metal casting		
25	**Sr.Metallography Technician**	80. Perform Etching Operation 81. Perform Microscopic Examination Operation
26	**QC Inspector**	82. Conduct process and product capability analysis 83. Perform advanced statistical quality control
27	**Non Destructive Testing Technician**	84. Visual 85. LPT MPT 86. UT Rt Eddy current
28	**Service Coating Technician**	87. Perform Vapor Deposition Coatings (PVD) 88. Perform Vapor Deposition Coatings (CVD) 89. Perform Thermal Spray Coatings (Plasma) 90. Perform Thermal Spray Coatings (Electric Arc Value) 91. Perform Thermal Spray Coatings (LVOF)
29	**CCM operator**	92.
30		93.
31	**Powder Metallurgy**	94. Handle Powder for required process 95. Perform Consolidation Operation 96. Perform Sintering Operation 97. Perform Finishing Operations

32	**Entrepreneur**	98. Develop project proposal 99. Apply management and communication techniques 100. Create human resource management plan 101. Develop project management plan 102. Develop sales plan 103. Conduct research for customer needs and satisfaction 104. Manage finances 105. Identify and resolve problems 106. Create Manage profile on Non-Traditional Freelancing platform 107. Create Manage profile on Traditional Freelancing platform 108. Write professional proposal for projects 109. Develop communications skills

12. Mapping of the Qualification



13. Mapping of Occupations



14. Detail of Qualification and its Competency Standards

LEVEL 5

1. Metallography Technician-II

CS 1 Perform Etching Operation

Overview: This competency standard covers the skills and knowledge required to Perform Fine Polishing Operation operations for Metallography of Metallic materials. Also determine Fine Polishing Operation requirements, Check the operations of equipment.

Competency Units/Task	Performance Criteria/Step
Perform Etching Operation	**P1.** Identify the etching method as per requirement of metallographic standards. • Chemical etching. • Electrolytic etching. **P2.** Adopt standard safety practice and procedure for handling
CU5. Perform Chemical Etching Operation	**P1.** Identify etching solution specifications according to metallographic standard and type of specimen. **P2.** Adopt standard safety practice and procedure for handling acid chemicals. **P3.** Make etching solution in china dish as per requirement. **P4.** Dip the specimen into solution with the help of tong for several time until its shine become dim. **P5.** Wash with distil water then clean with alcohol. **P6.** Dry the specimen with air dryer.
CU5. Perform Electrolytic Etching Operation	**P1.** Identify electrolyte solution specifications according to metallographic standard and type of specimen. **P2.** Adopt standard safety practice and procedure for handling acid chemicals. **P3.** Make etching solution in beaker as per requirement. **P4.** Transfer solution in machine bath. **P5.** Dip the specimen in bath.

	P6. Connect the specimen with positive pole. **P7.** Select the current and time for etching. **P8.** Wash with distil water then clean with alcohol. **P9.** Dry the specimen with air dryer.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

K1. Define purpose of etching in Metallography.
K2. Describe safety symbols for acid chemical.
K3. Explain etching techniques
K4. Define General chemical use in etching.
K5. Define fine polishing and polishing cloths.
K6. Define etching glass ware.
K7. Explain etching time and temperatures.

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify etching requirements according international standards given in the ASTM.
- Identify material specifications for etching according to metallographic standard requirements
- Identify etching chemicals and glass ware according to metallographic standard
- Interpret etching according to metallographic standard for different metals.
- Assemble electrolytic etching machine connections according to metallographic standard

Tools and Equipment

- Mounting tools & equipment
- Etching chemicals
- Glass wares

CS 2 Perform Microscopic Examination Operation

Overview: This competency standard covers the skills and knowledge required to Perform Fine microscopic examination operations of Metallic materials. Also determine Microscopic Examination Operation requirements, Check the operations of equipment.

Competency Units/Task	Performance Criteria/Step
Perform Leveling Operation	**P1.** Levelling the specimen by using on-toxic, non-staining, reusable modeling compound. **P2.** Put compound at bottom of specimen. **P3.** Cover the both ends of specimen with tissue to avoid stain on surface. **P4.** Apply small load with press.
Perform Microscopic Examination Operation	**P1.** Place the specimen onto the stage of Metallurgical microscope. **P2.** Power on source light and adjust its intensity. **P3.** Select the magnification power by adjusting eye piece number (50 to 1000X) **P4.** Adjusting the stage with the help of nobs to make clear microstructure of specimen. **P5.** Capture the picture of microstructure with the help of camera. **P6.** Save the image in computer for further study.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- **K1.** Define purpose of Metallography.
- **K2.** Describe safety symbols.
- **K3.** Explain metallographic technique
- **K4.** Explain microscopic examination.
- **K5.** Explain microstructure of steel, cast iron and Al, cu.

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify metallographic requirements according international standards given in the ASTM.
- Identify material specifications for rough and fine polishing according to metallographic standard requirements
- Interpret microscopic examination according to metallographic standard
- Assemble leveling press machine according to metallographic standard

Tools and Equipment

- ❖ Measuring devices
- ❖ Hand held calculator
- ❖ Metallurgical Microscope

2. QC Inspector-II

CS 3 Conduct process and product capability analysis

Overview: This competency standard covers the skills and knowledge required to Read and understand Process capability analysis, control limits and sampling plans

Competency Units/Task	Performance Criteria/Step
CU1. Conduct process capability studies	**P1.** Determine procedure for conducting capability study **P2.** Prepare instructions for personnel conducting trial run **P3.** Analyse data from trial run **P4.** Calculate process capability **P5.** Estimate possible number of product defects from a particular process **P6.** Determine optimum target mean to suit process capability data **P7.** Prepare reports listing various options from process capability studies **P8.** Design specifications based on an analysis of data are recommended.
CU2. Set control limits	**P1.** Calculate control limits for sample/subgroup average, range and standard deviation. **P2.** Calculate warning limits for subgroup average, range and standard deviation **P3.** Determine course of action resulting from out of control situation **P4.** Document course of action to standard operating procedure
CU3. Select sampling plans	**P1.** Select appropriate sampling plan to suit production schedule **P2.** Determine acceptable quality limits taking into account specified producer and consumer risks. **P3.** Document Sampling plan **P4.** Document implementation strategy

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding

required to carry out tasks covered in this competency standard. This includes the knowledge of:

K1. Describe the process
K2. Explain the procedures for conducting process capability studies
K3. Define the data used to calculate the process capability
K4. Define the procedures for estimating the possible number of product defects
K5. Describe options for improving the process
K6. Explain the procedures for determining the optimum target mean
K7. Define the procedures for setting control limits
K8. Describe numerical operations and calculations/formulae for process capability, control limits and other outcomes within the scope of this unit
K9. Describe the procedures for setting warning limits
K10. Define the concept of 'out of control' situations
K11. Define the action to be taken when an 'out of control' situation is detected
K12. Describe the procedures for documenting 'out of control' situations
K13. Define the acceptable level of quality
K14. Define a variety of sampling plans and their application
K15. Describe the sampling plan to be applied to a given situation
K16. Explain the reasons for selecting the chosen plan
K17. Describe the acceptable quality limits
K18. Define the risks associated with identifying acceptable quality limits for the producer and customer
K19. Explain the procedures for documenting and implementing sampling plans
K20. Define hazards and control measures
K21. Explain use and application of personal protective equipment
K22. Define safe work practices and procedures

Critical Evidence(s) Required:

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Select a process for improvement
- Perform process capability analysis of required process
- Calculation of control limits
- Calculation of warning limits

Tools and Equipment:

- Desktop Computer/laptop

CS 4 Perform advanced statistical quality control

Overview: This competency standard covers the skills and knowledge required to Read and understand the implementation of 6 quality tools and construction of control charts.

Competency Units/Task	Performance Criteria/Step
CU1. Understand sampling and sample size	**P1. Differentiate continuous and variable data** **P2. Identify population** **P3. Determine confidence level** **P4. Understand various sampling techniques** **P5. Understand sample size**
CU2. Implement six Quality tools	**P1. Understand cause and effect diagram** **P2. Understand check sheet template** **P3. Understand control charts** **P4. Understand histogram** **P5. Understand pareto chart** **P6. Understand scattered diagram** **P7. Implement required tool on given data**
CU3. Construct control charts	**P1. Identify the key product parameters to be controlled.** **P2. Understand the types of control charts** **P3. Construction of control charts including upper control limits and lower control limits from sample data as per requirement** **P4. Identify special and common causes of quality variation** **P5. Calculate sigma level 1,2 & 3.**

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

K1. Define process parameters
K2. Explain the procedures for constructing control charts and determining control limits from sample data
K3. Define sampling
K4. Define sample size
K5. Explain 6 Quality tools
K6. Describe population dispersion in terms of 1, 2 and 3 sigma limits
K7. Explain safe workplace practices

Critical Evidence(s) Required:

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify process parameters
- Calculate variance
- Measure sigma values

Tools and Equipment:

- ❖ Desktop Computer/laptop

3. Continuous casting machine (CCM) operator

CS 5 Maintain safe work environment

Overview: This competency standard covers the skills and knowledge required to identify hazards/risks on plant, prevent source of ignition, conduct regular cleaning and maintenance of equipment.

Competency Units	Performance Criteria
CU1. Identify hazards/risks on plant	**P1.** Handle physical hazards due conveyor system/ material handling **P2.** Handle escape dust of raw material at charging area **P3.** Use PPEs from fall of material/stacking failure **P4.** Carry out electrocution/electrical Hazard drills
CU2. Prevent source of Ignition	**P5.** Identify ignition source points in plant **P6.** Identify no go areas without PPEs **P7.** Avoid fire at Lubrication, Hydraulic & fuel oil installations **P8.** Arrange fire safety equipments at fuel storage area
CU3. Conduct regular cleaning of equipment	**P9.** Clean the equipments and process auxiliaries regularly to remove any dust, moisture, waste material **P10.** Open the equipment and clean the internal parts **P11.** Maintain hydraulic systems and its actuators **P12.** Perform greasing of all moving parts in the casting machine **P13.** Clean the work area under process and create safe working environment

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- Labels , signs & colours used as indicators
- Knowledge sort and store various types of tools, equipment, material etc.
- Knowledge to identify various types of waste products
- understand the impact of waste/ dirt/ dust/unwanted substances on the process
- best ways of cleaning & waste disposal

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify welding requirements according to welding symbols given in the manufacturing drawings
- Identify material specifications according to manufacturing drawing
- Identify bill of material (BOM) according to manufacturing drawing
- Interpret dimensional tolerances according to manufacturing drawing
- Assemble and tack weld parts according to manufacturing drawing

Tools and Equipment

- Layout tools
- Steel-toed footwear
- Hard hat
- Fall protection, and other applicable PPE
- Site emergency response plan
- Fire extinguishers
- Safety gloves
- Appropriate safety glasses

CS 6 Prepare tundish for casting

Overview: This competency standard covers the skills and knowledge required to Read and Understand to prepare lining of heat resistance board, Install fire bricks lining, Install tundish on CCM.

Competency Units	Performance Criteria
CU1. Prepare lining of heat resistance board	**P1.** Place tundish nozzles at designated points **P2.** Carry out pre-heating of tundish shell **P3.** Cut heat resistance board pieces as per requirement **P4.** Install heat resistance board cuttings in tundish without leaving any gap between the pieces **P5.** Perform heating/drying of installed heat resistance board lining
CU2. Install fire bricks lining	**P6.** Carry out stacking of fire bricks along the walls and base of tundish shell

	P7. Perform repairing of tundish and nozzles with refractory clay **P8.** Carry out the post heating of tundish
CU3. Install tundish on CCM	**P9.** Carry out lifting of tundish with over head crane **P10.** Place the tundish 80-90 feet above the ground level on top of casting machine **P11.** Carryout centering of tundish trolley through motor

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- Knowledge of refractory lining of tundish
- Knowledge in Lancing operations in tundish
- Knowledge in Preheating the tundish Nozzle and Safe Practices
- Knowledge of heat resistance board

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify welding requirements according to welding symbols given in the manufacturing drawings
- Identify material specifications according to manufacturing drawing
- Identify bill of material (BOM) according to manufacturing drawing
- Interpret dimensional tolerances according to manufacturing drawing
- Assemble and tack weld parts according to manufacturing drawing

Tools and Equipment

- Tundish cars
- Tundish nozzles
- Fire clay
- Refractory bricks
- Heat resistance tundish board
- Wood
- Heaters
- Overhead crane

CS 7 Prepare mold for casting

Overview: This competency standard covers the skills and knowledge required to Read and Understand to perform cleaning of mold parts, install mold on CCM, perform post installation checks.

Competency Units	Performance Criteria
CU4. Perform cleaning of mold parts	**P1.** Carry out cleaning of mold tube **P2.** Carry out cleaning of mold cooling jacket **P3.** Perform foot ring spray nozzle cleaning **P4.** Carry out cleaning of mold spares **P5.** Perform slag box cleaning and changing
CU5. Install mold on CCM	**P6.** Carry out inspection of mold coating **P7.** Assemble parts of mold body **P8.** Place mold body on oscillating platform on casting machine **P9.** Prepare launder and mold jacket safety cover **P10.** Put dummy bar in mold tube by skid bank operator **P11.** Apply dummy bar packing/sealing oil
CU6. Perform post-installation checks	**P12.** Check leakage of water in mold body **P13.** Check seal rings placement in case of leakage **P14.** Check primary cooling water pressure inlet and outlet **P15.** Check movement of dummy bar

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- Knowledge in Launder Operation
- Knowledge in Following SOP of Powder Preparation and usage
- Knowledge in Slag fishing
- Knowledge in Dummy Bar Sealing
- Knowledge of Dummy bar operation
- Knowledge of Sealants/Lubrication
- Knowledge in Manual controlling the level of liquid metal in mould tube

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify welding requirements according to welding symbols given in the manufacturing drawings
- Identify material specifications according to manufacturing drawing
- Identify bill of material (BOM) according to manufacturing drawing
- Interpret dimensional tolerances according to manufacturing drawing
- Assemble and tack weld parts according to manufacturing drawing

Tools and Equipment

- Oscillating mold
- Dummy bar
- Launders
- Mold tube
- Foot ring
- Lubrication
- Sealants

CS 8 Carry out casting process

Overview: This competency standard covers the skills and knowledge required to Read and Understand to Perform Pre-Casting steps, Carry out Pouring of molten metal, Perform Cooling Process, Carry out Withdrawal (Extraction) process, Perform Post-Casting Operation.

Competency Units	Performance Criteria
CU7. Perform Pre-Casting steps	**P1.** Get feedback from reliever at the start of shift **P2.** Coordinate with melting section to receive molten metal on CCM platform **P3.** Coordinate with the rolling mill, if direct rolling is required **P4.** Inform all the related sections if any abnormality arises **P5.** Carry out placement of slide gate ladle filled with molten metal on CCM platform **P6.** Take temperature of metal in slide gate ladle **P7.** Perform purging of the slide gate ladle, if required **P8.** Add slag former in the ladle to retain heat

CU8. Carry out Pouring of molten metal	**P9.** Open the slide gate ladle nozzle as per SOPs **P10.** Perform oxygen lancing to open the nozle, if required **P11.** Pour molten metal into the tundish **P12.** Open tundish nozzle as level reaches 3/4th **P13.** Open all tundish nozzles sequentially **P14.** Direct the flow of the material into the water cooled mold **P15.** Carry out continuous supply of molten metal in the mold to keep the process going **P16.** Perform continuous mold oscillation in order to prevent sticking with the casting **P17.** Add casting powder (flux) to the molten metal in mold to prevent sticking **P18.** Ensure molten metal grips the end of dummy bar **P19.** Remove slag continuously throughout casting process
CU9. Perform Cooling Process	**P20.** Open emergency valve to maintain mold water pressure **P21.** Carry out continuous heat extraction by the water-cooled jacket surrounding the mold for primary cooling **P22.** Take casting out of the mold to cool its surface by water spray **P23.** Use specific set of rollers to move the metal casting outside of the mold **P24.** Adjust water spray speed at the foot ring for secondary cooling
CU10. Carry out Withdrawal (Extraction) process	**P25.** Send down the semi-solid metal grid through the strand guide **P26.** Use withdrawal set of rollers to bend the grid **P27.** Carry out grid withdrawal at control speed until the production length is met **P28.** Use center tangent set of rollers to direct the grid **P29.** Send the fully solidified grids through straightener rolls to achieve final dimensions **P30.** Cut head of billet using gas cutter/shear machine **P31.** Control casting speed using knob once dummy bar is disconnected

CU11. Perform Post-Casting Operation	**P32.** Report level of molten metal in ladle to melting section by using lancing pipe **P33.** Report tundish level to in-charge during casting **P34.** Push billet to cooling bed/rolling mill as per requirement **P35.** Stack/wound finished grids as per requirement **P36.** Report and give feedback to his coming reliever at the end of shift

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- Knowledge in Start & Operating the machine smoothly for Quality Casting of Billets
- Knowledge in Dummy Bar Sealing
- Knowledge in Launder Operation
- Knowledge if Powder Preparation and usage
- Knowledge in Slag removing
- Knowledge in Lancing the tundish nozzle
- Knowledge of SOPs in case of any failure and restart again.
- Knowledge in Lancing operations in tundish and ladle Nozzle opening
- Knowledge in Manual controlling the level of liquid metal in mould tube
- Maintaining and setting the tundish nozzle, mould tube, Oiler plate and Launder in good condition
- Knowledge in Preheating the tundish Nozzle and Safe Practices
- Knowledge in Sample taking from the molten metal sample taking and safe work practices
- Mold level Control, by means of strand's speed regulation or nozzle regulation
- Strand cooling controls based on metallurgical recipes
- Breakout prediction

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify welding requirements according to welding symbols given in the manufacturing drawings
- Identify material specifications according to manufacturing drawing

- Identify bill of material (BOM) according to manufacturing drawing
- Interpret dimensional tolerances according to manufacturing drawing
- Assemble and tack weld parts according to manufacturing drawing

Tools and Equipment

- Ladle turret
- Tundish cars
- Oscillating mold
- Withdrawal units
- Straightening machines
- Dummy bar
- Roller tables
- Cooling bed and transfer

4. Non-destructive testing technician

CS 9 Perform dye penetrant, magnetic and ultrasonic test

Overview: This competency standard covers the skills and knowledge required to Determine the flaws in specimen using dye penetrant technique, Determine the flaws of specimen metallic specimen and Determine the flaws of given specimen using magnetic particle testing equipment

Competency Units	Performance Criteria
CU1. Determine the surface defects of specimen using dye penetrant technique	**P1.** Perform pre-cleaning of samples. **P2.** Apply dye penetrant. **P3.** Remove the excess dye penetrant. **P4.** Apply the developer. **P5.** Inspect the specimen for defects. **P6.** Interpret the results.
CU2. Determine the defects of specimen by	**P1.** Perform pre-cleaning of samples. **P2.** Inspect the working mode of the equipment **P3.** Switch ON the ultrasonic testing equipment

using ultrasonic technique	**P4.** Calibrate the ultrasonic equipment with respect to calibration block **P5.** Select the probe according to the specimen **P6.** Apply couplant gel on the given specimen **P7.** Test the given specimen **P8.** Observe the peaks. **P9.** Interpret the peaks and record the results
CU3. Determine the defects of given ferromagnetic specimen using magnetic particle testing technique	**P1.** Perform pre-cleaning of samples. **P2.** Inspect the working mode of the equipment **P3.** Apply magnetic field to the specimen **P4.** Apply ferromagnetic medium with respect to type of test (Dry or Wet) **P5.** Remove the excess ferromagnetic medium. **P6.** Interpret the indications. **P7.** Evaluated the results.
CU4. Determine the defects of given metallic specimen by using eddy current testing technique	**P1.** Perform pre-cleaning of samples. **P2.** Inspect the working mode of the equipment **P3.** Place the specimen on insulator table **P4.** Test the specimen **P5.** Note the values of resultant current of the coil **P6.** Interpret and record the results
CU5. Determine the defects of given specimen by radiography technique	**P1.** Perform pre-cleaning of samples. **P2.** Inspect the working mode of the radiographic equipment **P3.** Inspect all safety facilities as per standard **P4.** Set the position of photographic film **P5.** Place the specimen at specific position in front of photographic film **P6.** Pass the rays through the specimen **P7.** Develop the photographic film **P8.** Observe the image of specimen **P9.** Record the results

Knowledge & Understanding

K1. Define Non-destructive test.
K2. Describe different types of defects of engineering materials.
K3. Describe procedure of dye penetrant technique.
K4. Describe limitations of dye penetrant test.
K5. Enlist applications of dye penetrant test.
K6. Describe the test procedure of ultrasonic testing.
K7. Enlist applications of ultrasonic testing.
K8. Describe test procedure of magnetic particle test.
K9. Enlist applications of magnetic particle test.
K10. Enlist limitations of magnetic particle test.
K11. Describe test procedure of eddy current inspection.
K12. Describe applications of eddy current inspection.
K13. Describe test procedure of radiography.
K14. Describe applications of radiography.

Tool and Equipment

- Relevant Testing Apparatus
- Relevant safety tools
- Relevant instruments

CS 10 Perform radiography and eddy current test

Overview: This competency standard covers the skills and knowledge required to Determine the flaws in specimen using dye penetrant technique, Determine the flaws of specimen metallic specimen and Determine the flaws of given specimen using magnetic particle testing equipment

Competency Units	Performance Criteria
CU1. Determine the defects of given metallic specimen by using eddy	**P7.** Perform pre-cleaning of samples. **P8.** Inspect the working mode of the equipment **P9.** Place the specimen on insulator table **P10.** Test the specimen **P11.** Note the values of resultant current of the coil **P12.** Interpret and record the results

current testing technique	
CU2. Determine the defects of given specimen by radiography technique	**P10.** Perform pre-cleaning of samples. **P11.** Inspect the working mode of the radiographic equipment **P12.** Inspect all safety facilities as per standard **P13.** Set the position of photographic film **P14.** Place the specimen at specific position in front of photographic film **P15.** Pass the rays through the specimen **P16.** Develop the photographic film **P17.** Observe the image of specimen **P18.** Record the results

Knowledge & Understanding

K15. Define Non-destructive test.
K16. Describe different types of defects of engineering materials.
K17. Describe procedure of dye penetrant technique.
K18. Describe limitations of dye penetrant test.
K19. Enlist applications of dye penetrant test.
K20. Describe the test procedure of ultrasonic testing.
K21. Enlist applications of ultrasonic testing.
K22. Describe test procedure of magnetic particle test.
K23. Enlist applications of magnetic particle test.
K24. Enlist limitations of magnetic particle test.
K25. Describe test procedure of eddy current inspection.
K26. Describe applications of eddy current inspection.
K27. Describe test procedure of radiography.
K28. Describe applications of radiography.

Tool and Equipment

- Relevant Testing Apparatus
- Relevant safety tools
- Relevant instruments

5. Chemical assaying technician

CS 11 Perform handheld XRF analysis

Overview: This competency standard covers the skills and knowledge required to prepare the sample, perform calibration and standardization, and to perform the test of XRF analysis.

Competency Units/Task	Performance Criteria/Step
CU1. Prepare the Sample	**P1.** Clean the surface of sample with emery paper to remove rust **P2.** Make the surface of sample smooth and flat **P3.** Resin the sample with water **P4.** Clean with alcohol
CU2. Perform Calibration and standardization	**P1.** Charge the external battery **P2.** Energize the XRF gun **P3.** Open the analytical software of the XRF gun **P4.** Clean calibration block with alcohol **P5.** Apply the lubricant on the calibration block **P6.** Place XRF gun on calibration block **P7.** Press the XRF gun trigger to start calibration **P8.** Note and compare the results with calibration certificate **P9.** Place the XRF gun at proper station when not in use
CU3. Perform the Test	**P1.** Charge the extra batteries of gun **P2.** Energized the XRF gun **P3.** Open the analytical software of the XRF gun **P4.** Apply the lubricant on the sample surface **P5.** Place the XRF gun on the sample surface **P6.** Press the XRF gun trigger to start analysis **P7.** Note and evaluate the results **P8.** Print the results **P9.** Shut down the software

	P10. Place the XRF gun at proper station after the test

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

K1. Define spectrum.
K2. Describe the different parts of electromagnetic radiation spectrum.
K3. Describe principle of X rays production.
K4. Describe the properties of X rays.
K5. Describe Calibration.
K6. Describe Importance of calibration.
K7. Describe different standards of steel grades
K8. Describe the principle of XRF analysis.
K9. Describe different parts of XRF gun.

CS 12 Perform optical emission spectroscopic analysis

Overview: This competency standard covers the skills and knowledge required to prepare the sample, Perform calibration and standardization and to Perform Optical Emission test.

Competency Units/Task	Performance Criteria/Step
CU1. Prepare the Sample	**P1.** Cut the sample according to the size of sample stand **P2.** Clean the surface of sample with emery paper to remove rust **P3.** Make the surface of sample smooth and flat **P4.** Resin the sample with water **P5.** Clean with alcohol
CU2. Perform Calibration and standardization	**P1.** Energize the Optical Emission Spectrometer and warmup as per required time **P2.** Set the pressure of inert gas (Argon) **P3.** Switch ON the filter machine

	P4. Power ON the computer and open analytical software **P5.** Clean the electrode chamber with metal wire brush **P6.** Place the calibration block in electrode chamber **P7.** Clamp the calibration block **P8.** Start the spark for specific time **P9.** Note and compare the results with calibration certificate **P10.** Remove the calibration block and place at specific position
CU3. Perform the Test	**P1.** Ensure the pressure of gas (Argon) **P2.** Ensure the working of filter machine **P3.** Open the analytical software **P4.** Clean the electrode chamber with metal wire brush **P5.** Place the sample in electrode chamber **P6.** Clamp the sample **P7.** Start the spark for specific time **P8.** Note and evaluate the results **P9.** print the results **P10.** Shut down the software **P11.** Switch off the filter machine **P12.** Remove the sample and store as per requirements

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

K1. Define spark.
K2. Define ionization.
K3. Describe ionization of gases.
K4. Describe the properties of inert gases.
K5. Describe purpose of optical spectrometry.
K6. Describe different parts of optical emission spectrometer.
K7. Describe the working principle of optical emission spectrometer.

CS 13 Perform carbon and Sulphur detection analysis

Overview: This competency standard covers the skills and knowledge required to prepare the sample, Perform Calibration and standardization and to perform the test of Carbon and Sulphur Detection.

Competency Units/Task	Performance Criteria/Step
CU1. Prepare the sample	**P1.** Select the part of sample for drilling to get turnings (in case of large sample) **P2.** Clean the surface (selected surface in case of large sample) of sample with emery paper to remove rust **P3.** Clean the surface with alcohol **P4.** Drill in the sample to make turnings **P5.** Clean the turnings with alcohol
CU2. Perform Calibration and standardization	**P1.** Switch on the carbon sulfur detection machine. **P2.** Energize the catalyst up to proper temperature. **P3.** Connect the gases nozzles to gases supply (Oxygen & Nitrogen) **P4.** Place the calibration material in ceramic crucible. **P5.** Place the crucible on crucible stand. **P6.** Start the calibration by selecting calibration option **P7.** Note and compare the results with calibration certificate
CU3. Perform the Test	**P1.** Switch on the carbon sulfur detection machine. **P2.** Energize the catalyst up to proper temperature. **P3.** Enter the sample ID and weight in software **P4.** Connect the gases nozzles to gases supply (Oxygen & Nitrogen) **P5.** Place the sample in ceramic crucible. **P6.** Place the crucible on crucible stand. **P7.** Start the analysis **P8.** Note the results **P9.** Print the results **P10.** Disconnect the gas supply to the machine

	P11. Switch off the machine

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

Describe the effect of carbon and sulfur contents on ferrous materials.
Describe the effect of carbon and sulfur contents on Non-ferrous materials.
Describe the concept of infrared detectors.
Describe type and importance of absorber used for carbon dioxide gas in CS detector.
Describe type and importance of absorber used for sulfur dioxide gas in CS detector.
Describe different types of accelerators used during CS detection analysis.
Describe different parts of CS detector.
Describe working principle of CS detector.

6. Surface Coating technician-II

CS 14 Perform Vapor Deposition Coatings (PVD)

Overview: This competency standard covers the skills and knowledge required to perform Vapor Deposition coating (PVD) of steel materials and observing operational sequence and parameters.

Competency Units/Task	Performance Criteria/Step
CU1. Perform cataloging	**P1.** Perform proper documentation of the initial conditions of Specimen and recognize its identity. **P2.** Adopt standard safety practice and procedure for handling. **P3.** Prepare job layout according to process requirements
CU2. Perform Cleaning Operation	**P1.** Identify the Cleaning process as per requirement of standards.

	P2. Adopt standard safety practice and procedure for chemical handling. **P3.** Prepare degreasing cleaning solution where steel is treated with CCL4 solution which removes common dirt and oils. **P4.** Place specimen in the solution for specific time in ultrasonic bath then remove and rinsing with water. **P5.** Prepare chemical cleaning solution where the surface rust and scales are removed by using acetone solution. **P6.** Place specimen in the solution for specific time in ultrasonic bath then remove and rinsing with water. **P7.** Prepare cleaning solution where the surface oxides are removed by using cleano gel. **P8.** Place specimen in the solution for specific time in ultrasonic bath with agitation then rising with water. **P9.** Remove the specimen from bath and ready for next step.
CU5. Perform Drying Operation	**P1.** Place specimen in the tray. **P2.** Switch on hot air dryer use for drying . **P3.** Remove specimen after specific time for drying.
CU3. Set up Jigs & Fixture	**P1.** Adjust C plate length according to specimen height. **P2.** Adopt standard safety practice and procedure for handling process. **P3.** Use standard holder or fixture for specimen. **P4.** Hang the specimen in holders with S.S wires. **P5.** Clean the Carosole with cold compress air. **P6.** Clamping and tightening the holders in Carosole. **P7.** Lift the Carosole with lifter and place in chamber.
CU4. Perform Coating Operation	**P1.** Pre heat the chamber with open door at 120C for 30-60 min. **P2.** Clean the door, chamber and Carosole with vacuum cleaner.

	P3. Clean the door sealing with alcohol then apply vacuum sealing gel. **P4.** Close the door of machine. **P5.** Select the required recipe or parameters. **P6.** Start the coating machine, coating time depends upon type and thickness of coating. **P7.** After coating finished wait for cooling down of chamber. **P8.** Open door and take out Carosole with lifter. **P9.** Clean the specimen with cold compress air.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- **K1.** Define purpose of PVD coating.
- **K2.** Describe safety symbols for acid chemical.
- **K3.** Explain PVD coating techniques
- **K4.** Define General coating thickness ranges
- **K5.** Define cleaning types.
- **K6.** Define PVD coating materials.
- **K7.** Explain Coatingtime and temperatures.
- **K8.** Explain cleaning steps

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify PVD coating requirements according international standards given in the ASTM.
- Identify cleaning specifications for anodizing according to standard requirements
- Identify raw materials according to standard.
- Interpret coating examination according to standard.
- Assemble cleaning and PVD coating according to standard.

Tools and Equipment

- ❖ Drying tools & equipment

- PVD coating tools & equipment
- Cleaning tools & equipment
- Carosole & equipment
- Measuring devices
- Hand held calculator
- Chemical & Glass wares

CS 15 Perform Vapor Deposition Coatings (CVD)

Overview: This competency standard covers the skills and knowledge required to perform Vapor Deposition coating (CVD) of steel materials and observing operational sequence and parameters.

Competency Units/Task	Performance Criteria/Step
CU1. Perform cataloging	**P1.** Perform proper documentation of the initial conditions of Specimen and recognize its identity. **P2.** Adopt standard safety practice and procedure for handling. **P3.** Prepare job layout according to process requirements
CU2. Perform Cleaning Operation	**P1.** Identify the Cleaning process as per requirement of standards. **P2.** Adopt standard safety practice and procedure for chemical handling. **P3.** Prepare degreasing cleaning solution where steel is treated with CCL4 solution which removes common dirt and oils. **P4.** Place specimen in the solution for specific time in ultrasonic bath then remove and rinsing with water. **P5.** Prepare chemical cleaning solution where the surface rust and scales are removed by using acetone solution.

	P6. Place specimen in the solution for specific time in ultrasonic bath then remove and rinsing with water. **P7.** Prepare cleaning solution where the surface oxides are removed by using cleano gel. **P8.** Place specimen in the solution for specific time in ultrasonic bath with agitation then rising with water. **P9.** Remove the specimen from bath and ready for next step.
CU5. Perform Drying Operation	**P1.** Place specimen in the tray. **P2.** Switch on hot air dryer use for drying. **P3.** Remove specimen after specific time for drying.
CU3. Set up Jigs & Fixture	**P1.** Adjust fixtures according to specimen height. **P2.** Adopt standard safety practice and procedure for handling process. **P3.** Use standard holder or fixture for specimen. **P4.** Hang the specimen in holders with S.S wires. **P5.** Clean the Fixtures with cold compress air. **P6.** Clamping and tightening the holders in fixtures. **P7.** Lift the Carosole with lifter and place in chamber.
CU4. Perform Coating Operation	**P1.** Pre heat the chamber with open door at 120C for 30-60 min. **P2.** Clean the door, chamber and Carosole with vacuum cleaner. **P3.** Clean the door sealing with alcohol then apply vacuum sealing gel. **P4.** Close the door of machine. **P5.** Select the required recipe or parameters. **P6.** Start the coating machine, coating time depends upon type and thickness of coating. **P7.** After coating finished wait for cooling down of chamber. **P8.** Open door and take out fixture with lifter. **P9.** Clean the specimen with cold compress air.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

K9. Define purpose of CVD coating.

K10. Describe safety symbols for acid chemical.

K11. Explain CVD coating techniques

K12. Define General coating thickness ranges

K13. Define cleaning types.

K14. Define CVD coating materials.

K15. Explain Coating time and temperatures.

K16. Explain cleaning steps.

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify CVD coating requirements according international standards given in the ASTM.
- Identify cleaning specifications for anodizing according to standard requirements
- Identify raw materials according to standard.
- Interpret coating examination according to standard.
- Assemble cleaning and CVD coating according to standard.

Tools and Equipment

- ❖ Drying tools & equipment
- ❖ CVD coating tools & equipment
- ❖ Cleaning tools & equipment
- ❖ Carosole & equipment
- ❖ Measuring devices
- ❖ Hand held calculator
- ❖ Chemical & Glass wares

CS 16 Perform Thermal Spray Coatings (Plasma)

Overview: This competency standard covers the skills and knowledge required to perform Thermal Spray Coatings (Plasma) of steel materials and observing operational sequence and parameters.

Competency Units/Task	Performance Criteria/Step
CU1. Perform cataloging	**P1.** Perform proper documentation of the initial conditions of Specimen and recognize its identity. **P2.** Adopt standard safety practice and procedure for handling. **P3.** Prepare job layout according to process requirements
CU2. Perform ultrasonic Cleaning Operation	**P1.** Identify the Cleaning process as per requirement of standards. **P2.** Adopt standard safety practice and procedure for chemical handling. **P3.** Prepare degreasing cleaning solution where steel is treated with CCL4 solution which removes common dirt and oils. **P4.** Place specimen in the solution for specific time in ultrasonic bath then remove and rinsing with water. **P5.** Prepare chemical cleaning solution where the surface rust and scales are removed by using acetone solution. **P6.** Place specimen in the solution for specific time in ultrasonic bath then remove and rinsing with water. **P7.** Prepare cleaning solution where the surface oxides are removed by using cleano gel. **P8.** Place specimen in the solution for specific time in ultrasonic bath with agitation then rising with water. **P9.** Remove the specimen from bath and ready for next step.
CU. Perform Grit Blasting Operation	**P1.** Add grit of required mesh size in the blasting machine. **P2.** Adopt standard safety practice and procedure for handling. **P3.** Place the sample in chamber. **P4.** Set angle 90 or 45 degree for blasting depends upon type of materials. **P5.** Blast according to standard time. **P6.** Remove specimen from chamber. **P7.** Clean the specimen with compress air. **P8.** Also use alcohol for cleaning.

CU. Perform Masking Operation	**P1.** Place specimen in the tray. **P2.** Apply masking solution with help of brush on the safe from coating. **P3.** Let it dry or use compress air for drying. **P4.** Masking may also be use. **P5.** Remove specimen after specific time for drying.
CU. Set up Jigs & Fixture	**P1.** Adjust holder according to specimen height, width. **P2.** Adopt standard safety practice and procedure for handling process. **P3.** Use standard holder or fixture for specimen. **P4.** Grip the specimen in holders. **P5.** Clean the Fixtures with cold compress air. **P6.** Clamping and tightening the holders.
CU. Set up Plasma coating system	**P1.** Connect primary (Ar) and secondary (H2) gases and set required pressure. **P2.** Set the temperature max 18C of chiller and connect hoses to gun and system. **P3.** Set air pressure of compressor and connect to gun and system. **P4.** Pre heat coating powder in oven then mix in mixing machine. **P5.** Put powder in system hopper and set it flow rate. **P6.** Set coating current from 500-700 amps.
CU. Perform Coating Operation	**P1.** Perform ignition test to check parameters of plasma system. **P2.** Switch on holding machine to rotate the specimen. **P3.** Fix in holder and Set distance from specimen of plasma coating gun. **P4.** Open primary gas and adjust current as per coating standards. **P5.** Pre heat the specimen around 120C. **P6.** Open secondary gas to achieve required temperature. **P7.** Switch on powder feeder for coating. **P8.** Remove specimen from holder and cool with compress air.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge

of:

K17. Define purpose of Plasma coating.
K18. Describe safety symbols for acid chemical.
K19. Explain Plasma coating techniques
K20. Define General coating thickness ranges
K21. Define cleaning types.
K22. Define Plasma coating materials.
K23. Explain Coating time and temperatures.
K24. Explain cleaning steps.

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify Plasma coating requirements according international standards given in the ASTM.
- Identify cleaning specifications for plasma according to standard requirements
- Identify raw materials according to standard.
- Interpret coating examination according to standard.
- Assemble cleaning and Plasma coating according to standard.

Tools and Equipment

- Drying tools & equipment
- Plasma coating tools & equipment
- Cleaning tools & equipment
- Carosole & equipment
- Measuring devices
- Hand held calculator
- Chemical & Glass wares

CS 17 Perform Thermal Spray Coatings (Electric Arc Value)

Overview: This competency standard covers the skills and knowledge required to perform Thermal Spray Coatings (Electric Arc Value) of steel materials and observing operational sequence and parameters.

Competency Units/Task	Performance Criteria/Step
CU1. Perform cataloging	**P4.** Perform proper documentation of the initial conditions of Specimen and recognize its identity. **P5.** Adopt standard safety practice and procedure for handling. **P6.** Prepare job layout according to process requirements
CU2. Perform ultrasonic Cleaning Operation	**P10.** Identify the Cleaning process as per requirement of standards. **P11.** Adopt standard safety practice and procedure for chemical handling. **P12.** Prepare degreasing cleaning solution where steel is treated with CCL4 solution which removes common dirt and oils. **P13.** Place specimen in the solution for specific time in ultrasonic bath then remove and rinsing with water. **P14.** Prepare chemical cleaning solution where the surface rust and scales are removed by using acetone solution. **P15.** Place specimen in the solution for specific time in ultrasonic bath then remove and rinsing with water. **P16.** Prepare cleaning solution where the surface oxides are removed by using cleano gel. **P17.** Place specimen in the solution for specific time in ultrasonic bath with agitation then rising with water. **P18.** Remove the specimen from bath and ready for next step.
CU. Perform Grit Blasting Operation	**P9.** Add grit of required mesh size in the blasting machine. **P10.** Adopt standard safety practice and procedure for handling. **P11.** Place the sample in chamber. **P12.** Set angle 90 or 45 degree for blasting depends upon type of materials. **P13.** Blast according to standard time. **P14.** Remove specimen from chamber. **P15.** Clean the specimen with compress air.

	P16. Also use alcohol for cleaning.
CU. Perform Masking Operation	**P6.** Place specimen in the tray. **P7.** Apply masking solution with help of brush on the safe from coating. **P8.** Let it dry or use compress air for drying. **P9.** Masking may also be use. **P10.** Remove specimen after specific time for drying.
CU. Set up Jigs & Fixture	**P7.** Adjust holder according to specimen height, width. **P8.** Adopt standard safety practice and procedure for handling process. **P9.** Use standard holder or fixture for specimen. **P10.** Grip the specimen in holders. **P11.** Clean the Fixtures with cold compress air. **P12.** Clamping and tightening the holders.
CU. Set up Plasma coating system	**P7.** Set air pressure of compressor and connect to gun and system. **P8.** Adjust gear box, voltage, current and speed of coating wire parameters of system. **P9.** Adjust the gun distance from specimen. **P10.** Assemble the coating wire spools.
CU. Perform Coating Operation	**P9.** Perform ignition test to check parameters of arc value system. **P10.** Switch on holding machine to rotate the specimen. **P11.** Fix in holder and Set distance from specimen of plasma coating gun. **P12.** Switch on arc system then adjust voltage and current as per coating standards. **P13.** Pre heat the specimen around 120C. **P14.** Switch on wire feeder for coating. **P15.** Remove specimen from holder and cool with compress air.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge

of:

K25. Define purpose of electric Arc coating.
K26. Describe safety symbols for acid chemical.
K27. Explain electric Arc coating techniques
K28. Define General coating thickness ranges
K29. Define cleaning types.
K30. Define Plasma coating materials.
K31. Explain Coating time and temperatures.
K32. Explain cleaning steps.

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify electric Arc coating requirements according international standards given in the ASTM.
- Identify cleaning specifications for electric Arc coating according to standard requirements
- Identify raw materials according to standard.
- Interpret coating examination according to standard.
- Assemble cleaning and electric Arc coating according to standard.

Tools and Equipment

- Drying tools & equipment
- electric Arc coating tools & equipment
- Cleaning tools & equipment
- holder & equipment
- Measuring devices
- Hand held calculator
- Chemical & Glass wares

CS 18 Perform Thermal Spray Coatings (LVOF)

Overview: This competency standard covers the skills and knowledge required to perform Thermal Spray Coatings (LVOF) of steel materials and observing operational sequence and parameters.

Competency Units/Task	Performance Criteria/Step
CU1. Perform cataloging	**P7.** Perform proper documentation of the initial conditions of Specimen and recognize its identity. **P8.** Adopt standard safety practice and procedure for handling. **P9.** Prepare job layout according to process requirements
CU2. Perform ultrasonic Cleaning Operation	**P19.** Identify the Cleaning process as per requirement of standards. **P20.** Adopt standard safety practice and procedure for chemical handling. **P21.** Prepare degreasing cleaning solution where steel is treated with CCL4 solution which removes common dirt and oils. **P22.** Place specimen in the solution for specific time in ultrasonic bath then remove and rinsing with water. **P23.** Prepare chemical cleaning solution where the surface rust and scales are removed by using acetone solution. **P24.** Place specimen in the solution for specific time in ultrasonic bath then remove and rinsing with water. **P25.** Prepare cleaning solution where the surface oxides are removed by using cleano gel. **P26.** Place specimen in the solution for specific time in ultrasonic bath with agitation then rising with water. **P27.** Remove the specimen from bath and ready for next step.
CU. Perform Grit Blasting Operation	**P17.** Add grit of required mesh size in the blasting machine. **P18.** Adopt standard safety practice and procedure for handling. **P19.** Place the sample in chamber. **P20.** Set angle 90 or 45 degree for blasting depends upon type of materials. **P21.** Blast according to standard time. **P22.** Remove specimen from chamber. **P23.** Clean the specimen with compress air. **P24.** Also use alcohol for cleaning.

CU. Perform Masking Operation	**P11.** Place specimen in the tray. **P12.** Apply masking solution with help of brush on the safe from coating. **P13.** Let it dry or use compress air for drying. **P14.** Masking may also be use. **P15.** Remove specimen after specific time for drying.
CU. Set up Jigs & Fixture	**P13.** Adjust holder according to specimen height, width. **P14.** Adopt standard safety practice and procedure for handling process. **P15.** Use standard holder or fixture for specimen. **P16.** Grip the specimen in holders. **P17.** Clean the Fixtures with cold compress air. **P18.** Clamping and tightening the holders.
CU. Set up Plasma coating system	**P11.** Connect primary (Ar and O2) and secondary (CH/H2) gases and set required flow rate. **P12.** Connect gas and air hoses to gun and system. **P13.** Set air pressure of compressor and connect to gun and system. **P14.** Pre heat coating powder in oven then mix in mixing machine. **P15.** Put powder in system hopper and set it flow rate.
CU. Perform Coating Operation	**P16.** Perform ignition test to check parameters of LVOF system. **P17.** Switch on holding machine to rotate the specimen. **P18.** Fix in holder and Set distance from specimen of LVOF coating gun. **P19.** Open primary gas to adjust ignition. **P20.** Pre heat the specimen around 120C. **P21.** Open secondary gas to achieve required temperature. **P22.** Switch on powder feeder for coating. **P23.** Remove specimen from holder and cool with compress air.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

K33. Define purpose of LVOF coating.

K34. Describe safety symbols for acid chemical.

K35. Explain LVOF coating techniques

K36. Define General coating thickness ranges

K37. Define cleaning types.

K38. Define LVOF coating materials.

K39. Explain Coating time and temperatures.

K40. Explain cleaning steps.

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify LVOF coating requirements according international standards given in the ASTM.
- Identify cleaning specifications for LVOF according to standard requirements
- Identify raw materials according to standard.
- Interpret coating examination according to standard.
- Assemble cleaning and LVOF coating according to standard.

Tools and Equipment

- Drying tools & equipment
- LVOF coating tools & equipment
- Cleaning tools & equipment
- Carosole & equipment
- Measuring devices
- Hand held calculator
- Chemical & Glass wares

7. Powder Metallurgy

CS 19 Handle Powder for required process

Overview: This competency standard covers the skills and knowledge required to identify the size, morphology and required weight of powder.

Competency Units/Task	Performance Criteria/Step
• **CU1.** Identify the particle size and morphology of powder.	**P1.** Ensure appropriate PPE to control chemical hazards. **P2.** Select the required particle size from the powder material supplier catalogue. **P3.** Select the powder morphology from the powder material supplier catalogue.
• **CU2.** Identify the required weight of powder and binder.	**P1.** Identify the density of actual metal **P2.** Identify the volume of the required part **P3.** Apply formula of density to calculate the required mass of powder. **P4.** Calculate the percentage of binder **P5.** Make use of weighing scale to weight the right amount of powder and binder. **P6.** Check the balance of scale and tare the reading to zero.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

K41. Describe different shapes and size of powder particles.

K42. Describe the density of metals.

K43. Describe the bulk density and apparent density of powders.

K44. Describe the percentage i-e 5% of 20, 20% of 5 etc .

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify the size and morphology of powder particles.
- Identify material specifications according to supplier catalogue.
- Analyze the relationship between volume of part and weight of powder.

Tools and Equipment

- ❖ Measuring devices
- ❖ Hand held calculator
- ❖ Safety mask, goggles and gloves

CS 20 Perform Consolidation Operation

Overview: This competency standard covers the skills and knowledge required for Mixing and Blending of powder with binder, and operation of Hydraulic Press.

Competency Units/Task	Performance Criteria/Step
CU1. Mix and Blend powder with binder	**P1.** Make use of mixer machine for proper mixing and blending of powder and binder. **P2.** Set the time of mixer, **P3.** Add powder with binder and start the mixer. **P4.** Fill the die with blended powder and close the die.
CU2. Operate Hydraulic Press	**P1.** Raise the front safety guard of press **P1.** Place the die filled with powder on the lower pressing face. **P2.** Lower the front safety guard. **P3.** Lower the pressing face by turning the screw handle clockwise. **P4.** Pull and push the pump handle to smoothly build up required pressure and hold the applied tonnage as long as required. **P5.** Release the pressure load. **P6.** Turn the screw handle anticlockwise to raise the pressing face. **P7.** Open the front safety guard and remove the die from hydraulic press. **P8.** Remove the green compact part from the die. **P9.** Analyze the density of green compact.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

K1. Describe packing of particle in pressed form
K2. Explain the effect of particles size distribution in pressing
K3. Describe the effect of binder amount
K4. Explain the operating principle of hydraulic press
K5. Explain the relative density

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify the percentage of binder and particles size distribution in pressed form
- Interpret the required pressure for pressing
- Identify all the safety and maintenance (oil leak, over heating and loss of pressure) of hydraulic press
- Identify the relative density of green compact to the apparent density of powder.

Tools and Equipment

- Layout tools
- Mixer Machine
- Hydraulic press

CS 21 Perform Sintering Operation

Overview: This competency standard covers the skills and knowledge required to set the furnace temperature and environmental conditions during sintering.

Competency Units/Task	Performance Criteria/Step
▪ **CU1.** Set the furnace temperature and time	**P1.** Identify the right furnace for sintering **P2.** Identify the controls of the furnace i-e water flow, heating chamber, heating coils, thermocouple and exhaust system **P3.** Set the furnace to desired temperature **P4.** Set the heating rate of the furnace **P5.** Set the holding time of the furnace

▪ **CU2.** Set the furnace environmental conditions.	**P1.** Identify the required inert gas for environmental conditions **P2.** Connect the gas cylinder with furnace **P3.** Set the proper pressure of gas **P4.** Connect the vacuum pump to the furnace heating chamber if vacuum is required
▪ **CU3.** Place the green compact in furnace	**P1.** Set the furnace to required environmental conditions **P2.** Place the green compact in the heating chamber of furnace **P3.** Close the door of heating chamber **P4.** Set ON the furnace power supply. **P5.** Note the time of start. **P6.** Take out the sintered par from the furnace after process completion.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

K1. Explain the effect of sintering

K2. Describe sintering furnaces

K3. Describe environmental conditions of furnace

K4. Define vacuum

K5. Define inert gases

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify the furnace controls for sintering
- Identify the readings of pressure on pressure gauge
- Identify the reading of vacuum on gauge
- Identify the gas in a gas cylinder

Tools and Equipment

- ❖ Gas cylinder
- ❖ Vacuum Pump
- ❖ Sintering Furnace

CS 22 Perform Finishing Operations

Overview: This competency standard covers the skills and knowledge required to identify the size tolerance and carry out machining of sintered components.

Competency Units/Task	Performance Criteria/Step
• **CU1.** Identify the size tolerance after sintering	**P1.** Inspect the component visually for any defects **P2.** Inspect the dimensions of the component by using measuring scale or devices **P3.** Separate the defected and non defected components.
• **CU2.** Carry out machining of sintered components	**P1.** Make use of grinder to refine tolerance **P2.** Make use of buffing operation to improve surface finish

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

K1. Define the size tolerance.

K2. Explain finishing operations

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify the shrinkage before and after sintering.
- Identify the required surface finish.

Tools and Equipment

- ❖ Measuring devices
- ❖ Hand held calculator
- ❖ Grinders
- ❖ Buffer / polisher

8. Entrepreneur

CS 23 Develop Project Proposal

Overview: This Competency Standard identifies the competencies required to develop entrepreneurial skills by Hotel manager, in accordance with the organization's approved guidelines and procedures. You will be expected to develop a business plan, collect information regarding revenue generation, develop a marketing plan and develop basic business communication skills. Your underpinning knowledge regarding entrepreneurial skills will be sufficient to provide you the basis for your work.

Competency Unit	Performance Criteria
1. Develop a business plan	P1. Conduct a market survey to collect following information Business Model Financials Equipment Estimation Revenue Generation Sources Marketing strategy Market Trends Overall Expenses P2. Select the best option in terms of cost, service, quality, sales, operational expenses P3. Compile the information collected through the market survey, in the business plan format
2. Develop a marketing plan	P1. Make a marketing plan for the service products, price, placement, promotion, people, packaging and positioning P2. Include the information of marketing plan in the business plan
3. Develop basic business communication skills	P1. Communicate with guests using effective communication skills P2. Use different modes of communication to communicate effectively e.g.: presentation, speaking, writing, listening, visual representation, reading etc. P3. Use specific business terms used in the market

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:

7Ps of marketing including product, price, placement, promotion, people, packaging and positioning

7Cs of business communication

Different modes of communication and their application in the industry

Specific business terms used in the industry

Available funding sources

Low interest loans to start a new business

Market survey and its tools e.g. : questionnaire, interview, observation etc,.

Market trends for specific product offering

State the main elements of business plan

Business plan format

Critical Evidence(s) Required

The candidate needs to produce following Critical Evidence(s) in order to be competent in this competency standard:

List 7Ps of marketing

List 7Cs of business communication

CS 24 Apply management and communication techniques

Overview: This unit describes the skills and knowledge required to provide a critical link between people, ideas and information at all stages in the project life cycle. It involves assisting the project team to plan communications, communicating information related to the project, and reviewing Communications. It applies to individuals who are project practitioners working in a project support role.

Competency Unit	Performance Criteria
Contribute to communications planning	P1. Identify, source and contribute relevant information requirements to initial project documentation P2. Contribute to developing and implementing the project communications plan and communications networks
Conduct information-management activities	P1. Act on and process project information according to agreed procedures as directed, to aid decision-making processes throughout project life cycle P2. Maintain information to ensure data is secure and auditable
Communicate project information	P1. Communicate with clients and other stakeholders during project using agreed networks, processes and procedures to ensure flow of necessary information P2. Ensure reports are prepared and released according to authorization, or produced for release by others P3.Seek information and advice from appropriate project authorities as required
Contribute to assessing effectiveness of communication	P1. Assist in ongoing review of project outcomes to determine effectiveness of communications-management activities P2. Report communications-management issues and responses to higher project authorities for application of lessons learned to future projects

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:

Summarize models and methods of communications management in context of project life cycle and other project management functions

Importance of managing risk by treating information securely

Methods of reviewing outcomes

Organizational policies and procedures relevant to this role in a specific context.

Critical Evidence(s) Required

The candidate needs to produce following Critical Evidence(s) in order to be competent in this competency standard:

Demonstrate managerial and communications plan for IoT product

Elaborate decision-making processes throughout project life cycle

CS 25 Create human resource management plan

Overview: This unit describes the skills and knowledge required to assist with aspects of human resources management of a project. It involves establishing human resource requirements, identifying the learning and development needs of people working on the project, facilitating these needs being met, and resolving conflict in the team. It applies to individuals who are project practitioners working in a project support role.

Competency Unit	Performance Criteria
Assist in determining human resource requirements	P1. Analyze work breakdown structure to determine human resource requirements P2. Prepare a skills analysis of project personnel against project task requirements P3. Assist in assigning responsibilities for achieving project deliverables
Contribute to establishing and maintaining productive team relationships	P1. Actively seek views and opinions of team members during task planning and implementation P2. Promote cooperation and effective activities, goals and relationships within team P3. Communicate with others using styles and methods appropriate to organizational standards, group expectations and desired outcomes P4. Communicate information and ideas to others in a logical, concise and understandable manner P5. Regularly seek feedback on nature and quality of work relationships, and use feedback as basis for own improvement and development
Assist with human resource monitoring	P1. Monitor work of project personnel against assigned roles and responsibilities within delegated authority levels P2. Monitor and control actual effort against project plan P3 Review skill levels against allocated tasks and recommend solutions, where required, to others

	P4. Advise others within delegated authority when assigned responsibilities are not met by project personnel P5. Undertake work in a multi-disciplinary environment according to established human resource management practices, plans, guidelines and procedures P6. Resolve conflict within delegated authority according to agreed dispute-resolution processes P7. Assist in offering human resource development opportunities to individuals with skill gaps
Contribute to evaluating human resource practices	P1. Contribute to assessing effectiveness of project human resources management P2. Document lessons learned to support continuous improvement processes

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:

Alternative project personnel engagement options

Job design principles and work breakdown structures

Learning and development approaches that can be incorporated into project life cycle

Methods for skills analysis

Project roles, responsibilities and reporting requirements for human resources.

Critical Evidence(s) Required

The candidate needs to produce following Critical Evidence(s) in order to be competent in this competency standard:

Produce the assigned roles and responsibilities of your team within delegated authority levels

Provide dispute-resolution procedures for an organizations

CS 26 Develop project management plan

Overview: This unit describes the skills and knowledge to develop a plan for a hotel management plan, including assessing project requirements and planning for all stages to completion and final documentation.

Competency Unit	Performance Criteria
Prepare project management plan	P1. Evaluate and assess project brief and related documents P2. Produce document on project tasks and associated timelines, including installation processes and test requirements P3. Assess and produce document on resource requirements to assist allocation of appropriate resources P4. Produce training plan assessing training needs and associated timelines for efficient project implementation P5. Determine and document budgetary requirements P6. Discuss roles of all identified parties associated with project to ensure their involvement P7. Produce project verification document, including monitoring and control processes, and review processes such as quality audits P8. Consult with all relevant parties prior to finalizing draft plan and make changes as appropriate
Develop and evaluate management plan	P1. Produce preliminary plan for consultation, including identified factors that may impact on realization of project and observance of relevant legislation, codes, regulation and standards P2. Consult with client and clarify any amendments P3. Develop final plan with recommendations
Communicate project information	P1. Produce and document final plan to include implementation details and training needs P2. Present plan to client and obtain sign off

Contribute to assessing effectiveness of communication	P1. Assist in ongoing review of project outcomes to determine effectiveness of communications-management activities P2. Report communications-management issues and responses to higher project authorities for application of lessons learned to future projects

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:

Key attributes of common telecommunications applications and related equipment

Evaluate the connections to carrier infrastructure or equipment

Current legislation relating to the design of installation of telecommunications equipment and connection to carrier services

Advantages of leasing and purchase options to assist in delivering cost effective solutions

Evaluate network and transmission equipment

Network topologies, and interface and interconnect solutions

Workplace health and safety (WHS) issues that need to be built into a plan, with consideration of:

electrical safety

materials handling

physical hazards

confined spaces

heights

lifting

Evaluate the power requirements and electrical safety aspects of the installation plan

Performance parameters and typical faults that may be encountered in client equipment and related connection and transmission media

Various test equipment types suitable for tests to be made

Warranty information for equipment supplies and contractor work guarantees.

Critical Evidence(s) Required

The candidate needs to produce following Critical Evidence(s) in order to be competent in this competency standard:

Produce training plan assessing training needs and associated timelines for efficient project implementation

Determine and document budgetary requirements

Produce project verification document, including monitoring and control processes, and review processes such as quality audits

Produce and document final plan to include implementation details and training needs

Present plan to client and obtain sign off

CS 27 Develop sales plan

Overview: This unit describes the skills and knowledge required to develop a sales plan for a product or service for a team covering a specified sales territory based on strategic objectives and in accordance with established performance targets. It applies to individuals working in a supervisory or managerial sales role who develop a sales plan for a product or service.

Competency Unit	Performance Criteria
Identify organizational strategic direction	P1. Obtain and analyze assessment of market needs and strategic planning documents P2. Review previous sales performance and successful approaches to identify factors affecting performance P3. Analyze information on market needs, new opportunities, customer profiles and requirements as a basis for decision making P4. Carry out competitor analysis for rate structure
Establish performance targets	P1. Determine practical and achievable sales targets P2. Establish realistic timelines for achieving targets P3. Determine measures to allow for monitoring of performance P4 .Ensure objectives of the sales plan and style of the campaign are consistent with organizational strategic objectives and corporate image
Develop a sales plan for a product	P1. Determine approaches to be used to meet sales objectives P2. Identify additional expertise requirements and allocate budgetary resources accordingly P3. Identify risks and develop risk controls P4. Develop advertising and promotional strategy for product P5. Identify appropriate distribution channels for product P6. Prepare a budget for the sales plan P7. Present documented sales plan to appropriate personnel for approval

Identify support requirements	P1. Identify and acquire staff resources to implement sales plan P2. Develop an appropriate selling approach P3. Train staff in the selling approach selected P4. Develop and assess staff knowledge of product to be sold
Monitor and review sales plan	P1. Monitor implementation of the sales plan P2. Record data measuring performance versus sales targets P3. Make adjustments to sales plan as required to ensure required results are obtained

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:
Outline principles and techniques for selling
Outline methods for monitoring sales outcomes
Statistical techniques for analyzing sales and market trends
Internal and external sources of information that are relevant to identifying organizational strategic direction and developing a product sales plan.
Competitors intelligence

Critical Evidence(s) Required

The candidate needs to produce following Critical Evidence(s) in order to be competent in this competency standard:
Identify the risks of the product i.e., sale/deployments
Produce a sales plan for the product
Demonstrate marketing and selling approach
Demonstrate advertising and promotional strategy for product

CS 28 Conduct research for customer needs and satisfaction

Overview: This unit describes the skills and knowledge required to manage an ongoing relationship with a customer over a period of time. This includes helping customers articulate their needs and managing networks to ensure customer needs are addressed. It applies to individuals who are expected to have detailed product knowledge in order to recommend customized solutions. In this role, individuals would be expected to apply organizational procedures and be aware of, and apply as appropriate, broader factors involving ethics, industry practice and relevant government policies and regulations.

Competency Unit	Performance Criteria
1. Assist customer to articulate needs	P1. Ensure customer needs are fully explored, understood and agreed P2. Explain and match available services and products to customer needs P3. Identify and communicate rights and responsibilities of customers to the customer as appropriate
2. Satisfy complex customer needs	P1. Explain possibilities for meeting customer needs P2. Assist customers to evaluate service and/or product options to satisfy their needs P3. Determine and prioritize preferred actions P4. Identify potential areas of difficulty in customer service delivery and take appropriate actions in a positive manner
3. Manage networks to ensure customer needs are addressed	P1. Establish effective regular communication with customers P2. Establish, maintain and expand relevant networks to ensure appropriate referral of customers to products and services from within and outside the organization P3. Ensure procedures are in place to ensure that decisions about targeting of customer services are based on up-to-date information about the customer and the products and services available P4. Ensure procedures are put in place to ensure that referrals are based on the matching of the assessment of customer needs and availability of products and services

	P5.Maintain records of customer interaction in accordance with organizational procedures
4. Convert customer enquiries into sales	P1. Use information provided by customers or accessed from the customer relationship management (CRM) system to identify any needs P2. Identify suitable products/services to meet needs P3. Make convincing sales pitches to customers following standard scripts P4. Handle customer queries, objections and rebuttals following standard scripts P5. Adapt your approach and style to customer preferences, within the limits of your competence and authority P6. Refer issues outside your area of competence and authority to appropriate people, following your organization's procedures P7. Identify and act on opportunities to up-sell or cross-sell other products/services to customers P8. Confirm customer wishes and needs in order to close sales P9. Obtain required financial information from customers, following your organization's procedures P10.Complete your organization's post-sales procedures in order to complete/ fulfill sales P11. Comply with relevant standards, policies, procedures and guidelines when converting customer enquiries into sales

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:

Organizational procedures and standards for establishing and maintaining customer service relationships

Consumer rights and responsibilities

Ways to establish effective regular communication with customers
Outline details of products or services including with reference to:
possible alternative products and services
Variations within a limited product and service range

Critical Evidence(s) Required

The candidate needs to produce following Critical Evidence(s) in order to be competent in this competency standard:
Gather customer needs and requirements
Analyse customer needs and requirements
Enlist communication rights and responsibilities of customers
Handle customer relationship management (CRM) model to identify suitable products/services to meet customer needs

Manage finances

Overview: This unit of competency describes the outcomes required to develop, implement and monitor a personal budget in order to plan regular savings and manage debt effectively.

Competency Unit	Performance Criteria
1. Develop a personal budget	P1. Calculate current living expenses using available information to prepare a personal budget. P2. Keep a record of all income and expenses for a short period of time to help estimate ongoing expenses. P3. Subtract total expenses from total income to determine a surplus or deficit budget for the specified period. P4. Find reasons for a deficit budget and ways to reduce expenditure identified. P5. Identify ways to increase income, if possible
2. Develop longer term personal budget	P1. Analyze income and expenditure and set longer term personal, work and financial goals. P2. Develop a longer-term budget based on the outcomes of short-term budgeting, and adjust to meet living, work and future career requirements. P3. Identify obstacles that might affect finances such as job loss, sickness or unexpected expenses contingency savings P4. Formulate a regular savings plan based on budget, using secure savings products and services. P5. Monitor expenditure against budget and identify areas of possible expenditure saving
3. Identify ways to maximize future finances	P1. Determine sources and ways to maximize personal income, including from work, investments or available government payments/allowances. P2. Get further education or training to maintain or improve future income. P3. Identify the need for debt to finance living and other expenses, and determine the appropriate levels of debt and repayment.

	P4. Consolidate existing debt, where possible, to minimize interest costs and fees. P5.Seek professional money management services, where available, to ensure financial plans are effective and achievable

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:
Abilities to plan and organize to keep records and monitor a personal budget
Abilities to set and review goals
Basic financial management and record keeping to enable development and management of a personal budget
Benefits of financial goal setting and personal budgeting to enable effective management of personal finances
Numeracy skills to compare income and expenditure

Critical Evidence(s) Required

The candidate needs to produce following Critical Evidence(s) in order to be competent in this competency standard:
Produce a longer-term budget based on the outcomes of short-term budgeting
Develop and report the need for debt to finance living and other expenses,
Determine the appropriate levels of debt and repayment
Demonstrate the ways to increase finances and income

CS 29 Identify and resolve problems

Overview: This unit is focus on negotiation in critical incidents and the development of strategic responses designed to resolve threatening incidents.

Competency Unit	Performance Criteria
1. Identify a problem	P1. Form a problem statement and analyze root cause. P2. Take initiative in tackling problems rather than relying solely on directives P3. Follow logic steps in understanding root cause and analyzing potential solutions.
2. Determine strategies for a required solution	P1. Analyze all aspects of the incident for degree of hazard, priorities, optional outcomes and appropriate strategies P2. Analyze and determine strategies and priorities on the incident sought from a range of sources P3. Assess long term objectives against resources and priorities P4. Apply a range of communication techniques to make and maintain contact with the key people P5. Provide clear and factual information to enable an honest and realistic assessment of the interests of the key people and their positions P6. Resolve the conflict and express their likely consequences clearly and do an analysis of the benefits P7. Reassess points of disagreements for common positive Positions
3. Coordinate support Services	P1. Assess the need for support services in terms of the determined strategies and priorities P2. Negotiate the resources of support services according to established procedures and availability P3. Provide information on strategies to support services and maintain the communication P4 .Delegate roles and responsibilities according to expertise and resources

4. Restore order	P1 Assess the incidents for degree of risk and take appropriate action to reduce and remove the impact of the incident and restore order P2 Take action designed to minimize risk and the preserve the safety and security of all involved P3 Take action to prevent the escalation of the incident appropriate to the circumstances and agreed procedures. P4 Carry out the use of force for the restoration of control and the maintenance of security in the least restrictive manner. P5 Complete reports accurately and clearly provided to the appropriate authority promptly P6 Review, evaluate and analyze the incident and the organizational response to it and report it promptly and accurately.
5. Provide leadership. direction and guidance to the work group	P1. Link between the function of the group and the goals of the organization P2 .Participate in decision making routinely to develop, implement and review work of the group and to allocate responsibilities where appropriate P3 .Give opportunities and encouragement to others to develop new and innovative work practices and strategies P4. Identify conflict and resolve with minimum disruption to work group function P5.Provide staff with the support and supervision necessary to perform work safely and without risk to health P6 .Allocate tasks within the competence of staff and support with appropriate authority, autonomy and training P7 .Supervise appropriately the changing priorities and situations and takes into account the different needs of individuals and the requirements of the task

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:

Organization's policies, guidelines and procedures related to control and surveillance, safety and preventing and responding to incidents and breaches of orders covered in the range of variables.

Organization's management and accountability systems

Teamwork principles and strategies

Principles of effective communication

Guidelines for use of equipment and technology

Code of conduct

Critical Evidence(s) Required

The candidate needs to produce following Critical Evidence(s) in order to be competent in this competency standard:

Identify problem statement

Build team

Identify your target community for the proposed product/solution

Analyze product sale and marketing plan

Provide your strategy to execute entrepreneurial plan

Provide three solutions (A, B, C) of your business plan

Present complete portfolio of entrepreneurial plan as an evidence

Provide clear and factual information to enable an honest and realistic assessment of the interests of the key people and their positions

Provide information on strategies to support after sale services

Provide a complete entrepreneurial plan

CS 30 Create/Manage profile on Non-traditional Freelancing Platform

Overview: This competency standard covers the skills and knowledge required to create/manage profile on a non-traditional freelance platform.

Competency Unit	Performance Criteria
Recognize Gig Economy	Enlist at least 03 strong reasons to work as a freelancer Identify the terminologies related to the freelancing platform like (Gig, profiles, rating, review, revision and a bid etc.) Identity the most in demand freelance skills on non-traditional platform
Setup Profile	Set Up a Seller Profile Add personal and professional information on your profile

	Link up social media and other professional accounts to seller profile
Create the Gigs	Find your ideal category and services Check out the competition Create an appealing title for the gig Choose subcategory and tags Create and price gig packages Win buyers with gig description Boost gig success with visuals Choose a suitable gig package among Basic, Standard and Premium options.
Provide High Quality Services as a seller	Present a professional profile Get and maintain high rating Be responsive and polite to customer
Develop/Increase Business	Deliver the work on agreed deadline Ask for feedback form the client Keep in touch with Buyers/Customers Use the contacts page to maintain close coordination with the potential buyers/customers Request customer to recommend you to other clients and work circles Abide by the rules and regulations of freelance platform in order completion and cancelation

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:

Describe what is gig economy.

Differentiate between a seller and a buyer in non-traditional freelancing.

Write down the characteristics of a powerful gig.

List down the qualities of a top-level seller.

Prepare a business development strategy for a seller.

Tools and Equipment

The tools and equipment required for this competency standard are given below:

Items
Computer System
Internet Connection
Email Account
Bank account
Microsoft Office (Word, Excel, PowerPoint)
Seller Profile on Non-traditional Freelance Platform (Fiverr)

Critical Evidence(s) Required

The candidate needs to produce following Critical Evidence(s) in order to be competent in this competency standard:

Setup a seller account/profile.

Create a gig for SEO based Content Writing.

CS 31 Create/Manage profile on a Traditional Freelance Platform

Overview: This competency standard covers the skills and knowledge required to create/manage profile on a traditional freelance platform.

Competency Unit	Performance Criteria
Explore Traditional Freelance Marketplace	Identify characteristics of traditional freelancing Compare strengths and features of different traditional freelancing platforms/websites Select an appropriate freelance platform best suited to your niche
Get started with freelance platform	Join a freelance market place by creating an account Add personal information Add professional information Highlight your strengths and skills

	Build a great profile by adding portfolio
Find work/Submit proposals	Find the right project according to your niche Choose b/w hourly vs. fixed price projects Understand the requirements by reading the project description and demands with great attention/ get clear understanding of the project Write a comprehensive, solution oriented bid proposal for the project Ask questions to clarify the ambiguities. Offer a mockup Setup a competitive fee for the project Review your bid proposal to remove any spelling or grammatical mistakes Submit the bid proposal
Complete projects & Get paid	Setup a personal deadline to finish the project Make close consultation with your client during the development of the project Communicate with the client by using the freelance platform messaging service only Fulfill all project requirements Use payment protection methods to get your reward secure
Manage your reputation as a professional	Ask for the feedback Give priority to the returning customer Create a longstanding bond with customers by providing them great value for their money Promote your profile/business by asking clients to recommend you to others Practice fairness and honesty in your dealings

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:

Write down the names of popular traditional freelance platforms.

Differentiate between hourly and fixed-price projects.

Define mockup.

Perform bidding on the projects.

Describe best practices to win a customer's trust.

Tools and Equipment

The tools and equipment required for this competency standard are given below:

Items
Computer System
Internet Connection
Email Account
Bank account
Microsoft Office (Word, Excel, PowerPoint)
Seller Profile on a Traditional Freelance Platform (Upwork, Guru, freelance.com etc)

Critical Evidence(s) Required

The candidate needs to produce following Critical Evidence(s) in order to be competent in this competency standard:

Create and maintain a profile on a popular freelance platform.

Write a bid for a sample project.

Prepare mockup for a fashion blogpost.

CS 32 Write professional proposals for freelance projects

Overview: This competency standard covers the skills and knowledge required to write professional proposals for freelance projects.

Competency Unit	Performance Criteria
Write a winning proposal	Start proposal with the lines which show your interest and care in the project Write ideas and suggestions in original sentences (Don't Copy & Paste)

	Present yourself as a problem solver in proposal, suggest one or two workable ideas for the project. Mention expertise to tell the buyer why you are the best person for the specific project Ask for the resources (Website link etc.) to get more familiar about the business/buyer Ask for the reply from the client in response to suggestions
Adopt best practices of proposal writing	Analyze the project details beforehand Avoid scripted bid proposals Don't sound impersonal Avoid being too hasty in committing your time Do not underbid fellow freelancers Check buyer's history Use phrases that sell in the market Check competitor's reputation Proofread the bid

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:
Write the features of a good bid proposal.
Write a sample bid proposal for an essay writing job, highlight your skills/strengths for the job.

Tools and Equipment

The tools and equipment required for this competency standard are given below:

Items
Computer System
Internet Connection
Email Account

Bank account
Microsoft Office (Word, Excel, PowerPoint)
Seller Profile on a Freelance Platform (Upwork, Guru, freelancer.com etc.)

Critical Evidence(s) Required

The candidate needs to produce following Critical Evidence(s) in order to be competent in this competency standard:

Prepare a bid proposal for a research based article-writing project.

CS 33 Develop communication skills

Overview: This competency standard covers the skills and knowledge required to develop good communication skills.

Competency Unit	Performance Criteria
Win a client through good communication skills	Pay attention to Client's Requirements Reply Honestly to Client Keep the Client Informed Give good gestures while waiting for Response Win a Client through Best of Behavior Maintain the relationship even after the completion of the project
Work on improving communication skills	Reproduce any articles you like in your own words Share your knowledge with others Watch successful people's interviews to grab work life realities of your field Learn to improve your focus Spend time with learned individuals Make self-analysis

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:

Write down a note on importance of good communication skills to become a successful freelancer.

Tools and Equipment

The tools and equipment required for this competency standard are given below:

Items
Computer System
Internet Connection
Browser
Email Account

Books, Newspapers etc.
Microsoft Office (Word, Excel, PowerPoint)
Seller Profile on a Freelance Platform (Upwork, Guru, freelancer.com etc.)

Critical Evidence(s) Required

The candidate needs to produce following Critical Evidence(s) in order to be competent in this competency standard:

Demonstrate written communication skills in convincing a client for a particular project.