



*Curriculum*  
*“Metal Forming & Processing Supervisor” Level 05*



**National Vocational Certificate for  
“Metal Forming & Processing Supervisor”  
Level 05**



**Competency Based Curriculum**

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



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



## Table of Contents

<b>1. Introduction .....</b>	<b>4</b>
a. “Metal Forming & Processing Supervisor” Level 05 .....	4
b. Purpose of the Training Program .....	5
c. Overall Objectives of Training Program .....	5
d. Competencies to be gained after completion of course .....	5
e. Possible available Job opportunities available immediately and later in the future .....	6
f. Trainee Entry level .....	6
g. Minimum Qualification of Trainer .....	6
h. Recommended Trainer: Trainee Ratio .....	6
i. Medium of Instruction i.e. Language of Instruction .....	6
j. Duration of the Course .....	6
k. Sequence of the Modules .....	7
<b>2. Summary – Overview of the Curriculum .....</b>	<b>7</b>
<b>3. Modules .....</b>	<b>11</b>
0715-MF&P 01 Module: Perform Computerized Numerical Control, CNC Operations .....	11
0715-MF&P 02 Module: Perform CNC EDM Wire-Cut Operations .....	21
0715-MF&P 03 Module: Perform GTAW / TIG Welding .....	26
0715-MF&P 04 Module: Perform GMAW (MIG/MAG) and FCAW Welding .....	34
0715-MF&P 05 Module: Carryout Continuous Casting Machine (CCM) operations .....	42
0715-MF&P 06 Module: Carryout Metal processing with Metallic powder .....	47
0715-MF&P 07 Module: Perform Pre-Rolling Operation .....	53
0715-MF&P 08 Module: Perform Hot & Cold Rolling Process .....	56
0715-MF&P 09 Module: Perform Metallography of Metallic Materials .....	60
0715-MF&P 10 Module: Perform Handheld XRF Analysis .....	63
0715-MF&P 11 Module: Perform optical emission spectroscopic analysis .....	66
0715-MF&P 12 Module: Perform Non-Destructive Testing .....	70
0715-MF&P 13 Module: Perform Galvanizing Coating .....	75
0715-MF&P 14 Module: Perform Conversion Coating (Anodizing) .....	80
0715-MF&P 15 Module: Develop Project Proposal .....	86
0715-MF&P 16 Module: Develop project management plan .....	88
0715-MF&P 17 Module: Develop sales plan .....	92
0715-MF&P 18 Module: Conduct research for customer needs and satisfaction .....	96
<b>4. Supportive Notes .....</b>	<b>101</b>
<b>5. List of Tools, Machinery and Equipment .....</b>	<b>101</b>



**Curriculum**  
***“Metal Forming & Processing Supervisor” Level 05***



<b>6. List of Consumable Supplies .....</b>	<b>101</b>
<b>7. Members of the Curriculum Development Committee.....</b>	<b>101</b>



## **1. Introduction**

### **a. “Metal Forming & Processing Supervisor” Level 05**

The Metal Forming & Processing industries are an essential part of our society that processes metals in order to manufacture machine components, machinery, instruments and tools needed by industries as well as by other sectors of the economy.

The products and components created by the different metal shaping techniques are used in creating everything from scaffolding and heavy machinery, to designing and creating microprocessors and artificial intelligence.

When it comes to metal forming, there are several processes to choose from, with each offering its own list of benefits and detriments, each suited to certain applications and for different types of metals.

That includes:

- Knowing the principles of common forming processes and their typical applications
- Identifying the key factors in the product to be made which will guide the forming process selection
- Applying basic metallurgy to the situation so as to make an appropriate recommendation.

Keeping in view of the above, the competency based national vocational qualifications have been developed by NAVTTC to train the unskilled human resource on the technical and entrepreneurial skills.

Training Course is based on competency standards which are defined by the industry and the traditional role of a trainer changes and shifts towards the facilitation of training. A trainer encourages and assists trainees to learn for themselves. Trainees are likely to work in groups (pairs) and all doing something different. Some are doing practical tasks in the workshop, some writing, some not even in the classroom or workshop but in another part of the building using special equipment. As trainees learn at different pace they might be at different stages in their learning, thus learning must be tailored to suit individual needs.



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



**b. Purpose of the Training Program**

The purpose of this training program is to set the highly professional standards for **Metal Forming & Processing Level 02 - 05** in order to compete local and international job market requirements. The specific objectives of developing these qualifications are as under:

- Empower the youth with locally and globally required employable skills
- Produce competitive **Metal Forming & Processing Skilled Personnel**
- Improve the quality and effectiveness of the training and assessment for **Metal Forming & Processing Industry**

**c. Overall Objectives of Training Program**

The main objectives of the National Vocational Certificate for **“Metal Forming & Processing Supervisor” Level 05** are as follows:

- Improve the professional competence of the personnel
- Capacitate the local community and trainers in modern CBT training, methodologies and processes as envisaged under NVQF
- Provide flexible pathways and progressions in the Metal sector
- Enable the trainees to perform their duties in efficient manner
- Establish a standardized and sustainable system of training for Metal Forming & Processing work across globe

**d. Competencies to be gained after completion of course**

1. Perform Computerized Numerical Control, CNC Operations
2. Perform CNC EDM Wire-Cut Operations
3. Perform GTAW / TIG Welding
4. Perform GMAW (MIG/MAG) and FCAW Welding
5. Carryout Continuous Casting Machine (CCM) operations
6. Carryout Metal processing with Metallic powder
7. Perform Pre- Rolling Operation
8. Perform Hot & Cold Rolling Process
9. Perform Metallography of Metallic Materials
10. Perform Handheld XRF Analysis
11. Perform optical emission spectroscopic analysis
12. Perform Non-Destructive Testing
13. Perform Galvanizing Coating
14. Perform Conversion Coating (Anodizing)



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



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|--|
| 15. Develop Project Proposal                             |
| 16. Develop project management plan                      |
| 17. Develop sales plan                                   |
| 18. Conduct research for customer needs and satisfaction |

**e. Possible available Job opportunities available immediately and later in the future**

01	Machining Supervisor
02	Welding Supervisor
03	Metal Processing Supervisor
04	Metal Forming Supervisor
05.	Quality Testing Inspector
06	Coating Supervisor

**f. Trainee Entry level**

The entry for National Vocational Certificate for “Metal Forming & Processing Supervisor” Level 05 would be Middle Certificate (8th Class) or “Metal Forming & Processing Senior Technician” Level 04

**g. Minimum Qualification of Trainer**

Must be a holder of DAE in Metallurgy / Mechanical Technology with at least 2 years relevant experience

OR

BSc Engineering Technology (Metallurgy/Mechanical), B.E  
Metallurgy/Mechanical, BSc Metallurgy/Mechanical Engineering

**h. Recommended Trainer: Trainee Ratio**

The recommended maximum trainer: trainee ratio for this program is 1 trainer for 25 trainees.

**i. Medium of Instruction i.e. Language of Instruction**

Instructions will be in Urdu/ English/ Local language.

**j. Duration of the Course**

The distribution of contact hours is given below:



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



Total	-	1206 hours
Theory	-	369 hours (31%)
Practical	-	837 hours (69%)
Proposed Course Duration	-	12 Months

**k. Sequence of the Modules**

1. Perform Computerized Numerical Control, CNC Operations
2. Perform CNC EDM Wire-Cut Operations
3. Perform GTAW / TIG Welding
4. Perform GMAW (MIG/MAG) and FCAW Welding
5. Carryout Continuous Casting Machine (CCM) operations
6. Carryout Metal processing with Metallic powder
7. Perform Pre- Rolling Operation
8. Perform Hot & Cold Rolling Process
9. Perform Metallography of Metallic Materials
10. Perform Handheld XRF Analysis
11. Perform optical emission spectroscopic analysis
12. Perform Non-Destructive Testing
13. Perform Galvanizing Coating
14. Perform Conversion Coating (Anodizing)
15. Develop Project Proposal
16. Develop project management plan
17. Develop sales plan
18. Conduct research for customer needs and satisfaction

**2. Summary – Overview of the Curriculum**

Module Title	Learning Units	Th.	Pr.	T.	Cr. Hrs
1. Perform Computerized Numerical Control, CNC Operations	LU.1 Set-up CNC machine LU.2 Run Simulation LU.3 Feed the Program LU.4 Carry out CNC Lathe/Milling Operations LU.5 Perform CNC water jet cutting Operations LU.6 Perform CNC laser cutting Operations	21	81	102	10.2
2. Perform CNC EDM Wire-Cut	LU.1 Mount the Job on EDM Wire Cut Machine	18	66	84	8.4





**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



Operations	LU.2 Generate the Program LU.3 Run Simulation LU.4 Feed the Program LU.5 Perform CNC EDM Wire-cut Operations				
3. Perform GTAW / TIG Welding	LU.1 Prepare Welding Machine and Accessories for GTAW / TIG LU.2 Make Welds on Carbon Steel Plate Flat (1F) and Flat (1G) LU.3 Make Welds on Carbon Steel Plate Horizontal (2F) and Horizontal (2G) LU.4 Make Welds on Carbon Steel Plate Vertical (3F) and Vertical (3G) LU.5 Make Welds on Carbon Steel Plate Overhead (4F) and Overhead (4G) LU.6 Perform Post Welding Operations	21	48	69	6.9
4. Perform GMAW (MIG/MAG) and FCAW Welding	LU.1 Prepare Welding Machine for GMAW (MIG/MAG) LU.2 Make Welds on Carbon Steel Plate with GMAW Flat (1F) and Flat (1G) LU.3 Make Welds on Carbon Steel Plate with GMAW Horizontal (2F) and Horizontal (2G) LU.4 Prepare Welding Machine for FCAW LU.5 Make Welds on Carbon Steel Plate with FCAW Vertical (3F) and Vertical (3G) LU.6 Perform Post Welding Operations	18	36	54	5.4
5. Carryout Continuous Casting Machine (CCM) operations	LU.1 Practice safety requirements for CCM LU.2 Perform Coordination with attached sections LU.3 Carry out pre casting operations of CCM LU.4 Carry out casting process LU.5 Conduct cleaning and maintenance of equipment	21	81	102	10.2
6. Carryout Metal processing with Metallic powder	LU.1 Select particle size and morphology of powder LU.2 Calculate the required weight of powder and binder LU.3 Prepare metallic powder blend LU.4 Operate hydraulic press LU.5 Set the parameters of sintering furnace LU.6 Perform sintering operation in the furnace	18	60	78	7.8





**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	LU.7	Carry out the inspection of sintered Component				
7. Perform Pre-Rolling Operation	LU.1 LU.2	Select the suitable types of rollers Adjust the Sequence of rolling stages to obtain the desired shape	12	24	36	3.6
8. Perform Hot & Cold Rolling Process	LU.1 LU.2 LU.3	Perform Two, Three & Four high rolling mill process (Hot rolling) Perform Tandem rolling mill process (Cold rolling) Carryout inspection of finished product	18	81	99	9.9
9. Perform Metallography of Metallic Materials	LU.1 LU.2	Prepare specimen for metallography Demonstrate the working of metallurgical microscope	18	48	66	6.6
10. Perform Handheld XRF Analysis	LU.1 LU.2 LU.3	Prepare the Sample Perform Calibration and standardization Perform the Test on XRF machine	18	36	54	5.4
11. Perform optical emission spectroscopic analysis	LU.1 LU.2 LU.3	Prepare the Sample of emission spectroscopy Perform Calibration and standardization Perform the Test	18	45	63	6.3
12. Perform Non-Destructive Testing	LU.1 LU.2 LU.3 LU.4 LU.5	Determine the surface defects of specimen using dye penetrant technique Determine the defects of given specimen using magnetic particle testing technique Determine the defects of metallic specimen using eddy current testing technique Determine the defects of specimen using ultrasonic technique Determine the defects of given specimen by using radiographic testing technique	21	90	111	11.1
13. Perform Galvanizing Coating	LU1. LU2. LU3. LU4. LU5.	Perform cataloging Perform Cleaning Operation Perform Drying Operation Perform Galvanize coating Operation Perform quenching Operation	21	60	81	8.1
14. Perform Conversion Coating (Anodizing)	LU.1 LU.2 LU.3 LU.4	Perform cataloging Perform Cleaning Operation Perform Solution Preparation Set up Coating bath	18	51	69	6.9



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	LU.5 Perform Coating Operation				
	LU.6 Perform Drying Operation				
15. Develop Project Proposal	LU.1 Develop a business plan LU.2 Develop a marketing plan LU.3 Develop basic business communication skills	27	9	36	3.6
16. Develop project management plan	LU.1 Prepare project management plan LU.2 Develop and evaluate management plan LU.3 Communicate project information LU.4 Contribute to assessing effectiveness of communication	27	6	33	3.3
17. Develop sales plan	LU.1 Identify organizational strategic direction LU.2 Establish performance targets LU.3 Develop a sales plan for a product LU.4 Identify support requirements LU.5 Monitor and review sales plan	27	6	33	3.3
18. Conduct research for customer needs and satisfaction	LU.1 Assist customer to articulate needs LU.2 Satisfy complex customer needs LU.3 Manage networks to ensure customer needs are addressed LU.4 Convert customer enquiries into sales	27	9	36	3.6
<b>Total</b>		<b>369</b>	<b>837</b>	<b>1206</b>	<b>120.6</b>



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



### 3. Modules

#### 0715-MF&P 01 Module: Perform Computerized Numerical Control, CNC Operations

**Objective:** This module covers the knowledge and skills required to Set-up CNC machine, Run Simulation, Feed the Program, Carry out CNC Lathe/Milling Operations, Perform CNC water jet cutting Operations, Perform CNC laser cutting Operations

**Duration: 102Hours**

**Theory: 21Hours**

**Practice: 81 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Set-up CNC machine	<p><b>Trainee is able to:</b></p> <ul style="list-style-type: none"> <li>Select required work holding device(s) in order to achieve dimensional accuracy</li> <li>Mount the work-piece by considering the working capacity of machine as well as job requirement according to the drawing/design.</li> <li>Attain proper alignment of tool/cutter and work-piece e.g. concentricity of rotating jobs as per set practice</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of CNC and NC machines and accessories.</li> <li>Understanding of CNC machine operation.</li> <li>Identification of Machine process standards and functions.</li> <li>Methods and techniques of adjusting operating parameters of</li> </ul>	<p>Theory-3Hrs. Practical-12 Hrs. Total- 15 Hrs.</p>	<ul style="list-style-type: none"> <li>Personal Protective Equipment</li> <li>CNC Lathe machine and accessories</li> <li>CNC milling machine with all accessories</li> <li>Cutting Tools</li> <li>CNC Laser cutting Machine and accessories</li> <li>CNC water jet and accessories</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<ul style="list-style-type: none"> <li>• Set up and adjust machine according to parameters to achieve work specification.</li> <li>• Report uncertainties and deviations to person concerned for timely action.</li> <li>• Maintain safe measures while mounting the work-piece so that unwanted operation by machine may not be initiated as per safety precautions</li> </ul>	<ul style="list-style-type: none"> <li>• machine.</li> <li>• Description of work specifications.</li> <li>• Explanation of Techniques for checking accuracy of CNC Machine.</li> <li>• Types of Coolant</li> <li>• Use of coordinate system</li> <li>• Understanding of Basic knowledge of G-Code and M-Code.</li> <li>• Understanding of Basic computer operations.</li> <li>• Understanding of Procedure for reporting uncertainties and deviations to person concerned for timely action.</li> <li>• Understanding of Safety precautions</li> </ul>		<ul style="list-style-type: none"> <li>• Zero Setter, Edge Finder and Dial Indicator</li> <li>• CNC Programming Manual</li> <li>• Measuring Instruments (Vernier, Inside/Outside Callipers, Micrometre, Steel Rule,</li> <li>• Tri-Square, Bevel Protractor etc.)</li> <li>• Work Holding Devices</li> <li>• Tooling Catalogue</li> </ul>	
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



		<p>and guidelines.</p> <ul style="list-style-type: none"> <li>• Use of control panel.</li> <li>• Understanding of Basic knowledge of machine margins and alignments.</li> <li>• Explanation of drawing and work specifications.</li> </ul> <p><b><u>Practical Activity</u></b></p> <ol style="list-style-type: none"> <li>I. Select and attach appropriate tools Off setting.</li> <li>II. Select and attach appropriate Cutters and Adjust Cutter Hight compensation according to the given task requirements.</li> </ol>			
<b>LU2.</b> Run Simulation	<ul style="list-style-type: none"> <li>• Feed the generated part program into required simulation platform and run simulation for checking the tool gouge according</li> </ul>	<ul style="list-style-type: none"> <li>• Identification of working specifications.</li> <li>• Understanding of</li> </ul>	<p>Theory-3 Hrs. Practical-15 Hrs. Total- 18 Hrs.</p>	<ul style="list-style-type: none"> <li>• CNC Programming Manual</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>to safety measures</p> <ul style="list-style-type: none"> <li>• Run simulation and verify movements of tool/cutter to get same results as per defined sequence</li> <li>• Identify occurrence of errors and modify the program as per defined procedure</li> </ul>	<p>Basic knowledge of G-Code and M-Code.</p> <ul style="list-style-type: none"> <li>• Understanding of Basic knowledge of computer operations.</li> <li>• Understanding of manual programming of a given part with the help of G code and M code.</li> </ul> <p><b><u>Practical Activity</u></b> Select appropriate program and run simulation according to the given task and remove error, if any.</p>		<ul style="list-style-type: none"> <li>• CAM Software with Simulation Module</li> <li>• Computer</li> </ul>	
<b>LU3. Feed the Program</b>	<ul style="list-style-type: none"> <li>• Maintain synchronization between machine control unit and part program file as per standard operating procedure</li> <li>• Switch machine to receiving mode and feed the desired part program file into machine control unit for further execution as per standard operating procedure</li> </ul>	<ul style="list-style-type: none"> <li>• Methods and techniques of adjusting operating parameters of machine.</li> <li>• Methods and techniques of adjusting operating parameters of CNC Lathe machine.</li> <li>• Understanding of</li> </ul>	<ul style="list-style-type: none"> <li>• Theory 3 Hrs.</li> <li>• Practical -15 Hrs.</li> </ul> <p>Total- 18 Hrs</p>	<ul style="list-style-type: none"> <li>• CNC Lathe machine and accessories</li> <li>• CNC Milling Machine and accessories</li> <li>• CNC Programming Manual</li> <li>• CAM Software</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<ul style="list-style-type: none"> <li>Select the desired part program file for execution as per standard operating procedure</li> </ul>	<p>part dimensions.</p> <p><b><u>Practical Activity</u></b></p> <p>Select appropriate program and perform test run according to the given task .</p>		<ul style="list-style-type: none"> <li>CNC Manual</li> </ul>	
<b>LU4.</b> Carry out CNC Lathe/Milling Operations	<ul style="list-style-type: none"> <li>Perform dry run-on CNC Lathe/Milling machines to ensure safety measures.</li> <li>Control the feeds, speeds and override of machine before operating according to the prescribed procedure</li> <li>Switch machine to execution mode (single block or auto) and press cycle start to run the machining sequence as per prescribed method</li> <li>Compare the block-wise movements of machining sequence thoroughly during operation of machine according to the part program file</li> <li>Complete the job and inspect its accuracy and precision according to the drawing/design</li> </ul>	<ul style="list-style-type: none"> <li>Identification of CNC machine.</li> <li>Identification of work specifications.</li> <li>Understanding of Machine process and its functions.</li> <li>Methods and techniques of adjusting operating parameters of CNC Milling Machine/Machining Center .</li> <li>Description of Techniques for checking quality of components produced.</li> <li>Procedure of reporting</li> </ul>	<ul style="list-style-type: none"> <li>Theory 4 Hrs.</li> <li>Practical -15 Hrs.</li> </ul> <p>Total- 19 Hrs</p>	<ul style="list-style-type: none"> <li>CNC Lathe machine and accessories</li> <li>CNC milling machine with all accessories</li> <li>Cutting Tools</li> <li>Zero Setter, Edge Finder and Dial Indicator</li> <li>Power Vice</li> <li>CNC Programming Manual</li> <li>Measuring Instruments (Vernier, Inside/Outside Callipers, Micrometre,</li> </ul>	Class Room and Lab





**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



		<p>uncertainties and deviations to person concerned for timely action.</p> <ul style="list-style-type: none"> <li>• Explanation of Safety precautions and guidelines.</li> <li>• Understanding of Basic knowledge of machine margins and alignments.</li> <li>• Interpretation of drawing and work specifications.</li> <li>• Understanding of machine check sheet.</li> </ul> <p><b><u>Practical Activity</u></b></p> <p>I. Carry out CNC Lathe Machine operations as per given Instructions</p> <p>II. Carry out CNC Milling machine Operations as per given Instructions</p>		<p>Steel Rule,</p> <ul style="list-style-type: none"> <li>• Tri-Square, Bevel Protractor etc.)</li> <li>• Work Holding Devices</li> <li>• Measuring Gauges</li> <li>• Tooling Catalogue</li> <li>• CNC Manual</li> <li>• Hydraulic unit</li> <li>• On/Off Valve</li> </ul>	
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



<b>LU5. Perform CNC water jet cutting Operations</b>	<ul style="list-style-type: none"> <li>Perform dry run on CNC water jet cutting machine to ensure safety measures.</li> <li>Arrange abrasive material with water jet spray as per requirement</li> <li>Adjust the feeds, speeds and pressure by adjusting amperes and current setting before operating according to the prescribed procedure</li> <li>Switch machine to execution mode and start to work on defined tool-path as per prescribed method</li> <li>Compare the movements of machining sequence thoroughly during operating of machine according to the part program file</li> <li>Complete the job and inspect its accuracy and precision according to the drawing/design</li> </ul>	<ul style="list-style-type: none"> <li>Description of CNC Water jet machine.</li> <li>Understanding of Machine process standards and functions.</li> <li>Use of control panel.</li> <li>Use of coordinate system</li> <li>Understanding of Methods and techniques of adjusting operating parameters of machine.</li> <li>Explanation of work specifications.</li> <li>Explanation of Techniques for checking quality of components produced.</li> <li>Procedure of reporting uncertainties and</li> </ul>	<ul style="list-style-type: none"> <li>Theory 4 Hrs.</li> <li>Practical -12 Hrs.</li> </ul> <p>Total- 16 Hrs</p>	<ul style="list-style-type: none"> <li>CNC water jet and accessories</li> <li>Water jet nozzle</li> <li>Water jet catchers</li> <li>Fluid additives</li> <li>Water jet catchers</li> <li>Fluid additives</li> <li>Cutting Tools</li> <li>Zero Setter, Edge Finder and Dial Indicator</li> <li>Power Vice</li> <li>CNC Programming Manual</li> <li>Measuring Instruments (Vernier, Inside/Outside Callipers, Micrometre, Steel Rule,</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



		<p>deviations to person concerned for timely action.</p> <ul style="list-style-type: none"> <li>• Importance of Safety precautions and guidelines.</li> <li>• Understanding of Basic knowledge of machine margins and alignments.</li> <li>• Interpretation of drawing and work specifications.</li> <li>• Interpretation of machine check sheet.</li> <li>• Explanation of CNC water jet and its working</li> </ul> <p><b><u>Practical Activity</u></b> Perform CNC water jet cutting Operations as per Instructions</p>		<ul style="list-style-type: none"> <li>• Tri-Square, Bevel Protractor etc.)</li> <li>• Work Holding Devices</li> <li>• Measuring Gauges</li> <li>• Tooling Catalogue</li> <li>• CNC Manual</li> <li>• Hydraulic unit</li> <li>• On/Off Valve</li> </ul>	
<b>LU6.</b> Perform CNC laser cutting Operations	<ul style="list-style-type: none"> <li>• Perform dry run-on CNC laser cutting machine to ensure safety measures.</li> <li>• Connect CO2 gas cylinder</li> </ul>	<ul style="list-style-type: none"> <li>• Description of CNC laser cutting machine.</li> <li>• Identification of CNC</li> </ul>	<ul style="list-style-type: none"> <li>• Theory 4 Hrs.</li> <li>• Practical</li> </ul>	<ul style="list-style-type: none"> <li>• CNC Laser cutting Machine and accessories</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>and accessories with machine as per requirement</p> <ul style="list-style-type: none"> <li>• Adjust the feeds, speeds by adjusting amperes and current setting before operating according to the prescribed procedure</li> <li>• Switch machine to execution mode and start to work on defined tool path as per prescribed method</li> <li>• Compare the movements of machining sequence thoroughly during operating of machine according to the part program file</li> <li>• Complete the job and inspect its accuracy and precision according to the drawing/design</li> </ul>	<p>laser cutting machine process standards and functions.</p> <ul style="list-style-type: none"> <li>• Importance of Adjusting Operating Parameter of CNC laser cutting machine.</li> <li>• Methods and techniques of adjusting operating parameters of CNC laser cutting machine.</li> <li>• Interpreting work specifications.</li> <li>• Understanding of Techniques for checking quality of components produced.</li> <li>• Understanding of Procedure of reporting uncertainties and deviations to person concerned for timely</li> </ul>	<p>-12 Hrs. Total- 16 Hrs</p>	<ul style="list-style-type: none"> <li>• Cutting Tools</li> <li>• Zero Setter, Edge Finder and Dial Indicator</li> <li>• Power Vice</li> <li>• CNC Programming Manual</li> <li>• Measuring Instruments (Vernier, Inside/Outside Callipers, Micrometre, Steel Rule,</li> <li>• Tri-Square, Bevel Protractor etc.)</li> <li>• Work Holding Devices</li> <li>• Measuring Gauges</li> <li>• Tooling Catalogue</li> <li>• CNC Manual</li> <li>• Hydraulic unit</li> </ul>	
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



		<p>action.</p> <ul style="list-style-type: none"><li>• Importance of Safety precautions and guidelines.</li><li>• Using of control panel.</li><li>• Understanding of Basic knowledge of machine margins and alignments.</li><li>• Interpretation of drawing and work specifications.</li><li>• Using of coordinate system</li><li>• Interpreting machine check sheet.</li><li>• Explanation of CNC laser and its working</li></ul> <p><b><u>Practical Activity</u></b> Perform CNC laser cutting Operations as per instructions</p>		<ul style="list-style-type: none"><li>• On/Off Valve</li></ul>	
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



**0715-MF&P 02 Module: Perform CNC EDM Wire-Cut Operations**

**Objective:** This module covers the knowledge and skills required to mount the Job on EDM Wire Cut Machine, Generate the Program, Run Simulation, Feed the Program, Perform CNC EDM Wire-cut Operations

**Duration** 84 Hours

**Theory:** 18 Hours

**Practice:** 66 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Mount the Job on EDM Wire Cut Machine	<b>Trainee is able to:</b> <ul style="list-style-type: none"> <li>Mount the work-piece by considering the working capacity of machine as well as job requirement according to the drawing/design</li> <li>Select appropriate work holding device(s) in order to achieve dimensional accuracy and clamp the job firmly as per standard practice</li> <li>Install and adjust proper alignment of installed wire to the vertical direction as per standard practice</li> <li>Keep safe measures while mounting the work-piece and installing the wire so</li> </ul>	<ul style="list-style-type: none"> <li>identification of Work place safety and health considerations</li> <li>Use of PPE's</li> <li>Understanding of CAD/CAM and 3D models</li> <li>Types of Coolant</li> <li>Using of coolants</li> <li>Importance of coolants</li> <li>Understanding of working Mechanism of CNC EDM wire cut machine</li> <li>Using of control panel and commands</li> </ul>	<p>Theory-4 Hrs. Practical-15Hrs. Total- 19 Hrs.</p>	<ul style="list-style-type: none"> <li>CNC EDM Wire-cut Machine along with Standard Accessories</li> <li>Wire Spool(s) with Wire Dia 0.18mm</li> <li>Measuring Gauges with Dial Indicator</li> <li>Tooling Catalogue</li> <li>CNC Manual</li> <li>Measuring Instruments (Vernier, inside/ Outside Calipers,</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>that unwanted operation</p> <ul style="list-style-type: none"> <li>by machine may not be initiated as per safety precautions</li> </ul>	<ul style="list-style-type: none"> <li>Understanding and use of portable devices for CNC EDM wire cut</li> <li>Understanding of Possible accidents and their counter-actions.</li> <li>Understanding of Methods of calculating Coordinate's techniques</li> <li>Use of Clamping devices and their types used In CNC wire cut.</li> </ul> <p><b><u>Practical Activity</u></b></p> <ul style="list-style-type: none"> <li>Perform Mounting of Job on EDM Wire Cut Machine operation</li> </ul>		<p>Micrometer, Steel Rule, Tri-Square, Bevel Protractor etc.)</p> <ul style="list-style-type: none"> <li>Work Holding Devices</li> <li>Personal Protective Equipment (PPEs)</li> </ul>	
<b>LU2.</b> Generate the Program	<p><b>Trainee is able to:</b></p> <ul style="list-style-type: none"> <li>Select appropriate CAM software according to the machine control unit and import drawing/sketch into</li> </ul>	<ul style="list-style-type: none"> <li>Explanation of working Mechanism of CNC EDM wire cut machine</li> <li>Understanding of</li> </ul>	<p>Theory-3 Hrs. Practical-15 Hrs. Total- 18 Hrs.</p>	<ul style="list-style-type: none"> <li>Wire-cut Software (YH, YL or HF)</li> <li>Complete set of computer</li> </ul>	<p>Class Room and Lab</p>





**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>it as per standard procedure</p> <ul style="list-style-type: none"> <li>• Select reference point/start point and apply toolpath by considering the wire compensation according to the prescribed procedure</li> <li>• Execute the generated part program file in order to perform wire cutting operation as per prescribed method</li> </ul>	<p>Debugging techniques of Program</p> <ul style="list-style-type: none"> <li>• Use of G codes and M codes</li> </ul> <p><b><u>Practical Activity</u></b> Generate the Program for EDM wire cut machine.</p>		system with multimedia projector	
<b>LU3.</b> Run Simulation	<p><b>Trainee is able to:</b></p> <ul style="list-style-type: none"> <li>• Perform the simulation platform and run simulation of wire cutting sequence as per prescribed method</li> <li>• Run simulation and verify movements of wire cutting to get same results as per defined sequence</li> <li>• Identify occurrence of errors and modify the applied toolpath as per prescribed procedure</li> </ul>	<ul style="list-style-type: none"> <li>• Understanding of simulation techniques</li> <li>• Understanding the Debugging techniques of Program</li> <li>• Use of G codes and M codes</li> <li>• Importance of G codes and M codes</li> </ul> <p><b><u>Practical Activity</u></b> Run Simulation Program for EDM wire cut.</p>	<ul style="list-style-type: none"> <li>• Theory 3 Hrs.</li> <li>• Practical -12 Hrs.</li> </ul> <p>Total- 15 Hrs</p>	<ul style="list-style-type: none"> <li>• Wire-cut Software (YH, YL or HF)</li> <li>• Complete set of computer system with multimedia projector</li> </ul>	Class Room and Lab
<b>LU4.</b> Feed	<p><b>Trainee is able to:</b></p> <ul style="list-style-type: none"> <li>• Ensure proper</li> </ul>	<ul style="list-style-type: none"> <li>• Understanding of control panel and</li> </ul>	<ul style="list-style-type: none"> <li>• Theory 4Hrs.</li> </ul>	<ul style="list-style-type: none"> <li>• CNC EDM Wire-cut Machine</li> </ul>	Class Room



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



the Program	<p>synchronization between machine control unit and part program file as per standard operating procedure</p> <ul style="list-style-type: none"> <li>Select and execute the desired part program file as per job requirement.</li> </ul>	<p>commands used in CNC wire cut.</p> <ul style="list-style-type: none"> <li>Methods of feeding the program in EDM wire cut machine</li> <li>Adopt the required safety practice as per machine Requirement.</li> </ul> <p><b><u>Practical Activity</u></b> Perform feeding Program on CNC EDM wire cut machine</p>	<ul style="list-style-type: none"> <li>Practical -12 Hrs.</li> </ul> <p>Total- 16 Hrs</p>	<p>along with Standard Accessories</p> <ul style="list-style-type: none"> <li>Wire-cut Software (YH, YL or HF)</li> <li>CNC Manual</li> <li>Personal Protective Equipment (PPEs)</li> <li>Complete set of computer system with multimedia projector</li> </ul>	and Lab
<b>LU5. Perform CNC EDM Wire-cut Operations</b>	<p><b>Trainee is able to:</b></p> <ul style="list-style-type: none"> <li>Ensure to control the safe operation of working on EDM wire-cut machine before execution of part program according to the safety measures</li> <li>Adjust the feeds, speeds by adjusting amperes and current setting before operating according to the prescribed procedure</li> </ul>	<ul style="list-style-type: none"> <li>Identification and using of PPE's</li> <li>Understanding of Mechanism of working of CNC EDM wire cut machine</li> <li>Using of control panel and commands</li> <li>Using of portable devices for CNC EDM wire cut</li> </ul>	<ul style="list-style-type: none"> <li>Theory 4 Hrs.</li> <li>Practical -12 Hrs.</li> </ul> <p>Total- 16 Hrs</p>	<ul style="list-style-type: none"> <li>CNC EDM Wire-cut Machine along with Standard Accessories</li> <li>Wire Spool(s) with Wire Dia 0.18mm</li> <li>Wire-cut Software (YH, YL or HF)</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<ul style="list-style-type: none"> <li>• Switch machine to execution mode and start to work on defined toolpath as per prescribed method</li> <li>• Compare the movements of machining sequence thoroughly during operating of machine according to the part program file</li> <li>• Complete the job and inspect its accuracy and precision according to the drawing/design</li> </ul>	<ul style="list-style-type: none"> <li>• Understanding of Methods of calculating Coordinate's techniques</li> <li>• Understanding of G codes and M codes</li> <li>• Use of Clamping devices and their types for CNC wire Cut Machine</li> <li>• Understanding of Feed, speed and Current Adjustment As per required finish on CNC wire cut.</li> </ul> <p><b><u>Practical Activity</u></b> Perform CNC EDM Wire-cut Operations as per instructions</p>		<ul style="list-style-type: none"> <li>• Measuring Gauges with Dial Indicator</li> <li>• Tooling Catalogue</li> <li>• CNC Manual</li> <li>• Measuring Instruments (Vernier, inside/ Outside Calipers, Micrometer, Steel Rule, Tri-Square, Bevel Protractor etc.)</li> </ul> <p>Personal Protective Equipment (PPEs)</p> <ul style="list-style-type: none"> <li>• Complete set of computer system with multimedia</li> </ul>	
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



**0715-MF&P 03 Module: Perform GTAW / TIG Welding**

**Objective:** This module covers the knowledge and skills required to Prepare Welding Machine and Accessories for GTAW / TIG, Make Welds on Carbon Steel Plate Flat (1F) and Flat (1G), Make Welds on Carbon Steel Plate Horizontal (2F) and Horizontal (2G), Make Welds on Carbon Steel Plate Vertical (3F) and Vertical (3G), Make Welds on Carbon Steel Plate Overhead (4F) and Overhead (4G), Perform Post Welding Operations

**Duration: 69 Hours**

**Theory: 21 Hours**

**Practice: 48 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
<b>LU1.</b> Prepare Welding Machine and Accessories for GTAW / TIG	<b>Trainee will be able to:</b> <ul style="list-style-type: none"> <li>Identify welding requirements from welding procedure specifications/technical drawings</li> <li>Prepare welding machine in accordance with welding procedure specifications/ manufacturer instructions.</li> <li>Set up welding machine accessories and consumables as per job requirements, welding procedure specifications and/or manufacturer's instructions</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of TIG welding</li> <li>Use of Personal Protective Equipment required for TIG welding</li> <li>Safe working practices to be followed while carrying out TIG welding</li> <li>Purpose of shielding gas in TIG welding</li> <li>Factors considered in TIG welding;               <ol style="list-style-type: none"> <li>Type and thickness of the base metal</li> <li>Current and polarity</li> </ol> </li> </ul>	Theory-02Hrs. Practical-03 Hrs. Total- 05 Hrs.	<ul style="list-style-type: none"> <li>Personal Protective Equipment</li> <li>Bastard File</li> <li>Steel Ruler</li> <li>Meter tape</li> <li>Scriber</li> <li>Try Square</li> <li>Welding Plant</li> <li>Welding consumable</li> <li>TIG welding torch</li> <li>Argon cylinder</li> <li>Argon regulator</li> <li>Baby grinder</li> <li>Wire brush</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<ul style="list-style-type: none"> <li>• Connect welding machine to an independent power supply</li> <li>• Set polarity indicated in the welding procedure specifications job requirement</li> <li>• Prepare work piece for welding as per job requirement</li> </ul>	<p>III. Type of shielding gas to be used</p> <p><b><u>Practical Activity</u></b></p> <ul style="list-style-type: none"> <li>• Select appropriate hand tools and accessories for operating the GTAW/TIG welding machine according to the given task</li> </ul>			
<b>LU2.</b> Make Welds on Carbon Steel Plate Flat (1F) and Flat (1G)	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>• Adjust welding parameters (current, voltage etc.) as per welding procedure specifications/job requirements to produce acceptable weld</li> <li>• Maintain standard position of electrode and base metal as per SOPs</li> <li>• Carry out welding in Flat (1F) and Flat (1G) positions following standard procedures</li> <li>• Deposit root pass as per</li> </ul>	<ul style="list-style-type: none"> <li>• knowledge about Flat (1F) &amp; (1G) welding positions</li> <li>• understanding about the standard method to wear PPEs</li> <li>• Specifications/ classification of electrode/s required for the job</li> <li>• Knowledge about the Root pass, filling pass &amp; capping pass.</li> <li>• Hazards associated with TIG welding and its</li> </ul>	<p>Theory-3 Hrs. Practical-06 Hrs. Total- 09 Hrs.</p>	<ul style="list-style-type: none"> <li>• Personal Protective Equipment</li> <li>• Bastard File</li> <li>• Steel Ruler</li> <li>• Meter tape</li> <li>• Scriber</li> <li>• Try Square</li> <li>• Welding Plant</li> <li>• Welding consumable</li> <li>• TIG welding torch</li> <li>• Argon cylinder</li> <li>• Argon regulator</li> <li>• Baby grinder</li> <li>• Wire brush</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>welding procedure specifications/job requirements</p> <ul style="list-style-type: none"> <li>• Deposit filling passes as per welding procedure specifications/job requirements</li> <li>• Deposit capping pass as per welding procedure specifications/job requirements</li> <li>• Check root, filling and capping passes for any visual discontinuities at regular intervals</li> </ul> <p>Follow applicable manufacturing codes and standards for acceptance criteria of visual welding defects</p>	<p>remedial measures</p> <ul style="list-style-type: none"> <li>• Knowledge of Welding codes standards</li> </ul> <p>Method of Pre-heating of base metal</p> <p><b><u>Practical Activity</u></b></p> <ul style="list-style-type: none"> <li>• Make a single V butt joint on Flat (1G) Position</li> <li>• Make a lap joint of carbon steel plates on flat (1F) position</li> </ul>			
<p><b>LU3.</b> Make Welds on Carbon Steel Plate</p> <p>Horizontal (2F) and</p>	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>• Adjust welding parameters (current, voltage etc.) as per welding procedure specifications/job</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge about Horizontal (2F) &amp; (2G) welding position.</li> <li>• Understanding about the standard working</li> </ul>	<p>Theory-3 Hrs. Practical-06 Hrs. Total- 09 Hrs.</p>	<ul style="list-style-type: none"> <li>• Personal Protective Equipment</li> <li>• Bastard File</li> <li>• Steel Ruler</li> <li>• Meter tape</li> </ul>	



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



Horizontal (2G)	<p>requirements to produce acceptable weld</p> <ul style="list-style-type: none"> <li>• Maintain standard position of electrode and base metal as per SOPs</li> <li>• Carry out welding in Horizontal (2F) and Horizontal (2G) positions following standard procedures</li> <li>• Deposit root pass as per welding procedure specifications/job requirements</li> <li>• Deposit filling passes as per welding procedure specifications/job requirements</li> <li>• Deposit capping pass as per welding procedure specifications/job requirements</li> <li>• Check root, filling and capping passes for any visual discontinuities at regular intervals <ul style="list-style-type: none"> <li>• Follow applicable</li> </ul> </li> </ul>	<p>procedures of welding</p> <p><b><u>Practical Activity</u></b></p> <ul style="list-style-type: none"> <li>• Make a single V butt joint on Horizontal (2G) Position</li> <li>• Make a corner joint of carbon steel plates on horizontal (2F) position</li> </ul>		<ul style="list-style-type: none"> <li>• Scriber</li> <li>• Try Square</li> <li>• Welding Plant</li> <li>• Welding consumable</li> <li>• TIG welding torch</li> <li>• Argon cylinder</li> <li>• Argon regulator</li> <li>• Baby grinder</li> <li>• Wire brush</li> </ul>	
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	manufacturing codes and standards for acceptance criteria of visual welding defects				
<b>LU4.</b> Make Welds on Carbon Steel Plate  Vertical (3F) and Vertical (3G)	<b>Trainee will be able to:</b> <ul style="list-style-type: none"> <li>• Adjust welding parameters (current, voltage etc.) as per welding procedure specifications/job requirements to produce acceptable weld</li> <li>• Maintain standard position of electrode and base metal as per SOPs</li> <li>• Carry out welding in Vertical (3F) and Vertical (3G) positions following standard procedures</li> <li>• Deposit root pass as per welding procedure specifications/job requirements</li> <li>• Deposit filling passes as per welding procedure specifications/job requirements</li> <li>• Deposit capping pass as</li> </ul>	Hazards associated with TIG welding and take remedial measures <ul style="list-style-type: none"> <li>• Knowledge about vertical (3F) &amp; (3G) position</li> <li>• Understanding about the standard working procedures of welding</li> </ul> <b>Practical Activity</b> <ul style="list-style-type: none"> <li>• Make a Double V butt joint on Vertical (3G) Position</li> <li>• Make a T joint of carbon steel plates on Vertical (3F) position</li> </ul>	Theory-4 Hrs. Practical-09 Hrs. Total- 13 Hrs.	<ul style="list-style-type: none"> <li>• Personal Protective Equipment</li> <li>• Bastard File</li> <li>• Steel Ruler</li> <li>• Meter tape</li> <li>• Scriber</li> <li>• Try Square</li> <li>• Welding Plant</li> <li>• Welding consumable</li> <li>• TIG welding torch</li> <li>• Argon cylinder</li> <li>• Argon regulator</li> <li>• Baby grinder</li> <li>• Wire brush</li> </ul>	



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>per welding procedure specifications/job requirements</p> <ul style="list-style-type: none"> <li>• Check root, filling and capping passes for any visual discontinuities at regular intervals</li> <li>• Follow applicable manufacturing codes and standards for acceptance criteria of visual welding defects</li> </ul>				
<p><b>LU5.</b>Make Welds on Carbon Steel Plate</p> <p>Overhead (4F) and Overhead (4G)</p>	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>• Adjust welding parameters (current, voltage etc.) as per welding procedure specifications/job requirements to produce acceptable weld</li> <li>• Maintain standard position of electrode and base metal as per SOPs</li> <li>• Carry out welding in</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge about vertical (4F) &amp; (4G) position</li> <li>• Understanding about the standard working procedures of welding</li> </ul> <p>standard specifications</p> <p><b><u>Practical Activity</u></b></p>	<p>Theory-4 Hrs. Practical-12 Hrs. Total- 16 Hrs.</p>	<ul style="list-style-type: none"> <li>• Personal Protective Equipment</li> <li>• Bastard File</li> <li>• Steel Ruler</li> <li>• Meter tape</li> <li>• Scriber</li> <li>• Try Square</li> <li>• Welding Plant</li> <li>• Welding consumable</li> <li>• TIG welding</li> </ul>	



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>Overhead (4F) and Overhead (4G) positions following standard procedures</p> <ul style="list-style-type: none"> <li>• Deposit root pass as per welding procedure specifications/job requirements</li> <li>• Deposit filling passes as per welding procedure specifications/job requirements</li> <li>• Deposit capping pass as per welding procedure specifications/job requirements</li> <li>• Check root, filling and capping passes for any visual discontinuities at regular intervals</li> <li>• Follow applicable manufacturing codes and standards for acceptance criteria of visual welding defects</li> </ul>	<ul style="list-style-type: none"> <li>• Make a Single V butt joint on Overhead (4G) Position</li> <li>• Make a T joint of carbon steel plates on overhead (4F) position</li> </ul>		<p>torch</p> <ul style="list-style-type: none"> <li>• Argon cylinder</li> <li>• Argon regulator</li> <li>• Baby grinder</li> <li>• Wire brush</li> </ul>	
<b>LU6.</b> Perform Post Welding Operations	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>• Carry out finishing work of</li> </ul>	<ul style="list-style-type: none"> <li>• Understanding of welding defects</li> <li>• Knowledge about</li> </ul>	Theory-5 Hrs. Practical-12 Hrs.	<ul style="list-style-type: none"> <li>• Personal Protective Equipment</li> </ul>	



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>welds following standard procedures.</p> <ul style="list-style-type: none"> <li>• Inspect weld visually and mark any visual defects, as required</li> <li>• Perform Dye Penetration Test (DPT)</li> <li>• Carry out repair work in accordance with approved procedures, as required.</li> <li>• Clean work area in accordance with workplace safety practices.</li> <li>• Maintain tools/ equipment/consumable materials in accordance with organization guidelines</li> <li>• Store tools / equipment / consumable materials in accordance with organization guidelines.</li> </ul>	<p>the Inspection techniques of welding joints</p> <ul style="list-style-type: none"> <li>• Knowledge about the DPT</li> <li>• Understanding about the procedure of DPT</li> <li>• Method of Post-weld heat-treatment of base metal</li> </ul> <p><b><u>Practical Activity</u></b></p> <ul style="list-style-type: none"> <li>• Perform Dye Penetration Test (DPT) of welding joints</li> </ul>	Total- 17 Hrs.	<ul style="list-style-type: none"> <li>• Bastard File</li> <li>• Steel Ruler</li> <li>• Meter tape</li> <li>• Wire brush</li> <li>• Post-weld Heat treatment apparatus</li> <li>• Baby Grinder</li> <li>• Magnifying glass</li> <li>• Torch</li> <li>• DPT Sprays</li> </ul>	
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



**0715-MF&P 04    Module: Perform GMAW (MIG/MAG) and FCAW Welding**

**Objective:** This module covers the knowledge and skills required to Identify basic knowledge and skills required to Prepare Welding Machine for GMAW (MIG/MAG), Make Welds on Carbon Steel Plate with GMAW at Flat (1F) and Flat (1G), Make Welds on Carbon Steel Plate with GMAW at Horizontal (2F) and Horizontal (2G), Prepare Welding Machine for FCAW, Make Welds on Carbon Steel Plate with FCAW at Vertical (3F) and Vertical (3G) and Perform Post Welding Operations.

**Duration: 54            Hours**

**Theory: 18            Hours**

**Practice:            36 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
<b>LU1.</b> Prepare Welding Machine for GMAW (MIG/MAG)	<b>Trainee will be able to:</b> <ul style="list-style-type: none"> <li>Identify welding requirements from welding procedure specifications/technical drawings</li> <li>Prepare welding machine in accordance with welding procedure specifications/ manufacturer instructions.</li> <li>Set up welding machine accessories and consumables as per job requirements, welding procedure specifications and/or manufacturer's instructions</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of MIG welding</li> <li>Use of Personal Protective Equipment required for MIG welding</li> <li>Safe working practices to be followed while carrying out MIG welding</li> <li>Purpose of shielding gas in MIG welding</li> <li>Factors considered in MIG welding; <ul style="list-style-type: none"> <li>Type and thickness of the base metal</li> <li>Current and polarity</li> </ul> </li> <li>Type of shielding gas to be</li> </ul>	Theory-3Hrs. Practical-06 Hrs. Total- 09 Hrs.	<ul style="list-style-type: none"> <li>Personal Protective Equipment</li> <li>Bastard File</li> <li>Steel Ruler</li> <li>Meter tape</li> <li>Scriber</li> <li>Try Square</li> <li>Welding Plant with wire feed unit</li> <li>Welding consumable/ Wire spool</li> <li>MIG welding Gun</li> <li>Argon cylinder</li> <li>Argon regulator</li> <li>CO<sup>2</sup> Cylinder</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<ul style="list-style-type: none"> <li>Connect welding machine to an independent power supply</li> <li>Set polarity indicated in the welding procedure specifications job requirement</li> <li>Prepare work piece for welding as per job requirement</li> </ul>	<p>used</p> <p><b><u>Practical Activity</u></b></p> <ul style="list-style-type: none"> <li>Select appropriate hand tools and accessories for operating the GMAW /MIG/MAG welding machine according to the given task</li> </ul>		<ul style="list-style-type: none"> <li>CO<sup>2</sup> regulator</li> <li>CO<sup>2</sup> Heater</li> <li>Baby grinder</li> <li>Wire brush</li> </ul>	
<b>LU2.</b> Make Welds on Carbon Steel Plate with GMAW Flat (1F) and Flat (1G)	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>Adjust welding parameters (current, voltage etc.) as per welding procedure specifications/job requirements to produce acceptable weld</li> <li>Maintain standard position of electrode and base metal as per SOPs</li> <li>Carry out welding in Flat (1F) and Flat (1G) positions following standard procedures</li> <li>Deposit root pass as per welding procedure</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of Flat (1F) and Flat (1G) welding positions</li> <li>Knowledge about standard procedure of MIG welding</li> <li>Understanding about the standard welding codes of MIG Method of Pre-heating of base metal</li> </ul> <p>purpose of using shielding gas in MIG/MAG welding</p> <p><b><u>Practical Activity</u></b></p>	<p>Theory-3Hrs. Practical-06 Hrs. Total- 09 Hrs</p>	<ul style="list-style-type: none"> <li>Scriber</li> <li>Try Square</li> <li>Welding Plant with wire feed unit</li> <li>Welding consumable/ Wire spool</li> <li>MIG welding Gun</li> <li>Argon cylinder</li> <li>Argon regulator</li> <li>CO<sup>2</sup> Cylinder</li> <li>CO<sup>2</sup> regulator</li> <li>CO<sup>2</sup> Heater</li> <li>Baby grinder</li> <li>Wire brush</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>specifications/job requirements</p> <ul style="list-style-type: none"> <li>• Deposit filling passes as per welding procedure specifications/job requirements</li> <li>• Deposit capping pass as per welding procedure specifications/job requirements</li> <li>• Check root, filling and capping passes for any visual discontinuities at regular intervals</li> <li>• Follow applicable manufacturing codes and standards for acceptance criteria of visual welding defects</li> </ul>	<ul style="list-style-type: none"> <li>• Make a single V butt joint on Flat (1G) Position</li> <li>• Make a lap joint of carbon steel plates on Flat (1F) position</li> </ul>			
<b>LU3.</b> Make Welds on Carbon Steel Plate with GMAW Horizontal (2F) and	<b>Trainee will be able to:</b> <ul style="list-style-type: none"> <li>• Adjust welding parameters (current, voltage etc.) as per welding procedure specifications/job</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of Flat (1F) and Flat (1G) welding positions</li> </ul>	Theory-3Hrs. Practical-06 Hrs. Total- 09 Hrs	<ul style="list-style-type: none"> <li>• Scriber</li> <li>• Try Square</li> <li>• Welding Plant with wire feed unit</li> </ul>	





**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



Horizontal (2G)	<p>requirements to produce acceptable weld</p> <ul style="list-style-type: none"> <li>• Maintain standard position of electrode and base metal as per SOPs</li> <li>• Carry out welding in Horizontal (2F) and Horizontal (2G) positions following standard procedures</li> <li>• Deposit root pass as per welding procedure specifications/job requirements</li> <li>• Deposit filling passes as per welding procedure specifications/job requirements</li> <li>• Deposit capping pass as per welding procedure specifications/job requirements</li> <li>• Check root, filling and capping passes for any visual discontinuities at regular intervals</li> </ul> <p>Follow applicable</p>	<ul style="list-style-type: none"> <li>• Knowledge about standard procedure of Horizontal (2F) &amp; (2G) MIG welding</li> </ul> <p>Polarity setting according to standard specifications</p> <p><b><u>Practical Activity:</u></b></p> <ul style="list-style-type: none"> <li>• Make a single V butt joint on Horizontal (2G) Position</li> <li>• Make a corner joint of carbon steel plates on Horizontal (2F) position</li> </ul>		<ul style="list-style-type: none"> <li>• Welding consumable/ Wire spool</li> <li>• MIG welding Gun</li> <li>• Argon cylinder</li> <li>• Argon regulator</li> <li>• CO<sup>2</sup> Cylinder</li> <li>• CO<sup>2</sup> regulator</li> <li>• CO<sup>2</sup> Heater</li> <li>• Baby grinder</li> <li>• Wire brush</li> </ul>	
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	manufacturing codes and standards for acceptance criteria of visual welding defects				
<b>LU4.</b> Prepare Welding Machine for FCAW	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>Identify welding requirements from welding procedure specifications/technical drawings</li> <li>Prepare welding machine in accordance with welding procedure specifications/ manufacturer instructions.</li> <li>Set up welding machine accessories and consumables as per job requirements, welding procedure specifications and/or manufacturer’s instructions</li> <li>Connect welding machine to an independent power supply</li> <li>Set polarity indicated in the welding procedure specifications job</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge about the FCAW welding</li> <li>Differentiate GMAW and FCAW process Attach the welding gun with wire feed unit.</li> </ul> <p>Safe working practices to be followed while carrying out FCAW welding</p> <ul style="list-style-type: none"> <li>Knowledge about the purpose of shielding gas in FCAW welding</li> <li>Factors considered in FCAW:               <ol style="list-style-type: none"> <li>Type and thickness of the base metal</li> <li>current and polarity</li> <li>Type of shielding gas to be used</li> </ol> </li> </ul> <p><b>Practical Activity:</b> <b><u>Practical Activity</u></b></p> <ul style="list-style-type: none"> <li>Select appropriate hand tools and</li> </ul>	<p>Theory-3Hrs. Practical-06 Hrs. Total- 09 Hrs .</p>	<ul style="list-style-type: none"> <li>Scriber</li> <li>Try Square</li> <li>Welding Plant with wire feed unit</li> <li>Welding consumable/ Wire spool</li> <li>FCAW welding Gun</li> <li>Argon cylinder</li> <li>Argon regulator</li> <li>CO<sup>2</sup> Cylinder</li> <li>CO<sup>2</sup> regulator</li> <li>CO<sup>2</sup> Heater</li> <li>Baby grinder</li> <li>Wire brush</li> <li></li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	requirement Prepare work piece for welding as per job requirement	accessories for operating the GTAW/TIG welding machine according to the given task requirements.			
<b>LU5.</b> Make Welds on Carbon Steel Plate with FCAW  Vertical (3F) and Vertical (3G)	<b>Trainee will be able to:</b> <ul style="list-style-type: none"> <li>• Adjust welding parameters (current, voltage etc.) as per welding procedure specifications/job requirements to produce acceptable weld</li> <li>• Maintain standard position of electrode and base metal as per SOPs</li> <li>• Carry out welding in Vertical (3F) and Vertical (3G) positions following standard procedures</li> <li>• Deposit root pass as per welding procedure specifications/job requirements</li> <li>• Deposit filling passes as per welding procedure specifications/job requirements</li> </ul>	<ul style="list-style-type: none"> <li>• Understanding about vertical (3F) &amp; (3G) positions of FCAW welding</li> <li>• Understanding about the standard working procedures of FCAW welding</li> </ul> <b><u>Practical Activity:</u></b> <ul style="list-style-type: none"> <li>• Make a Double V butt joint on Vertical (3G) Position</li> <li>• Make a T joint of carbon steel plates on Vertical (3F) position</li> </ul>	Theory-3Hrs. Practical-06 Hrs. Total- 09 Hrs	<ul style="list-style-type: none"> <li>• Scriber</li> <li>• Try Square</li> <li>• Welding Plant with wire feed unit</li> <li>• Welding consumable/ Wire spool</li> <li>• FCAW welding Gun</li> <li>• Argon cylinder</li> <li>• Argon regulator</li> <li>• CO<sup>2</sup> Cylinder</li> <li>• CO<sup>2</sup> regulator</li> <li>• CO<sup>2</sup> Heater</li> <li>• Baby grinder</li> <li>• Wire brush</li> </ul>	



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<ul style="list-style-type: none"> <li>• Deposit capping pass as per welding procedure specifications/job requirements</li> <li>• Check root, filling and capping passes for any visual discontinuities at regular intervals</li> <li>• Follow applicable manufacturing codes and standards for acceptance criteria of visual welding defects</li> </ul>				
<b>LU6.</b> Perform Post Welding Operations	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>• Carry out finishing work of welds following standard procedures.</li> <li>• Inspect weld visually and mark any visual defects, as required</li> <li>• Perform Dye Penetration Test (DPT)</li> <li>• Carry out repair work in accordance with approved procedures, as required.</li> <li>• Clean work area in</li> </ul>	<ul style="list-style-type: none"> <li>• Understanding of welding defects</li> <li>• Knowledge about the Inspection techniques of welding joints</li> <li>• Knowledge about the DPT</li> <li>• Understanding about the procedure of DPT</li> </ul>	<p>Theory-3Hrs. Practical-06 Hrs. Total- 09 Hrs</p>	<ul style="list-style-type: none"> <li>• Personal Protective Equipment</li> <li>• Bastard File</li> <li>• Steel Ruler</li> <li>• Meter tape</li> <li>• Wire brush</li> <li>• Post-weld Heat-treatment apparatus</li> <li>• Baby Grinder</li> <li>• Magnifying glass</li> <li>• Torch</li> <li>• DPT Sprays</li> </ul>	



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>accordance with workplace safety practices.</p> <ul style="list-style-type: none"> <li>• Maintain tools, equipment and consumable materials in accordance with organization guidelines</li> <li>• Store tools / equipment / consumable materials in accordance with organization guidelines .</li> </ul>	<p><b><u>Practical Activity</u></b></p> <ul style="list-style-type: none"> <li>• Perform Dye Penetration Test (DPT) of welding joints</li> </ul>		(Cleaner, Penetrant and Developer)	
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



**0715-MF&P 05      Module: Carryout Continuous Casting Machine (CCM) operations**

**Objective:** This module covers the knowledge and skills required to Read and Understand Practice safety requirements for CCM, Perform Coordination with attached sections, Carry out pre- casting operations of CCM, Carry out casting process and Conduct cleaning and maintenance of equipment

**Note:** The learning units in the module are recommended to be carried out in a real work environment (relevant industry) under MOU agreed upon between the concerned industry for practical work and training institute for impart of theoretical portion of the module

Duration: **102**

**Hours**

**Theory: 21**

**Hours**

**Practice: 81 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
<b>LU1.</b> Practice safety requirements for CCM	<b>Trainee will be able to:</b> <ul style="list-style-type: none"> <li>• Use standard PPEs as per job requirement</li> <li>• Use standard tools and equipment as per job requirement</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of PPE's.</li> <li>• Identification of Work place safety and health considerations</li> <li>• Using of PPE's</li> <li>• Understanding of health and safety.</li> <li>• Importance of health safety.</li> </ul> <p><u><b>Practical Activity</b></u></p>	<p>Theory-6Hrs. Practical-15 Hrs. Total- 21 Hrs.</p>	<ul style="list-style-type: none"> <li>• PPE's</li> <li>• Manual of Organizational SOP</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



		<ul style="list-style-type: none"> <li>Identify and wear PPE's equipment as per requirements.</li> </ul>			
<b>LU2.</b> Perform Coordination with attached sections	<b>Trainee will be able to:</b> <ul style="list-style-type: none"> <li>Coordinate with melting section to receive molten metal</li> <li>Coordinate with the rolling mill section for direct rolling operation</li> <li>Inform to the concerned shops in case of any abnormality arises during casting process.</li> </ul>	<ul style="list-style-type: none"> <li>Description of CCM.</li> <li>Understanding of working with other departments.</li> <li>Importance of communication skills</li> <li>Understanding of communication skills</li> <li>Importance of communication skills</li> </ul> <p><b><u>Practical Activity</u></b></p> <p>Written communication with relevant departments.</p>	Theory-6 Hrs. Practical-15 Hrs. Total- 21 Hrs.		Class Room and relevant industry
<b>LU3.</b> Carry out pre-casting operations of CCM	<b>Trainee will be able to:</b> <ul style="list-style-type: none"> <li>Prepare launder and mold jacket safety cover</li> <li>Carry out mold tube</li> </ul>	<ul style="list-style-type: none"> <li>Explanation of CCM.</li> <li>Understanding of per casting steps.</li> <li>Importance of per</li> </ul>	<ul style="list-style-type: none"> <li>3 Hrs.</li> <li>Practical -18 Hrs.</li> </ul> <p>Total- 21 Hrs</p>	<ul style="list-style-type: none"> <li>CCM and accessories</li> <li>Overhead crane</li> <li>Mold tube</li> </ul>	Class Room and relevant industry



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>cleaning as per standard</p> <ul style="list-style-type: none"> <li>• Perform slag box cleaning and changing</li> <li>• Apply dummy bar packing/ceiling oil as per requirement</li> <li>• Perform Spray nozzle cleaning as per requirement</li> <li>• Check primary cooling water pressure inlet and outlet</li> <li>• Prepare strands for casting as per requirement</li> <li>• Preheat tundish and tundish nozzles as per requirement</li> <li>• Prepare strands of casting tundish nozzles</li> <li>• Carryout centering of tundish trolley as per requirement</li> <li>• Check the operation of all strands in new tundish as per standard</li> <li>• Check ladle nozzle opening as per</li> </ul>	<p>casting operations.</p> <ul style="list-style-type: none"> <li>• Understanding of per casting operations</li> <li>• Importance of per casting operations.</li> </ul> <p><b><u>Practical Activity</u></b> Inspection of Equipments before casting operations.</p>		<ul style="list-style-type: none"> <li>• Foot ring</li> <li>• Ladle turret</li> <li>• Tundish cars</li> <li>• Oscillating mould</li> <li>• Withdrawal units</li> <li>• Straightening machines</li> <li>• Dummy bar</li> <li>• Roller tables</li> <li>• Cooling bed and transfer</li> <li>• Oxygen lancing accessories</li> </ul>	
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<ul style="list-style-type: none"> <li>standard</li> <li>• Fix slide gate plate of ladle as per standard</li> <li>• Put dummy bar in mold tube by skid bank operator.</li> </ul>				
<b>LU4.</b> Carry out casting process		<ul style="list-style-type: none"> <li>• Explanation of CCM.</li> <li>• Knowledge of casting steps.</li> <li>• Importance of casting operations.</li> <li>• Understanding of casting operations</li> <li>• Importance of casting operations.</li> <li>• Understanding of Tundish level Control</li> <li>• Function of tundish nozzels</li> <li>• Importance of Mould level, by means of strand's speed and nozzle regulation.</li> <li>• importance of Mould width Strand cooling controls,</li> </ul>	<ul style="list-style-type: none"> <li>• 3 Hrs.</li> <li>• Practical -15 Hrs.</li> </ul> <p>Total- 18 Hrs</p>	<ul style="list-style-type: none"> <li>• CCM and accessories</li> <li>• Overhead crane</li> <li>• Mold tube</li> <li>• Foot ring</li> <li>• Ladle turret</li> <li>• Tundish cars</li> <li>• Oscillating mould</li> <li>• Withdrawal units</li> <li>• Straightening machines</li> <li>• Dummy bar</li> <li>• Roller tables</li> <li>• Cooling bed and transfer</li> <li>• Oxygen lancing</li> </ul>	Class Room and relevant industry



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



		<p>based on metallurgical recipes</p> <ul style="list-style-type: none"> <li>• importance of Breakout prediction</li> <li>• understanding of Laddle handling and slide gate plate.</li> </ul> <p><b><u>Practical Activity</u></b> Inspection of Equipments during casting operations.</p>		accessories	
<b>LU5.</b> Conduct cleaning and maintenance of equipment	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>• Clean the equipments and process auxiliaries regularly to remove any dust, moisture, waste material</li> <li>• Open the equipment and clean the internal parts of the equipment</li> <li>• Clean the working area under the process and create a healthy, clean and safe working environment</li> </ul>	<ul style="list-style-type: none"> <li>• Description of CCM.</li> <li>• Understanding of cleaning steps after casting.</li> <li>• Importance of cleaning operations.</li> <li>• Understanding of cleaning operations</li> <li>• Importance of per casting operations.</li> </ul>	<ul style="list-style-type: none"> <li>• 3 Hrs.</li> <li>• Practical -18 Hrs.</li> </ul> <p>Total- 21 Hrs</p>		Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



**0715-MF&P 06 Module: Carryout Metal processing with Metallic powder**

**Objective:** This module covers the knowledge and skills required to Select particle size and morphology of powder, Calculate the required weight of powder and binder, Prepare metallic powder blend, Operate hydraulic press, Set the parameters of sintering furnace, Perform sintering operation in the furnace, Carry out the inspection of sintered Component

Duration: **78 Hours**

**Theory: 18 Hours**

**Practice: 60 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
<b>LU1.</b> Select particle size and morphology of powder	<b>Trainee is able to:</b> <ul style="list-style-type: none"> <li>Practice PPEs to control chemical hazards.</li> <li>Select the required metallic powder particle size as per job requirement.</li> <li>Select the metallic powder morphology from the material supplier catalogue.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge about powder metallurgy</li> <li>using of PPE's.</li> <li>Understanding of Work place safety and health considerations</li> <li>Use of PPE's Importance of health safety.</li> <li>Description of different shapes and size of powder particles.</li> <li>Knowledge of shapes and size of powder particles. Types of shapes and size of powder</li> </ul>	Theory-2Hrs. Practical-6 Hrs. Total- 08 Hrs.	<ul style="list-style-type: none"> <li>Compound Pressure Gauge</li> <li>Allen Key Set</li> <li>Gauge manifold</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



		<p>particles.</p> <p><b><u>Practical Activity</u></b></p> <ul style="list-style-type: none"> <li>Select the powder particles shapes and size as per requirements.</li> </ul>			
<p><b>LU2.</b> Calculate the required weight of powder and binder</p>	<p><b>Trainee is able to:</b></p> <ul style="list-style-type: none"> <li>Select the density of actual metal</li> <li>Select the volume of the required part</li> <li>Calculate the required mass of powder</li> <li>Calculate the required percentage of binder</li> <li>Weight the amount of powder and binder as per requirement</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge about density of different metals.Importance of density of metals.</li> <li>Understanding powder weighing</li> <li>Importance of powder blending.</li> <li>Procedure of powder blending.</li> </ul> <p><b><u>Practical Activity</u></b></p> <p>Calculate the required weight of powder for blending as per job requirement</p>	<p>Theory-2Hrs. Practical-6 Hrs. Total- 08 Hrs .</p>	<ul style="list-style-type: none"> <li>High Pressure Gauge</li> <li>Allen Key Set</li> <li>Gauge manifold</li> </ul>	<p>Class Room and Lab</p>
<p><b>LU3.</b> Prepare metallic powder blend</p>	<p><b>Trainee is able to:</b></p> <ul style="list-style-type: none"> <li>Carry out mixing and blending of powder and binder as per</li> </ul>	<p>Importance of powder particles sizes and shapes.Understanding of powder mixing.</p> <ul style="list-style-type: none"> <li>Knowledge of different techniques of powder mixing</li> </ul>	<p>Theory-2Hrs. Practical-6 Hrs. Total- 08 Hrs</p>	<ul style="list-style-type: none"> <li>Basic Measuring tools</li> <li>Basic Hand tools</li> <li>Basic Marking</li> </ul>	<p>Class Room and Lab</p>



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<ul style="list-style-type: none"> <li>requirement</li> <li>Set the time of mixer as per requirement.</li> <li>Fill the die with blended powder and close the die.</li> </ul>	<ul style="list-style-type: none"> <li>Understanding the importance of powder mixing</li> <li>Understanding the method of time setting of mixer and die filling with blended powder</li> </ul> <p><b><u>Practical Activity</u></b></p> <p>Prepare powder blend and perform die filling with blended powder</p>		<p>tools</p> <ul style="list-style-type: none"> <li>Gauge manifold</li> <li>Compound Pressure Gauge</li> <li>High Pressure Gauge</li> <li>Refrigerant Recovery Unit</li> </ul>	
<b>LU4.</b> Operate hydraulic press	<p><b>Trainee is able to:</b></p> <ul style="list-style-type: none"> <li>Raise the front safety guard of press as per standard</li> <li>Place the die filled with powder on the lower pressing die</li> <li>Lower the front safety guard as per standard</li> <li>Lower the pressing face by turning the screw handle as per SOPs</li> <li>Pull and push the pump handle to smoothly build up required pressure and</li> </ul>	<p>Importance of pressing operations.</p> <ul style="list-style-type: none"> <li>Knowledge about different techniques used for powder pressing operation</li> </ul> <p>Understanding of green strength.</p> <ul style="list-style-type: none"> <li>Importance green strength.</li> </ul> <p><b><u>Practical Activity</u></b></p> <p>Perform pressing of blended powder in die</p>	<p>Theory-3Hrs. Practical-9 Hrs. Total- 12 Hrs</p>		<p>Class Room and Lab</p>



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>hold the applied tonnage as required.</p> <ul style="list-style-type: none"> <li>• Release the pressure load as per standard</li> <li>• Open the front safety guard and remove die from hydraulic press.</li> <li>• Remove the green compact part from the die.</li> <li>• Calculate the density of green</li> </ul>				
<b>LU5.</b> Set the parameters of sintering furnace	<p><b>Trainee is able to:</b></p> <ul style="list-style-type: none"> <li>• Adjust the controls of the furnace i.e. water flow, heating chamber, heating coils, thermocouple and exhaust system</li> <li>• Set the furnace to required temperature</li> <li>• Set the heating rate of the furnace</li> <li>• Set the holding time of the furnace</li> <li>• Select the required inert gas for environmental conditions</li> </ul>	<ul style="list-style-type: none"> <li>• Definition of sintering.</li> <li>• Identification of sintering parameters.</li> <li>• Importance of soaking operations.</li> <li>• Knowledge about the sintering furnaces</li> </ul> <p><b>Practical Activity</b> Perform setting of furnace for sintering operation</p>	<ul style="list-style-type: none"> <li>• 3 Hrs.</li> <li>• Practical -9 Hrs.</li> </ul> <p>Total- 12 Hrs</p>		Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<ul style="list-style-type: none"> <li>• Connect the gas cylinder with furnace</li> <li>• Set the required pressure of gas</li> <li>• Connect the vacuum pump to the furnace heating chamber, if vacuum is required</li> </ul>				
<b>LU6.</b> Perform sintering operation in the furnace	<p><b>Trainee is able to:</b></p> <ul style="list-style-type: none"> <li>• Place the green compact in the heating chamber of furnace</li> <li>• Close the door of heating chamber</li> <li>• Set ON the furnace power supply.</li> <li>• Carryout sintering cycle as per set parameters</li> <li>• Take out the sintered part from the furnace after process completion.</li> </ul>	<ul style="list-style-type: none"> <li>• Understanding of inert environment.</li> <li>• Knowledge about the gases use for sintering.</li> </ul> <p><b>Practical Activity</b> Perform the sintering operation on compacted material</p>	<p>Theory-3Hrs. Practical-12 Hrs. Total- 15 Hrs</p>		Class Room and Lab
<b>LU7.</b> Carry out the inspection of sintered Component	<p><b>Trainee is able to:</b></p> <ul style="list-style-type: none"> <li>• Inspect the component visually for any defects</li> <li>• Inspect the dimensions of the component by using measuring scale</li> </ul>	<ul style="list-style-type: none"> <li>• Understanding the inspection of dimensions.</li> <li>• Understanding of measuring of porosity.</li> </ul>	<p>Theory-3Hrs. Practical-12 Hrs. Total- 15 Hrs</p>		Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<ul style="list-style-type: none"><li>or devices</li><li>• Separate the defected and non-defected components.</li><li>• Make use of grinder to refine tolerance</li><li>• Make use of buffing operation to improve surface finish</li></ul>	<ul style="list-style-type: none"><li>• Explanation of Powered Metallurgy (PM) defects.</li><li>• Types of defects.</li><li>• Understanding of Finishing operation in PM.</li></ul>			
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



**0715-MF&P 07 Module: Perform Pre-Rolling Operation**

**Objective:** This module covers the knowledge and skills required to perform suitable types of rollers, adjust the Sequence of rolling stages to obtain the desired shape

**Duration: 36**

**Hours**

**Theory: 12**

**Hours**

**Practice:**

**24 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Select the suitable types of rollers	<b>Trainee will be able to:</b> <ul style="list-style-type: none"> <li>Check the property of rolling Materials as per requirement</li> <li>Arrange the required Materials for rolling</li> <li>Measure the work piece dimensions as per standard</li> <li>Select the types of roller as per the shape, size and gap between the rollers and their contour</li> <li>Set parameters (Pressure, Current, Speed, Time Temperature cycle, concentration, Tension)</li> </ul>	<ul style="list-style-type: none"> <li>Types of rolling process (Hot &amp; Cold)</li> <li>Importance of material behavior in Rolling process</li> <li>rolling temperature for different materials.</li> <li>Describe friction and lubrication in rolling</li> <li>Types of Heating Furnaces</li> <li>Types of forces required for rolling process.</li> </ul> <p><b><u>Practical Activity</u></b></p> <ul style="list-style-type: none"> <li>Set the rollers as</li> </ul>	<p>Theory-06Hrs. Practical-09 Hrs. Total- 15 Hrs.</p>	<ul style="list-style-type: none"> <li>Personal Protective Equipment</li> <li>Measuring Tools</li> <li>Hand Tools</li> <li>Inspection tools</li> <li>Rolling Mills and accessories</li> <li>Heating Furnaces</li> <li>Twist Pipe</li> <li>Brush Rolls</li> <li>Billet Pusher</li> <li>Rolling Mill Un Coiler Machine</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>according to work piece specifications</p> <ul style="list-style-type: none"> <li>• Set the rollers according to required rolling process</li> <li>• Set the number of passes through the rollers required to get the finished product</li> </ul>	<p>per given instructions</p>		<ul style="list-style-type: none"> <li>• Steel Rolling Mill Parts</li> <li>• Fly Wheel</li> <li>• Different types of Rollers</li> </ul>	
<p><b>LU2.</b> Adjust the Sequence of rolling stages to obtain the desired shape</p>	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>• Check points in different mills during roller assembly.</li> <li>• Check the functions of guide and stripper guards</li> <li>• Perform the Cleaning / Lubrication of different parts of rolling mill.</li> <li>• Maintain the specified tolerance for straightness</li> <li>• Align the Rollers after changing the section</li> <li>• Adjust straightening</li> </ul>	<ul style="list-style-type: none"> <li>• Cleaning and lubrication of different parts of rolling mill</li> <li>• Alignment techniques of rolling mill</li> <li>• Types of rolling mills</li> </ul> <p><b><u>Practical Activity</u></b></p> <p>Align different Rollers stages to obtain the desired shape of the product</p>	<p>Theory-06 Hrs. Practical-15 Hrs. Total- 21 Hrs.</p>	<ul style="list-style-type: none"> <li>• Personal Protective Equipment</li> <li>• Basic Measuring Tools</li> <li>• Hand Tools</li> <li>• Inspection tools</li> <li>• Rolling Mills and accessories</li> <li>• Heating Furnaces</li> <li>• Twist Pipe</li> <li>• Brush Rolls</li> <li>• Billet Pusher</li> <li>• Rolling Mill Un Coiler</li> </ul>	<p>Class Room and Lab</p>



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>rollers as per job requirement</p> <ul style="list-style-type: none"><li>• Use hammer for tightening / opening lock nut and Ring nut.</li><li>• Use Sample piece for fixing liners in between Roll pairs for Out of Square adjustment.</li></ul>			<p>Machine</p> <ul style="list-style-type: none"><li>• Steel Rolling Mill Parts</li><li>• Fly Wheel</li><li>• Different types of Rollers</li></ul>	
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



**0715-MF&P 08 Module: Perform Hot & Cold Rolling Process**

**Objective:** This module covers the knowledge and skills required to perform rolling mill process (Cold rolling) and Carryout inspection of finished product.

**Duration: 99**

**Hours**

**Theory: 18**

**Hours**

**Practice: 81 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
<b>LU1.</b> Perform Two, Three & Four high rolling mill process (Hot rolling)	<b>Trainee will be able to:</b> <ul style="list-style-type: none"> <li>• Ensure health safety and environment standards as per requirement</li> <li>• Set the temperature of the Re-heating furnace for heating the job to be rolled as per standard operating procedures.</li> <li>• Adjust the rollers in Rolling Mill according to job requirements (shape and size)</li> <li>• Set the rollers gap according to the job dimensions as per</li> </ul>	<ul style="list-style-type: none"> <li>• Understanding about the types of rolling process (Hot &amp; Cold)</li> <li>• Understanding of material behavior in metal rolling processes</li> <li>• Understanding about temperature in metal rolling</li> <li>• knowledge of strain rate sensitivity</li> <li>• Understanding about the safety practices regarding rolling process</li> <li>• Types of heating furnaces</li> <li>• Types of lubricants</li> </ul>	Theory-6Hrs. Practical-33Hrs. Total- 39 Hrs.	<ul style="list-style-type: none"> <li>• Personal Protective Equipment</li> <li>• Measuring Tools</li> <li>• Mechanical Hand Tools kit</li> <li>• Two-High Rolling Mills</li> <li>• Three-High Rolling Mills</li> <li>• Four high rolling mills</li> <li>• Reheating Furnaces</li> <li>• Pre Stressed Mill Stands</li> <li>• Twist Pipe</li> <li>• Brush Rolls</li> <li>• Billet Pusher</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<ul style="list-style-type: none"> <li>drawing</li> <li>Use lubrication in rolling process to reduce the friction between rolls and metal</li> <li>Pass the job in different high rolling mills gradually to get the final product as per given requirement</li> <li>Use standard hand tools used in rolling process as per requirement</li> </ul>	<ul style="list-style-type: none"> <li>Two-High Rolling Mills</li> <li>Three-High Rolling Mill</li> <li>Four high rolling mills</li> </ul> <p><b><u>Practical Activity</u></b></p> <ul style="list-style-type: none"> <li>Perform Two/Three/Four high rolling mill process (Hot rolling) as per requirement</li> </ul>		<ul style="list-style-type: none"> <li>Rolling Mill Un-Coiler Machine</li> <li>Steel Rolling Mill Parts</li> <li>Fly Wheel</li> <li>Rolling Mill Plant Spare Parts</li> <li>Ejector Machines</li> <li>Metal Straightening Machine</li> <li>Roller Guide Box</li> <li>Rolling Mill Coilers</li> </ul>	
<b>LU2.</b> Perform Tandem rolling mill process (Cold rolling)	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>Ensure health safety and environment standards as per requirement</li> <li>Adjust the rollers in Rolling Mill according to job requirement</li> </ul>	<p>Types of heating furnaces</p> <ul style="list-style-type: none"> <li>Knowledge about the tandem rolling mill</li> <li>Understanding about the Tandem rolling mill process</li> </ul>	<p>Theory-6 Hrs. Practical-30 Hrs. Total- 36 Hrs.</p>	<ul style="list-style-type: none"> <li>Measuring Tools</li> <li>Mechanical Hand Tools kit</li> <li>Tandem rolling mills</li> <li>Reheating Furnaces</li> <li>Pre Stressed Mill</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<ul style="list-style-type: none"> <li>Set the rollers gap according to the job dimensions as per drawing</li> <li>Use lubrication in rolling process to reduce the friction between rolls and metal</li> <li>Pass the job in tandem rolling mills to get the final product as per given requirement</li> <li>Use standard hand tools used in rolling process as per requirement</li> </ul>	<p><b><u>Practical Activity</u></b></p> <ul style="list-style-type: none"> <li>Perform Tandem rolling mill process (Cold rolling) as per requirement</li> </ul>		<p>Stands</p> <ul style="list-style-type: none"> <li>Twist Pipe</li> <li>Brush Rolls</li> <li>Billet Pusher</li> <li>Rolling Mill Un-Coiler Machine</li> <li>Steel Rolling Mill Parts</li> <li>Fly Wheel</li> <li>Rolling Mill Plant Spare Parts</li> <li>Ejector Machines</li> <li>Metal Straightening Machine</li> <li>Roller Guide Box</li> <li>Rolling Mill Coilers</li> </ul>	
<b>LU3.</b> Carryout inspection of finished product	<ul style="list-style-type: none"> <li>Inspect rolling defects as per standard operating procedure</li> <li>Use standard tools to rectify the defects in the given product.</li> <li>Check the dimension</li> </ul>	<ul style="list-style-type: none"> <li>Measuring techniques used for inspection of the rolling product</li> <li>Knowledge about the rolling defects and its remedies</li> </ul>	<p>Theory-6 Hrs. Practical-18Hrs. Total- 24 Hrs</p>	<ul style="list-style-type: none"> <li>Measuring Tools</li> <li>Mechanical Hand Tools kit</li> <li>Inspection tools</li> </ul>	



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>of the product by using calibrated tools</p> <ul style="list-style-type: none"><li>• Verify the final product dimensions</li><li>• Generate report as per requirement</li></ul>	<p><b><u>Practical Activity</u></b></p> <ul style="list-style-type: none"><li>• Inspect the rolling Product</li></ul>			
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



**0715-MF&P 09 Module: Perform Metallography of Metallic Materials**

**Objective:** This module covers the knowledge and skills required to Prepare specimen for metallography, Demonstrate the working of metallurgical microscope

**Duration: 66**

**Hours**

**Theory:18**

**Hours**

**Practice: 48 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare specimen for metallography	<b>Trainee is able to:</b> <ul style="list-style-type: none"> <li>Select the material to perform metallography</li> <li>Cut the specimen according to specifications</li> <li>Mount the specimen by ensuring flat level</li> <li>Perform Rough polishing of the specimen with round grinder</li> <li>Perform fine polishing of the specimen using emery paper from low mesh number to high mesh number</li> <li>use polishing cloth as final polishing step</li> <li>Etch the polished</li> </ul>	<ul style="list-style-type: none"> <li>knowledge of the metallography Process</li> <li>Identification of types of emery paper and mesh sizes</li> <li>Importance of rough and fine grinding.</li> <li>Identification of Various types of etchants</li> <li>Applications of etchants.</li> <li>Importance of metallography.</li> </ul> <p><b><u>Practical Activity</u></b></p> <p>Prepare the steel sample for metallography.</p>	<p>Theory-9Hrs. Practical-24 Hrs. Total- 33 Hrs.</p>	<ul style="list-style-type: none"> <li>Specimen Cut off Machine &amp; Accessories</li> <li>Specimen Mounting Press &amp; Accessories</li> <li>Belt Grinder,</li> <li>Polishing Stand,</li> <li>Disc Polishing Machine,</li> <li>Drier,</li> <li>Emery Papers (120, 220, 400, 600, 800 Grit)</li> <li>Polishing Cloth</li> <li>Etchant (2% Nital).</li> <li>Safety Equipment</li> </ul>	Class Room and Lab





**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	specimen using advised etchant				
	<ul style="list-style-type: none"> <li>Observe the work piece under metallurgical microscope</li> </ul>				
<b>LU2.</b> Demonstrate the working of metallurgical microscope	<b>Trainee is able to:</b> <ul style="list-style-type: none"> <li>Prepare metallic specimen according to metallographic procedures</li> <li>Put the specimen on the mechanical stage of microscope</li> <li>Use plasticine to level its surface</li> <li>use various magnifications to observe microstructure of specimen</li> <li>throw light on the surface of metallic specimen to see its microstructures</li> <li>observe the light throwing procedure in the microscope</li> <li>inspect a bright reflection of the work piece through eye piece</li> <li>inspect the microstructure through eye piece</li> </ul>	<ul style="list-style-type: none"> <li>Explanation of various parts of Metallurgical Microscope</li> <li>Understanding of Functioning of different parts of Metallurgical microscope</li> <li>Understanding of Working Principal of Metallurgical microscope</li> <li>understanding about the importance of throwing light on the metallic work piece before seeing the microstructure</li> <li>understanding about the Purpose of Metallurgical microscope</li> </ul> <p><b><u>Practical Activity</u></b></p> <ul style="list-style-type: none"> <li>Perform the</li> </ul>	Theory-9Hrs. Practical-24 Hrs. Total- 33 Hrs .	<ul style="list-style-type: none"> <li>Metallurgical Microscope &amp; Accessories</li> <li>Metallic Specimen</li> <li>Tissue</li> <li>PPE's</li> </ul>	Class Room and Lab



**Curriculum**  
***“Metal Forming & Processing Supervisor” Level 05***



	<ul style="list-style-type: none"><li>record the results</li></ul>	examination under Metallurgical microscope			
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



**0715-MF&P 10      Module: Perform Handheld XRF Analysis**

**Objective:** This module covers the knowledge and skills required to Prepare the Sample, Perform Calibration and standardization and Perform the Test

**Duration: 54      Hours**

**Theory: 18      Hours**

**Practice:      36 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
<b>LU1.</b> Prepare the Sample	<b>Trainee is able to:</b> <ul style="list-style-type: none"> <li>Clean the surface of sample with emery paper to remove rust</li> <li>Make the surface of sample smooth and flat</li> <li>Resin the sample with water</li> <li>Clean with alcohol</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge about the cleaning of surface for XRF.</li> <li>Importance of cleaning.</li> <li>Procedure of cleaning.</li> <li>Types of Chemical use for cleaning.</li> <li>Understanding of removing rust from surface.</li> </ul> <p><b><u>Practical Activity</u></b></p> <p>Prepare sample for XRF analysis.</p>	<ul style="list-style-type: none"> <li>Theory- 6Hrs.</li> <li>Practical -12 Hrs.</li> <li>Total- 18 Hrs.</li> </ul>	<ul style="list-style-type: none"> <li>Specimen Cut off Machine &amp; Accessories</li> <li>Belt Grinder,</li> <li>Emery Papers (120, 220, 400, 600, 800 Grit)</li> <li>Distilled water</li> <li>Alcohol</li> <li>Safety Equipment</li> </ul>	Class Room and Lab
<b>LU2.</b> Perform Calibration and	<b>Trainee is able to:</b> <ul style="list-style-type: none"> <li>Charge the external battery</li> </ul>	<ul style="list-style-type: none"> <li>Description of XRF spectrum.</li> <li>Identification of</li> </ul>	<ul style="list-style-type: none"> <li>Theory- 6Hrs.</li> <li>Practical</li> </ul>	<ul style="list-style-type: none"> <li>Personal Protective Equipment</li> </ul>	Class Room and



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



standardization	<ul style="list-style-type: none"> <li>Energize the XRF gun</li> <li>Open the analytical software of the XRF gun</li> <li>Clean calibration block with alcohol</li> <li>Apply the lubricant on the calibration block</li> <li>Place XRF gun on calibration block</li> <li>Press the XRF gun trigger to start calibration</li> <li>Record and compare the results with calibration certificate</li> </ul>	<ul style="list-style-type: none"> <li>different parts of XRF gun.</li> <li>Explanation of principle of x rays production.</li> <li>Description of the properties of x rays.</li> <li>Understanding of Calibration Describe different standards of steel grades</li> <li>Importance of the of XRF analysis.</li> <li>Importance of Record keeping and reporting</li> <li>Use of Personal Protective Equipment (PPE) for XRF</li> </ul> <p><b><u>Practical Activity</u></b> Perform Calibration and standardization of XRF gun.</p>	<ul style="list-style-type: none"> <li>-12 Hrs.</li> <li>Total- 18 Hrs .</li> </ul>	<ul style="list-style-type: none"> <li>XRF Gun and accessories</li> <li>Lubricants</li> <li>PPEs</li> <li>Standard samples</li> <li>ASTM/AISI standards</li> </ul>	Lab
<b>LU3.</b> Perform the Test on XRF machine	<b>Trainee is able to:</b> <ul style="list-style-type: none"> <li>Charge the extra batteries of gun</li> <li>Energized the XRF</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge about the XRF test</li> <li>Understanding about the</li> </ul>	<ul style="list-style-type: none"> <li>Theory- 6Hrs.</li> <li>Practical -12 Hrs.</li> </ul>	<ul style="list-style-type: none"> <li>Personal Protective Equipment</li> <li>XRF Gun</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>gun</p> <ul style="list-style-type: none"> <li>• Open the analytical software of the XRF gun</li> <li>• Apply the lubricant on the sample surface</li> <li>• Place the XRF gun on the sample surface</li> <li>• Press the XRF gun trigger to start analysis</li> <li>• Evaluate and Record the results</li> <li>• Print the results</li> <li>• Shut down the software</li> <li>• Store the XRF gun at designated station after the test</li> </ul>	<p>procedure of XRF test Kn</p> <p><b><u>Practical Activity</u></b>  Perform XRF analysis on steel sample.</p>	<ul style="list-style-type: none"> <li>• Total-18 Hrs</li> </ul>	<p>and accessories</p> <ul style="list-style-type: none"> <li>• Lubricants</li> <li>• PPEs</li> <li>• Standard samples</li> <li>• ASTM/AISI standards</li> </ul>	
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



**0715-MF&P 11 Module: Perform optical emission spectroscopic analysis**

**Objective:** This module covers the knowledge and skills required to prepare the sample, Perform calibration and standardization and to Perform Optical Emission test.

**Duration: 63 Hours**

**Theory: 18 Hours**

**Practice: 45 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
<b>LU1.</b> Prepare the Sample of emission spectroscopy	<b>Trainee is able to:</b> <ul style="list-style-type: none"> <li>Cut the sample as per standard</li> <li>Clean the surface of sample with emery paper to remove rust</li> <li>Make the surface of sample smooth and flat</li> <li>Resin the sample with water</li> <li>Clean with alcohol and dry.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge about the cleaning of surface for optical emission spectroscopic analysis.</li> <li>Importance of cleaning.</li> <li>Understanding of Procedure of cleaning.</li> <li>Types of Chemical use for cleaning.</li> <li>Understanding of Purpose of removing rust from surface.</li> </ul> <p><b><u>Practical Activity</u></b> Prepare sample for optical emission spectroscopic analysis.</p>	<ul style="list-style-type: none"> <li>Theory- 6Hrs.</li> <li>Practical -15 Hrs.</li> <li>Total- 21 Hrs .</li> </ul>	<ul style="list-style-type: none"> <li>Specimen Cut off Machine &amp; Accessories</li> <li>Belt Grinder,</li> <li>Emery Papers (120, 220, 400, 600, 800 Grit)</li> <li>Distilled water</li> <li>Alcohol</li> <li>Safety Equipment</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



<p><b>LU2.</b> Perform Calibration and standardization</p>	<p><b>Trainee is able to:</b></p> <ul style="list-style-type: none"> <li>• Energize the Optical Emission Spectrometer as per standard</li> <li>• Set the pressure of inert gas (Argon)</li> <li>• Switch ON the filter machine</li> <li>• Power ON the computer and open analytical software</li> <li>• Clean the electrode chamber with metal wire brush</li> <li>• Place the calibration block in electrode chamber</li> <li>• Clamp the calibration block</li> <li>• Start the spark for specific time</li> <li>• Record and compare the results with calibration certificate</li> <li>• Remove the calibration block and place at designated place</li> </ul>	<ul style="list-style-type: none"> <li>• Description of optical emission spectroscope.</li> <li>• Identification of the different parts of optical emission spectrometer.</li> <li>• Explanation of working principle of optical emission spectrometer.</li> <li>• Explanation of characteristic of optical emission spectrum.</li> <li>• Understanding of Calibration of optical emission spectrometer.</li> <li>• Importance of calibration.</li> <li>• Description of different standards of steel grades</li> <li>• Importance of the of optical emission spectrometer.</li> <li>• Understanding of Record keeping and reporting</li> </ul>	<ul style="list-style-type: none"> <li>• Theory-Theory-6Hrs.</li> <li>• Practical -15 Hrs.</li> <li>• Total- 21 Hrs .</li> </ul>	<ul style="list-style-type: none"> <li>• Personal Protective Equipment</li> <li>• XRF Gun and accessories</li> <li>• Lubricants</li> <li>• PPEs</li> <li>• Standard samples</li> <li>• ASTM/AISI standards</li> </ul>	<p style="text-align: center;">Class Room and Lab</p>
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



		<ul style="list-style-type: none"> <li>Use of Personal Protective Equipment (PPE).</li> </ul> <p><b><u>Practical Activity</u></b></p> <p>Perform Calibration and standardization of optical emission spectrometer.</p>			
<b>LU3.</b> Perform the Test	<p><b>Trainee is able to:</b></p> <ul style="list-style-type: none"> <li>Ensure the pressure of gas (Argon)</li> <li>Ensure the working of filter machine</li> <li>Open the analytical software</li> <li>Clean the electrode chamber with metal wire brush</li> <li>Place the sample in electrode chamber</li> <li>Clamp the sample as per SOPs</li> <li>Ignite the spark for specific time</li> <li>Record and evaluate the results</li> <li>Perform printout of the results</li> <li>Shut down the</li> </ul>	<ul style="list-style-type: none"> <li>Understanding of optical emission spectrometer.</li> <li>Description of optical emission spectroscope.</li> <li>understanding about the cleaning procedure</li> </ul> <p>Explanation of characteristic of optical emission spectrum.</p> <p><b><u>Practical Activity</u></b></p> <p>Perform optical emission spectrometer analysis on steel sample.</p>	<ul style="list-style-type: none"> <li>Theory- 6Hrs.</li> <li>Practical -15 Hrs.</li> <li>Total- 21 Hrs</li> </ul>	<ul style="list-style-type: none"> <li>Personal Protective Equipment</li> <li>optical emission spectrometer and accessories</li> <li>Filter</li> <li>Gages</li> <li>PPEs</li> <li>Standard samples</li> <li>ASTM/AISI standards</li> </ul>	Class Room and Lab





**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>software</p> <ul style="list-style-type: none"><li>• Switch off the filter machine</li><li>• Remove the sample and store as per requirements</li></ul>				
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



**0715-MF&P 12 Module: Perform Non-Destructive Testing**

**Objective:** This module covers the knowledge and skills required to perform and determine the surface defects of specimen using dye penetrant technique, Determine the defects of given specimen using magnetic particle testing technique, Determine the defects of metallic specimen using eddy current testing technique, Determine the defects of specimen using ultrasonic technique and Determine the defects of given specimen by using radiographic testing technique

**Duration: 111 Hours**

**Theory: 21 Hours**

**Practice: 90 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
<b>LU1.</b> Determine the surface defects of specimen using dye penetrant technique	<b>Trainee will be able to:</b> <ul style="list-style-type: none"> <li>Perform pre-cleaning of samples</li> <li>Apply dye penetrant on the specimen</li> <li>Remove the excess dye penetrant</li> <li>Apply the developer on the specimen</li> <li>Inspect the specimen for defects</li> <li>Interpret the results</li> <li>Record the results</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge about non-destructive test.</li> <li>Understanding about the different types of defects of engineering materials</li> <li>procedure of dye penetrant technique</li> <li>Understanding about the applications of dye penetrant test.</li> <li>limitations of dye penetrant test.</li> </ul>	<p>Theory-03Hrs. Practical-15 Hrs. Total- 18 Hrs.</p>	<ul style="list-style-type: none"> <li>dye penetrant &amp; Accessories (cleaner, penetrant &amp; developer sprays)</li> <li>Relevant Testing Apparatus</li> <li>Relevant PPEs</li> <li>Relevant instruments</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



		<b><u>Practical Activity</u></b> <ul style="list-style-type: none"> <li>Perform Dye Penetrant test on given sample</li> </ul>			
<b>LU2.</b> Determine the defects of given specimen using magnetic particle testing technique	<b>Trainee will be able to:</b> <ul style="list-style-type: none"> <li>Perform pre-cleaning of given ferromagnetic samples.</li> <li>Select the working mode of the equipment</li> <li>Apply magnetic field to the specimen</li> <li>Apply ferromagnetic medium with respect to type of test (Dry or Wet)</li> <li>Remove the excess ferromagnetic medium.</li> <li>Interpret the indications.</li> <li>Evaluate the results.</li> </ul>	procedure of Magnetic particle technique <ul style="list-style-type: none"> <li>knowledge about the magnetic particle technique</li> <li>Applications of Magnetic particle technique</li> <li>Types of Magnetic particle technique</li> <li>limitations of Magnetic particle technique</li> </ul> <b><u>Practical Activity</u></b> <ul style="list-style-type: none"> <li>Perform magnetic particle testing on given sample</li> </ul>	Theory-03Hrs. Practical-15 Hrs. Total- 18 Hrs..	<ul style="list-style-type: none"> <li>magnetic particle &amp; Accessories (Ferro-magnetic materials like sprays, chips &amp; paste )</li> <li>Relevant Testing Apparatus</li> <li>Relevant PPEs</li> <li>Relevant instruments</li> </ul>	Class Room and Lab
<b>LU3.</b> Determine the defects of metallic	<b>Trainee will be able to:</b> <ul style="list-style-type: none"> <li>Differentiate between</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge about the eddy current</li> </ul>	Theory-03Hrs. Practical-18 Hrs.	<ul style="list-style-type: none"> <li>eddy current &amp;</li> </ul>	Class Room



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



specimen using eddy current testing technique	<p>low pressure and high-pressure gauge.</p> <ul style="list-style-type: none"> <li>Access port that will be used for vacuuming and charging of refrigerant.</li> <li>Check a flow and condition of refrigerant during recovering and charging.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge about the inspection technique of eddy current procedure of using eddy current testing technique</li> <li>Knowledge about the applications of using eddy current testing technique</li> <li>limitations of using eddy current testing technique</li> </ul> <p><b><u>Practical Activity</u></b> Perform eddy current testing technique on given sample</p>	Total- 21 Hrs.	<p>Accessories</p> <ul style="list-style-type: none"> <li>Relevant Testing Apparatus</li> <li>Relevant PPEs</li> <li>Relevant instruments</li> </ul>	and Lab
<b>LU4.</b> Determine the defects of specimen using ultrasonic technique	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>Perform pre-cleaning of given samples.</li> <li>Select the working mode of the equipment</li> <li>Switch ON the ultrasonic testing equipment</li> </ul>	<p>procedure of using ultrasonic technique</p> <ul style="list-style-type: none"> <li>Knowledge about the ultrasonic waves</li> <li>Knowledge about the ultrasonic testing technique</li> </ul>	<p>Theory-06Hrs. Practical-21 Hrs. Total- 27 Hrs.</p>	<ul style="list-style-type: none"> <li>ultrasonic&amp; Accessories</li> <li>Relevant Testing Apparatus</li> <li>Relevant PPEs</li> <li>Relevant</li> </ul>	



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<ul style="list-style-type: none"> <li>• Calibrate the ultrasonic equipment with respect to calibration block</li> <li>• Select the probe according to the specimen</li> <li>• Apply couplant gel on the given specimen</li> <li>• Test the given specimen as per SOPs</li> <li>• Record the graph peaks on the display</li> <li>• Interpret the graph peaks</li> <li>• Record the results</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge about the applications of using ultrasonic technique</li> <li>• limitations of using ultrasonic technique</li> </ul> <p><b><u>Practical Activity</u></b></p> <ul style="list-style-type: none"> <li>• Perform ultrasonic technique on given sample</li> </ul>		instruments	
<b>LU5.</b> Determine the defects of given specimen by using radiographic testing technique	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>• Perform pre-cleaning of given metallic samples.</li> <li>• Select the working mode of the radiographic equipment</li> <li>• Inspect all safety facilities as per standard</li> <li>• Set the position of</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge about the radiographic testing procedure of using radiographic testing</li> <li>• understanding about the applications of using radiographic testing</li> </ul>	<p>Theory-06Hrs. Practical-21 Hrs. Total- 27 Hrs.</p>	<ul style="list-style-type: none"> <li>• radiographic &amp; Accessories</li> <li>• Relevant Testing Apparatus</li> <li>• Relevant PPEs</li> <li>• Relevant instruments</li> </ul>	



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>photographic film</p> <ul style="list-style-type: none"><li>• Place the specimen at specific position in front of photographic film</li><li>• Pass the rays through the specimen</li><li>• Develop the photographic film</li><li>• Inspect the image of specimen</li><li>• Record the results</li></ul>	<ul style="list-style-type: none"><li>• limitations of using radiographic testing</li></ul> <p><b><u>Practical Activity</u></b></p> <ul style="list-style-type: none"><li>• Perform radiographic testing technique on given sample</li></ul>			
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



**0715-MF&P 13 Module: Perform Galvanizing Coating**

**Objective:** This module covers the knowledge and skills required to prepare the sample, Perform calibration and standardization and to Perform Optical Emission test.

**Duration: 81**

**Hours**

**Theory: 21**

**Hours**

**Practice: 60 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Perform cataloging	<b>Trainee is able to:</b> <ul style="list-style-type: none"> <li>Perform documentation of the initial conditions of Specimen and recognize its identity.</li> <li>Adopt standard safety practice and procedure for handling.</li> <li>Prepare job layout according to process requirements</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge about the cataloging of samples.</li> <li>Explanation of the documentation of samples.</li> <li>Understanding of the marking of samples</li> <li>Importance of cataloging, marking and documentation.</li> <li>Explanation of the Procedure of cataloging.</li> <li>Understanding about the corrosion of steel.</li> <li>Knowledge about the Effects of</li> </ul>	Theory-3Hrs. Practical-9 Hrs. <ul style="list-style-type: none"> <li>Total- 12 Hrs .</li> </ul>	<ul style="list-style-type: none"> <li>Papers</li> <li>Markers</li> <li>Tapes</li> <li>Cuter</li> <li>Colour</li> <li>Specimen</li> <li>Safety Equipment</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



		<p>corrosion.</p> <ul style="list-style-type: none"> <li>Types of corrosion.</li> </ul> <p><b><u>Practical Activity</u></b></p> <p>Prepare cataloging and documentation of sample for storing.</p>			
<p><b>LU2.</b> Perform Cleaning Operation</p>	<p><b>Trainee is able to:</b></p> <ul style="list-style-type: none"> <li>Carry out cleaning process as per standard requirement.</li> <li>Perform standard safety practice and procedure for chemical handling.</li> <li>Select the specimen side/face for coating</li> <li>Prepare caustic cleaning solution for treatment with a hot alkali solution to remove dirt and oil.</li> <li>Place specimen in the solution for standard time then remove and rinsing with water.</li> <li>Prepare pickling cleaning solution where the surface rust</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge about the pre- cleaning of surface for galvanizing process.</li> <li>Importance of cleaning in coating process.</li> <li>Explanation of Steps involved in Procedure of cleaning.</li> <li>Types of Chemical use for cleaning.</li> <li>Understanding of Purpose of removing rust from surface.</li> <li>Description of pickling process.</li> <li>Explanation of PH valves.</li> </ul>	<p>Theory-3Hrs. Practical-09 Hrs.</p> <ul style="list-style-type: none"> <li>Total- 12 Hrs .</li> </ul>	<ul style="list-style-type: none"> <li>Personal Protective Equipment</li> <li>Cleaning tools &amp; equipment</li> <li>Baths &amp; equipment</li> <li>Measuring devices</li> <li>Hand held calculator</li> <li>Chemical</li> <li>Glass wares</li> </ul>	<p>Class Room and Lab</p>





**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>and scales are removed by using a hydrochloric acid solution.</p> <ul style="list-style-type: none"> <li>Place specimen in the solution for specific time then remove and rinsing with water.</li> <li>Prepare flux solution where the surface oxides are removed and protected from further oxidation risks.</li> <li>Place specimen in the solution for specific time.</li> <li>Remove the specimen from bath and ready for next step.</li> </ul>	<ul style="list-style-type: none"> <li>Understanding of safety symbols for acid chemical</li> </ul> <p><b><u>Practical Activity</u></b></p> <p>Perform cleaning of sample for galvanizing coating.</p>			
<p><b>LU3.</b> Perform Drying Operation</p>	<p><b>Trainee is able to:</b></p> <ul style="list-style-type: none"> <li>Place the specimen on the drying holders or fixtures.</li> <li>Arrange specimen in sequence with all safety factors</li> <li>Use hot air blower for drying the specimen.</li> </ul>	<ul style="list-style-type: none"> <li>Description of drying process.</li> <li>Description of the drying temperature.</li> <li>Understanding of the properties of coating after drying.</li> <li>Explain the steps involved in drying process</li> <li>Importance of</li> </ul>	<p>Theory-3Hrs. Practical-12 Hrs.</p> <ul style="list-style-type: none"> <li>Total-15 Hrs</li> </ul>	<ul style="list-style-type: none"> <li>Personal Protective Equipment</li> <li>Temperature Measuring devices</li> <li>Drying tools &amp; equipment</li> </ul>	<p>Class Room and Lab</p>



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



		drying process  <b><u>Practical Activity</u></b>  Perform Drying Operation after galvanizing coating on steel samples.			
<b>LU4.</b> Perform Galvanize Coating Operation	<b>Trainee is able to:</b> <ul style="list-style-type: none"> <li>Identify galvanizing material specifications (Zn or Al %) according to standard and type of galvanizing coating on specimen.</li> <li>Follow standard safety practice and procedure for handling process.</li> <li>Prepare molten metal bath to react specimen surface with molten material.</li> <li>Place specimen in the bath for given time</li> <li>Remove specimen from bath and detract the excess coating material through pressurized air</li> </ul>	<ul style="list-style-type: none"> <li>Definition of galvanizing.</li> <li>knowledge about the galvanizing time requirement</li> <li>Description of galvanizing temperature.</li> <li>Understanding of galvanizing of metals specimen.</li> <li>Importance of galvanization.</li> <li>Defects of coatings.</li> <li>Principles Of corrosion.</li> <li>Disadvantage of excessive coating.</li> <li>Limitation of galvanizing coating.</li> <li>Understanding of Range of coating thickness for</li> </ul>	Theory-6Hrs. Practical-15 Hrs. <ul style="list-style-type: none"> <li>Total- 21 Hrs</li> </ul>	<ul style="list-style-type: none"> <li>Personal Protective Equipment</li> <li>Temperature Measuring devices</li> <li>Galvanizing tools &amp; equipment</li> <li>Measuring devices</li> <li>Galvanizing bath</li> <li></li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



		galvanizing.			
		<b><u>Practical Activity</u></b> Perform galvanizing coating on steel samples.			
<b>LU5.</b> Perform quenching Operation	<b>Trainee is able to:</b> <ul style="list-style-type: none"> <li>Identify quenching material specifications according to standard and type of galvanizing coating on specimen.</li> <li>Follow standard safety practice and procedure for handling process.</li> <li>Prepare mild sodium dichromate solution in the bath to prevent the onset of wet storage staining during the early life of galvanizing.</li> <li>Place specimen in the bath for given time then remove.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of quenching process. Understanding of the purpose of quenching.</li> <li>Explanation of the steps involved in quenching process</li> <li>Importance of quenching process</li> <li>Understanding of safety procedure during quenching</li> <li>Types of Quenching media</li> </ul> <b><u>Practical Activity</u></b>  Perform galvanizing coating on steel samples.	Theory-6Hrs. Practical-15 Hrs. <ul style="list-style-type: none"> <li>Total- 21 Hrs</li> </ul>		Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



**0715-MF&P 14 Module: Perform Conversion Coating (Anodizing)**

**Objective:** This module covers the knowledge and skills required to Perform cataloging, Perform Cleaning Operation, Perform Solution Preparation, Set up Coating bath, Perform Coating Operation and Perform Drying Operation

**Duration: 69 Hours**

**Theory: 18 Hours**

**Practice: 51 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Perform cataloging	<b>Trainee is able to:</b> <ul style="list-style-type: none"> <li>Perform documentation of the initial conditions of Specimen and recognize its identity.</li> <li>Follow standard safety practice and procedure for handling.</li> <li>Prepare job layout according to process requirements</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge about the cataloging of samples.</li> <li>Understanding about the documentation of samples.</li> <li>Understanding of the marking of samples</li> <li>Importance of cataloging, marking and documentation.</li> <li>Explanation of the Procedure of cataloging.</li> </ul> <p><b><u>Practical Activity</u></b> Prepare cataloging and documentation of sample</p>	Theory-3Hrs. Practical-06 Hrs. Total- 09 Hrs	<ul style="list-style-type: none"> <li>Specimen Cut Papers</li> <li>Markers</li> <li>Tapes</li> <li>Cuter</li> <li>Color</li> <li>Specimen</li> <li>Safety Equipment</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



		for storing.			
<b>LU2.</b> Perform Cleaning Operation	<b>Trainee is able to:</b> <ul style="list-style-type: none"> <li>Identify the cleaning process as per requirement of standards.</li> <li>Follow standard safety practice and procedure for chemical handling.</li> <li>Select the specimen side or face, which will be coating.</li> <li>Prepare degreasing cleaning solution where steel is treated with spirit solution which removes common dirt and oils.</li> <li>Place specimen in the solution for specific time then remove and rinsing with water.</li> <li>Prepare chemical cleaning solution</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge about the pre- cleaning of surface for anodizing process.</li> <li>Importance of cleaning in coating process.</li> <li>knowledge about the cleaning procedure</li> <li>Types of Chemical used for cleaning.</li> <li>Understanding of Purpose of removing rust from surface.</li> <li>Definition of pickling process.</li> <li>Explanation of the range of PH values.</li> <li>Description of safety symbols for acid chemical</li> </ul>	Theory-3Hrs. Practical-06 Hrs. <ul style="list-style-type: none"> <li>Total- 09 Hrs</li> </ul>	<ul style="list-style-type: none"> <li>Personal Protective Equipment</li> <li>Cleaning tools &amp; equipment</li> <li>Baths &amp; equipment</li> <li>Measuring devices</li> <li>Hand held calculator</li> <li>Chemical</li> <li>Glass wares</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>where the surface rust and scales are removed by using alkaline solution.</p> <ul style="list-style-type: none"> <li>Place specimen in the solution for specific time then remove and rinsing with water.</li> <li>Prepare nitric acid solution where the surface oxides are removed.</li> <li>Place specimen in the solution for specific time.</li> <li>Remove the specimen from bath and ready for next step.</li> </ul>	<p><b><u>Practical Activity</u></b></p> <p>Perform cleaning of parts for anodizing</p>			
<p><b>LU3.</b> Perform Solution Preparation</p>	<p><b>Trainee is able to:</b></p> <ul style="list-style-type: none"> <li>Take glass beaker or polythene tank.</li> <li>Follow standard safety practice and procedure for handling chemical process.</li> <li>Filled half with distil or deionized water.</li> <li>Add acid solution slowly and stir it.</li> </ul>	<ul style="list-style-type: none"> <li>Explain the Steps involved in Procedure</li> <li>Definition of pickling process.</li> <li>Expiation the range of PH valves.</li> </ul> <p><b><u>Practical Activity</u></b></p> <p>Solution Preparation for anodize coating of</p>	<p>Theory-3Hrs. Practical-09 Hrs.</p> <ul style="list-style-type: none"> <li>Total-12 Hrs</li> </ul>	<ul style="list-style-type: none"> <li>Personal Protective Equipment</li> <li>Mixing tools &amp; equipment</li> <li>Baths &amp; equipment</li> <li>Measuring devices</li> <li>Chemical</li> </ul>	<p>Class Room and Lab</p>



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



		samples.		<ul style="list-style-type: none"> <li>Glass wares</li> </ul>	
<b>LU4.</b> Set up Coating bath	<b>Trainee is able to:</b> <ul style="list-style-type: none"> <li>Take glass beaker or polythene tank.</li> <li>Follow standard safety practice and procedure for handling chemical process.</li> <li>Filled half with distil or deionized water.</li> <li>Add acid solution slowly and stir it.</li> </ul>	<ul style="list-style-type: none"> <li>Steps involved in setting up bath for coating.</li> <li>Knowledge about the procedure of coating bath</li> <li>Understanding of safety symbols for acid chemical.</li> <li>Describe the range of current and voltage for coating.</li> <li>Understanding of measuring of current and voltage.</li> </ul> <p><b><u>Practical Activity</u></b></p> <p>Preparation of coating bath for anodizing of samples.</p>	Theory-3Hrs. Practical-12 Hrs. <ul style="list-style-type: none"> <li>Total- 15 Hrs</li> </ul>	<ul style="list-style-type: none"> <li>Personal Protective Equipment</li> <li>Connecting tools &amp; equipment</li> <li>Baths &amp; equipment</li> <li>Measuring devices</li> <li>Chemical</li> <li>Glass wares</li> <li>Electrical supply</li> <li>batteries</li> </ul>	Class Room and Lab
<b>LU5.</b> Perform Coating Operation	<b>Trainee is able to:</b> <ul style="list-style-type: none"> <li>Add prepared solution in the bath.</li> <li>Follow standard safety</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge about the safety procedure.</li> <li>Identification of</li> </ul>	Theory-3Hrs. Practical-12 Hrs. <ul style="list-style-type: none"> <li>Total-</li> </ul>	<ul style="list-style-type: none"> <li>Personal Protective Equipment</li> <li>Temperature</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>practice and procedure for handling process.</p> <ul style="list-style-type: none"> <li>Place the lead sheets or plates on the opposite sides of bath. (Act as cathodes)</li> <li>Connect the both lead plates to electric supply.</li> <li>Place Ti rod or wood coiled with Al wire in the middle of bath. (Act as Anode)</li> <li>Connect the bar to electric supply.</li> <li>Arrange them in sequence and order that they don't touch each other.</li> <li>Hang the specimen with wire to anode.</li> </ul>	<p>safety equipment Understanding of anode and cathode.</p> <ul style="list-style-type: none"> <li></li> <li>Importance of anodizing temperature.</li> <li>Description of the range of current and voltage for anodizing</li> <li>Explanation anodizing of metals specimen.</li> <li>Importance of anodizing.</li> </ul> <p><b><u>Practical Activity</u></b></p> <ul style="list-style-type: none"> <li>Perform anodizing on samples.</li> </ul>	15 Hrs	<p>, current and voltage Measuring devices</p> <ul style="list-style-type: none"> <li>Anodizing tools &amp; equipment</li> <li>Thickness of Measuring devices</li> <li>Anodizing bath</li> <li>Cathodes</li> <li>Anode</li> <li></li> </ul>	
<b>LU6.</b> Perform Drying Operation	<p><b>Trainee is able to:</b></p> <ul style="list-style-type: none"> <li>Place specimen in the drying oven.</li> <li>Set temperature the switch on oven.</li> <li>Remove specimen after specific time for drying.</li> </ul>	<ul style="list-style-type: none"> <li>Description of drying process.</li> <li>Understanding of Effect of drying on the properties of coating.</li> <li>steps involved in drying process</li> </ul>	<p>Theory-3Hrs. Practical-06 Hrs.</p> <ul style="list-style-type: none"> <li>Total-09 Hrs</li> </ul>	<ul style="list-style-type: none"> <li>Personal Protective Equipment</li> <li>Temperature Measuring devices</li> <li>Drying tools &amp; equipment</li> </ul>	Class Room and Lab





**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



		<ul style="list-style-type: none"><li>• Importance of drying process</li><li>• Description of safety procedures.</li></ul> <p><b><u>Practical Activity</u></b></p> <ul style="list-style-type: none"><li>• Perform Drying Operation on coated samples.</li></ul>			
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



**0715-MF&P 15    Module: Develop Project Proposal**

**Objective:** 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.

**Duration: 36 Hours**

**Theory: 27 Hours**

**Practice: 09 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Develop a business plan	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>Conduct a market survey to collect following information <ul style="list-style-type: none"> <li>➤ Business Model</li> <li>➤ Financials</li> <li>➤ Equipment Estimation</li> <li>➤ Revenue Generation Sources</li> <li>➤ Marketing strategy</li> <li>➤ Market Trends</li> <li>➤ Overall Expenses</li> </ul> </li> <li>Select the best option in terms of cost, service, quality, sales, operational expenses</li> <li>Compile the information</li> </ul>	<ul style="list-style-type: none"> <li>Understanding of Specific business terms used in the industry</li> <li>Knowledge about the available funding sources</li> <li>Knowledge of Low interest loans to start a new business</li> <li>Understanding of procedure to conduct Market survey and its tools.</li> <li>Knowledge of main elements of business plan</li> </ul>	<p>Theory- 09 Hrs. Practical- 03 Hrs. Total- 12 Hrs.</p>	<ul style="list-style-type: none"> <li>Stationary</li> <li>Information communication Technology (ICT) Resources.</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	collected through the market survey, in the business plan format	<b><u>Practical Activity</u></b> Develop the Business plan			
<b>LU2.</b> Develop a marketing plan	<b>Trainee will be able to:</b> <ul style="list-style-type: none"> <li>• Make a marketing plan for the service products, price, placement, promotion, people, packaging and positioning</li> <li>• Incorporate the information of marketing plan in the business plan</li> </ul>	<ul style="list-style-type: none"> <li>• Understanding of 7Ps of marketing including product, price, placement, promotion, people, packaging and positioning</li> <li>• Knowledge of Market trends for specific product offering</li> </ul> <b><u>Practical Activity</u></b> Enlist 7Ps of marketing	Theory- 09 Hrs. Practical- 03 Hrs. Total- 12 Hrs.	<ul style="list-style-type: none"> <li>• Stationary</li> <li>• Information communication Technology (ICT) Resources.</li> </ul>	Class Room and Lab
<b>LU3.</b> Develop basic business communication skills	<b>Trainee will be able to:</b> <ul style="list-style-type: none"> <li>• Communicate with guests using effective communication skills</li> <li>• Use different modes of communication to communicate effectively e.g.: presentation, speaking, writing, listening, visual representation, reading etc.</li> <li>• Use specific business terms used in the market</li> </ul>	<ul style="list-style-type: none"> <li>• Understanding of 7Cs of business communication</li> <li>• Knowledge of Different modes of communication and their application in the industry</li> </ul> <b><u>Practical Activity</u></b> Enlist 7Cs of business communication	Theory- 09 Hrs. Practical- 03 Hrs. Total- 12 Hrs.	<ul style="list-style-type: none"> <li>• Stationary</li> <li>• Information communication Technology (ICT) Resources.</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



**0715-MF&P 16 Module: Develop project management plan**

**Objective:** 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.

**Duration: 33**

**Hours**

**Theory: 27 Hours**

**Practice:**

**06 Hours**

	Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1	Prepare project management plan	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>Evaluate and assess project brief and related documents</li> <li>Produce document on project tasks and associated timelines, including installation processes and test requirements</li> <li>Assess and produce document on resource requirements to assist allocation of appropriate resources</li> <li>Produce training plan</li> </ul>	<ul style="list-style-type: none"> <li>Understanding of project plan</li> <li>Knowledge about the project scope, cost and time line</li> <li>Assessment techniques of resources for their appropriate allocation to the project</li> <li>Procedure for conduct of TNA of relevant workforce</li> <li>Understanding of Training plan development</li> </ul>	<p>Theory- 09 Hrs. Practical-1.5 Hr. Total- 10.5 Hrs.</p>	<ul style="list-style-type: none"> <li>Stationary</li> <li>Information communication Technology (ICT) Resources.</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>assessing training needs and associated timelines for efficient project implementation</p> <ul style="list-style-type: none"> <li>• Determine and document budgetary requirements</li> <li>• Discuss roles of all Stake holders associated with project to ensure their involvement</li> <li>• Prepare project verification document, including monitoring and control processes, and review processes such as quality audits</li> <li>• Consult with all relevant stake holders prior to finalizing draft plan and make changes as appropriate</li> </ul>	<ul style="list-style-type: none"> <li>• Identification of all the stakeholders related to the project</li> <li>• Presentation of draft plan to get input from all the stakeholders prior to finalize project plan</li> </ul> <p><b><u>Practical Activity</u></b> Produce training plan assessing training needs and associated timelines for efficient project implementation</p>			
<b>LU2.</b> Develop monitoring and evaluation plan	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>• Produce preliminary plan for consultation, including identified factors that may impact on realization of project and observance of relevant legislation, codes,</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of the relevant scope of project, cost of project and timeline of project.</li> <li>• Knowledge of legislation, codes, regulation and</li> </ul>	<p>Theory- 06Hrs. Practical-1.5 Hr. Total- 7.5 Hrs.</p>	<ul style="list-style-type: none"> <li>• Stationary</li> <li>• Information communication Technology (ICT) Resources.</li> </ul>	<p>Class Room and Lab</p>



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>regulation and standards</p> <ul style="list-style-type: none"> <li>Consult with client and clarify any amendments</li> <li>Develop final plan with recommendations</li> </ul>	<p>standards related to project</p> <ul style="list-style-type: none"> <li>Monitoring and evaluation of project scope and timeline</li> <li>Evaluate the factors that may impact on the project progress</li> </ul> <p><b><u>Practical Activity</u></b></p> <p>Develop project monitoring and evaluation plan</p>			
<p><b>LU3.</b> Communicate project Plan</p>	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>Produce and document final plan to include implementation details and training needs</li> <li>Present plan to client and obtain sign off</li> </ul>	<ul style="list-style-type: none"> <li>Understanding of client's satisfaction parameters               <ol style="list-style-type: none"> <li>Cost</li> <li>Timeline</li> <li>Quality</li> </ol> </li> </ul> <p><b><u>Practical Activity</u></b></p> <p>Present project plan to client and obtain sign off</p>	<p>Theory- 06Hrs. Practical-1.5 Hr. Total- 7.5 Hrs.</p>	<ul style="list-style-type: none"> <li>Stationary</li> <li>Information communication Technology (ICT) Resources.</li> </ul>	<p>Class Room and Lab</p>
<p><b>LU4.</b> Contribute to assessing effectiveness of</p>	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>Assist in ongoing review of</li> </ul>	<ul style="list-style-type: none"> <li>Understanding of project outcomes</li> <li>Knowledge about</li> </ul>	<p>Theory- 06Hrs. Practical-1.5 Hr. Total- 7.5 Hrs.</p>	<ul style="list-style-type: none"> <li>Stationary</li> <li>Information communication</li> </ul>	<p>Class Room and Lab</p>



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



communication	<p>project outcomes to determine effectiveness of communications-management activities</p> <ul style="list-style-type: none"> <li>• Report communications-management issues and responses to higher project authorities for application of lessons learned to future projects</li> </ul>	<p>evaluation techniques of project outcomes to determine effectiveness of communications-management activities</p> <ul style="list-style-type: none"> <li>• Knowledge about report writing techniques</li> </ul> <p><b><u>Practical Activity</u></b></p> <p>Produce and document final plan of the project to include implementation details and training needs</p>		Technology (ICT) Resources.	
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



**0715-MF&P 17 Module: Develop sales plan**

**Objective:** 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.

**Duration: 33**

**Hours**

**Theory: 27 Hours**

**Practice:**

**06 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
<b>LU1.</b> Identify organizational strategic direction	<b>Trainee will be able to:</b> <ul style="list-style-type: none"> <li>Obtain and analyze assessment of market needs and strategic planning documents</li> <li>Review previous sales performance and successful approaches to identify factors affecting performance</li> <li>Analyze information on market needs, new opportunities, customer profiles and requirements as a</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge about the market needs analyses</li> <li>Knowledge about marketing techniques</li> </ul> <p><b><u>Practical Activity</u></b> Demonstrate marketing and selling approach</p>	<p>Theory- 03 Hrs. Practical- 01 Hr. Total- 04 Hrs.</p>	<ul style="list-style-type: none"> <li>Stationary</li> <li>Information communication Technology (ICT) Resources.</li> </ul>	<p>Class Room and Lab</p>





**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>basis for decision making</p> <ul style="list-style-type: none"> <li>Carry out competitor analysis for rate structure</li> </ul>				
<b>LU2.</b> Establish performance targets	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>Determine practical and achievable sales targets</li> <li>Establish realistic timelines for achieving targets</li> <li>Determine measures to allow for monitoring of performance</li> <li>Ensure objectives of the sales plan and style of the campaign are consistent with organizational strategic objectives and corporate image</li> </ul>	<ul style="list-style-type: none"> <li>Explain Internal and external sources of information that are relevant to identifying organizational strategic direction and developing a product sales plan.</li> </ul> <p><b><u>Practical Activity</u></b> Develop a report on achieving organizational targets.</p>	<p>Theory- 03 Hrs. Practical- 01 Hr. Total- 4 Hrs</p>		



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



<b>LU3.</b> Develop a sales plan for a product	<b>Trainee will be able to:</b> <ul style="list-style-type: none"> <li>Determine approaches to be used to meet sales objectives</li> <li>Identify additional expertise requirements and allocate budgetary resources accordingly</li> <li>Identify risks and develop risk controls</li> <li>Develop advertising and promotional strategy for product</li> <li>Identify appropriate distribution channels for product</li> <li>Prepare a budget for the sales plan</li> <li>Present documented sales plan to appropriate personnel</li> </ul>	<ul style="list-style-type: none"> <li>Statistical techniques for analyzing sales and market trends</li> </ul> <p><b><u>Practical Activity</u></b> Produce a sales plan for the product</p>	<p>Theory- 09 Hrs. Practical- 1.5 Hr. Total- 10.5 Hrs</p>	<ul style="list-style-type: none"> <li>Stationary</li> <li>Information communication Technology (ICT) Resources.</li> </ul>	
<b>LU4.</b> Identify support requirements	<b>Trainee will be able to:</b> <ul style="list-style-type: none"> <li>Identify and acquire staff resources to</li> </ul>	<ul style="list-style-type: none"> <li>Understanding about Competitors intelligence</li> </ul>	<p>Theory- 06 Hrs. Practical- 01 Hr. Total- 07 Hrs.</p>	<ul style="list-style-type: none"> <li>Stationary</li> <li>Information communication</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<ul style="list-style-type: none"> <li>implement sales plan</li> <li>• Develop an appropriate selling approach</li> <li>• Train staff in the selling approach selected</li> <li>• Develop and assess staff knowledge of product to be sold</li> </ul>	<p><b><u>Practical Activity</u></b></p> <p>Demonstrate advertising and promotional strategy for product</p>		Technology (ICT) Resources.	
<b>LU5.</b> Monitor and review sales plan	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>• Monitor implementation of the sales plan</li> <li>• Record data measuring performance versus sales targets</li> <li>• Make adjustments to sales plan as required to ensure required results are obtained</li> </ul>	<ul style="list-style-type: none"> <li>• Describe Outline methods for monitoring sales outcomes</li> </ul> <p><b><u>Practical Activity</u></b></p> <p>Identify the risks of the product i.e., sale/deployments</p>	<p>Theory- 06 Hrs. Practical- 1.5 Hr. Total- 7.5Hrs</p>	<ul style="list-style-type: none"> <li>• Stationary</li> <li>• Information communication Technology (ICT) Resources.</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



**0715-MF&P 18 Module: Conduct research for customer needs and satisfaction**

**Objective:** 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.

**Duration: 36**

**Hours**

**Theory: 27 Hours**

**Practice: 09 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
<b>LU1.</b> Assist customer to articulate needs	<b>Trainee will be able to:</b> <ul style="list-style-type: none"> <li>Ensure customer needs are fully explored, understood and agreed</li> <li>Explain and match available services and products to customer needs</li> <li>Identify and communicate rights and responsibilities of customers to the customer as appropriate</li> </ul>	<ul style="list-style-type: none"> <li>Organizational procedures and standards for establishing and maintaining customer service relationships</li> </ul> <p><b><u>Practical Activity</u></b></p> <p>conduct a survey to analyse customer needs and requirements</p>	<p>Theory- 06Hrs. Practical-1.5 Hrs. Total- 7.5 Hrs.</p>	<ul style="list-style-type: none"> <li>Stationary</li> <li>Information communication Technology (ICT) Resources.</li> </ul>	Class Room and Lab



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



<p><b>LU2.</b> Satisfy complex customer needs</p>	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>• Explain possibilities for meeting customer needs</li> <li>• Assist customers to evaluate service and/or product options to satisfy their needs</li> <li>• Determine and prioritize preferred actions</li> <li>• Identify potential areas of difficulty in customer service delivery and take appropriate actions in a positive manner.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge about outline details of products or services</li> <li>• Knowledge about possible alternative products and services</li> <li>• Understanding of variations within a limited product and service range</li> </ul> <p><b><u>Practical Activity</u></b></p>	<p>Theory- 06 Hrs. Practical-1.5 Hrs. Total- 7.5 Hrs.</p>	<ul style="list-style-type: none"> <li>• Stationary</li> <li>• Information communication Technology (ICT) Resources.</li> </ul>	<p>Class Room and Lab</p>
<p><b>LU3.</b> Manage networks to ensure customer needs are addressed</p>	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>• Establish effective regular communication with customers</li> <li>• Establish, maintain and expand relevant networks to ensure appropriate</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge about the methods of obtaining customers feedback</li> <li>• Describe different Ways</li> </ul>	<p>Theory- 06 Hrs. Practical-03 Hrs. Total- 09 Hrs</p>	<ul style="list-style-type: none"> <li>• Stationary</li> <li>• Information communication Technology (ICT) Resources.</li> </ul>	



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>referral of customers to products and services from within and outside the organization</p> <ul style="list-style-type: none"> <li>• 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</li> <li>• 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</li> <li>• Maintain records of customer interaction in accordance with organizational procedures</li> </ul>	<p>to establish effective regular communication with customers</p> <p><b><u>Practical Activity</u></b></p> <p>Prepare a list to collect data for customer need analyses</p>			
<b>LU4.</b> Convert customer enquiries into	<p><b>Trainee will be able to:</b></p> <ul style="list-style-type: none"> <li>• Use information provided</li> </ul>	<ul style="list-style-type: none"> <li>• Understanding about CRM</li> <li>• Knowledge</li> </ul>	<p>Theory- 09 Hrs. Practical-03 Hrs. Total- 12 Hrs</p>	<ul style="list-style-type: none"> <li>• Stationary</li> <li>• Information communication Technology</li> </ul>	



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



sales	<p>by customers or accessed from the customer relationship management (CRM) system to identify any needs</p> <ul style="list-style-type: none"> <li>• Identify suitable products/services to meet needs</li> <li>• Make convincing sales pitches to customers following standard scripts</li> <li>• Handle customer queries, objections and rebuttals following standard scripts</li> <li>• Adapt your approach and style to customer preferences, within the limits of your competence and authority</li> <li>• Refer issues outside your area of competence and authority to appropriate people, following your organization’s procedures</li> <li>• Identify and act on opportunities to up-sell or cross-sell other</li> </ul>	<p>about consumer rights and responsibilities</p> <p><b><u>Practical Activity</u></b></p> <p>Handle customer relationship management (CRM) model to identify suitable products/services to meet customer needs</p>		(ICT) Resources.	
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



	<p>products/services to customers</p> <ul style="list-style-type: none"><li>• Confirm customer wishes and needs in order to close sales</li><li>• Obtain required financial information from customers, following your organization's procedures</li><li>• Complete your organization's post-sales procedures in order to complete/ fulfill sales</li><li>• Comply with relevant standards, policies, procedures and guidelines when converting customer enquiries into sales</li></ul>				
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**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



#### 4. Supportive Notes

Assessment Text, Critical Aspects, Assessment Conditions, Resources required for Assessments

#### 5. List of Tools, Machinery and Equipment

Sr. No.	Name of Item / Equipment / Tools	Quantity

#### 6. List of Consumable Supplies

Sr. No.	Name of Consumable Supplies	Quantity

#### 7. Members of the Curriculum Development Committee

The following members participated in the curriculum development process of the **Metal Forming & Processing Level 02 - 05** at PITAC, Lahore.

**Date: 29<sup>th</sup> November – 03<sup>rd</sup> December 2021**

S#	Name	Designation	Organization
1.	Engr. Salman Khalid Chaudhary	Assistant Director (Technical) Metallurgy	PITAC, Lahore
2.	Engr. Sohail Naseer	Assistant Professor	GSPCT, Gujrat



**Curriculum**  
**“Metal Forming & Processing Supervisor” Level 05**



3.	Engr. Ahsan Shahbaz	Manager	PSS, Lahore
4.	Engr. Rashid Bashir	Senior Instructor	Pak Swiss Training Center, Lahore
5.	Engr. Farooq Iftikhar	Senior Engineer	PCSIR, Lahore
6.	Engr. Umer Farooq	Instructor Mechanical	GSPCT, Gujrat
7.	Engr. Adil Qadeer	Lecturer	UOL, Lahore
8.	Engr. Muhammad Arshad	Chief Instructor	PSTC, Lahore
9.	Engr. Nadeem Shahid	Vice Principal/Director	PCT, Lahore
10.	Engr. Fazal Rehman	Principal	GCT, Swabi
11.	Mr. Mushtaq Ahmed	Director M&E	P-TEVTA
12.	Engr. Liaqat Jamro	Director Academics	S-TEVTA
13.	Engr. Muhammad Umar	Project Engineer	OQE, Islamabad
14.	Engr. Abdul Maqsood	DACUM Facilitator, Principal	GPI Mardan
15.	Engr. Muhammad Yasir	Deputy Director	NAVTTC HQ, Islamabad