



National Vocational Certificate for "Metal Forming & Processing Senior Technician"

Level 04



Competency Based Curriculum

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





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1. Introduction

a. "Metal Forming & Processing Senior Technician" Level 04

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.





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 Senior Technician" Level 04 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. Manage the meetings
- 2. Manage workforce planning
- 3. Undertake project work
- 4. Identify and communicate trends in career development
- 5. Apply interpersonal skills
- 6. Work safely in an office environment
- 7. Maintain professionalism in workplace
- 8. Perform Lathe Machine and Shaper Operations
- 9. Perform Milling and Hobbing Operations
- 10. Perform Shielded Metal Arc Welding (SMAW)
- 11. Perform Submerged Arc Welding (SAW)
- 12. Perform Metal Die Casting Operations
- 13. Perform Centrifugal Casting Process
- 14. Perform Shell Mold Casting





- 15. Perform Investment Casting
- 16. Perform Die Forging Process
- 17. Perform Hydrostatic Extrusion Process
- 18. Perform Wire Drawing Process
- 19. Perform Heat Treatment of Ferrous Materials
- 20. Perform Heat Treatment of Non-Ferrous Materials
- 21. Carryout Hardness Testing
- 22. Carryout Impact Testing
- 23. Perform Mechanical Testing on Universal Testing Machine
- 24. Perform Torsion Test and Fatigue test

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

- 01 Machining Senior Technician
- 02 Welding Senior Technician
- 03 Metal Casting Senior Technician
- 04 Metal Forming Senior Technician
- 05. Heat Treatment Technician
- 06 Destructive Testing Technician

f. Trainee Entry level

The entry for National Vocational Certificate for "Metal Forming & Processing Senior Technician" Level 04 would be Middle Certificate (8th Class) or "Metal Forming & Processing Technician" Level 03

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.

i. Duration of the Course

The distribution of contact hours is given below:

Total - 1200 hours

Theory - 186 hours (15.5%)
Practical - 1014 hours (84.5%)

Proposed Course Duration - 12 Months

k. Sequence of the Modules

- 1. Manage the meetings
- 2. Manage workforce planning
- 3. Undertake project work
- 4. Identify and communicate trends in career development
- 5. Apply interpersonal skills
- 6. Work safely in an office environment
- 7. Maintain professionalism in workplace
- 8. Perform Lathe Machine and Shaper Operations
- 9. Perform Milling and Hobbing Operations
- 10. Perform Shielded Metal Arc Welding (SMAW)
- 11. Perform Submerged Arc Welding (SAW)
- 12. Perform Metal Die Casting Operations
- 13. Perform Centrifugal Casting Process
- 14. Perform Shell Mold Casting
- 15. Perform Investment Casting
- 16. Perform Die Forging Process
- 17. Perform Hydrostatic Extrusion Process
- 18. Perform Wire Drawing Process
- 19. Perform Heat Treatment of Ferrous Materials
- 20. Perform Heat Treatment of Non-Ferrous Materials
- 21. Carryout Hardness Testing
- 22. Carryout Impact Testing
- 23. Perform Mechanical Testing on Universal Testing Machine
- 24. Perform Torsion Test and Fatigue test





2. Summary - Overview of the Curriculum

Module Title		Learning Units	Th.	Pr.	т.	Cr. Hrs
Manage the meetings	LU.1 LU.2 LU.3	Prepare for meetings Conduct meetings Follow up meetings	6	12	18	1.8
Manage workforce planning	LU.1 LU.2 LU.3 LU.4	Identify workforce Develop workforce objectives and strategies Implement initiatives to support workforce planning objectives Monitor and evaluate workforce trends	6	12	18	1.8
Undertake project work	LU.1 LU.2 LU.3 LU.4	Identify project Develop project plan Monitor project Finalize the project	6	12	18	1.8
4. Identify and communicate trends in career development	LU.1 LU.2 LU.3	Research and explore career trends Assess and confirm ongoing career development Maintain quality of career development services and professional practice	3	12	15	1.5
5. Apply interpersonal skills	LU.1 LU.2	Communicate effectively Apply specialized counseling interviewing skills Evaluate own communication	3	12	15	1.5
Work safely in an office environment	LU.1 LU.2 LU.3	Ensure safe work environment Implement workplace safety requirements Participate in OHS consultative processes Follow safety procedures	3	12	15	1.5
7. Maintain professionalism in workplace	LU.1 LU.2 LU.3	Respect work timeframes Maintain personal appearance and hygiene Maintain adequate distance with colleagues and clients Work in an ethical manner	3	12	15	1.5
8. Perform Lathe Machine and Shaper Operations	LU.1 LU.2 LU.3 LU.4	Perform centering operations on lathe machine Perform facing Operations Perform turning Operations Perform drilling and boring operations	9	48	57	5.7





	LU.5 LU.6 LU.7 LU.8 LU.9	Perform step turning operations Perform knurling Operations Perform Internal and External threading Operation Perform Squaring of workpiece on shaper machine. Perform Slotting on Shaper machine				
9. Perform Milling and Hobbing Operations	LU.1 LU.2 LU.3 LU.4 LU.5 LU.6 LU.7	Arrange Tools, Equipment and material for Milling Operation Prepare work piece for milling operation Perform setting of milling machine Carryout Milling operations. Arrange Tools, Equipment and material for hobbing to make the gear Set Hobbing Machine for operations Carry out Hobbing operations to make gear	12	51	63	6.3
10. Perform Shielded Metal Arc Welding (SMAW)	LU.1 LU.2 LU.3 LU.4 LU.5 LU.6	Prepare Welding Machine and Accessories for SMAW 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	10	66	76	7.6
11. Perform Submerged Arc Welding (SAW)	LU.1 LU.2 LU.3 LU.4	Prepare Welding Machine and Accessories for SAW Make Fillet Weld on Carbon Steel Plate Make Groove Weld on Carbon Steel Plate Perform Post Welding Operations	10	48	58	5.8
12. Perform Metal Die Casting Operations	LU.1 LU.2 LU.3 LU.4 LU.5	Arrange material for die (Cold Chambered High pressure) casting Conduct pre-operational checks on machine Prepare the high pressure die casting molds Operate die casting machine (Cold chambered high pressure) Inspect final product	6	96	102	10.2





	LU.6	Perform Workplace cleaning				
13. Perform Centrifugal Casting Process	LU.1 LU.2 LU.3 LU.4	Prepare mold for casting Cast the molten metal Remove the Casting from molds Perform post casting operations	6	45	51	5.1
14. Perform Shell Mold Casting	LU.1 LU.2 LU.3 LU.4 LU.5	Arrange pattern for casting Arrange mold for casting Assemble mold for casting Cast molten metal in mold Remove the casting from mold	6	51	57	5.7
15. Perform Investment Casting	LU.1 LU.2 LU.3 LU.4	Arrange pattern for Casting Prepare mold for casting Perform casting Perform post-casting operations	8	60	68	6.8
16. Perform Die Forging Process	LU.1 LU.2 LU.3 LU.4	Perform Open Die Forging (Cold/Hot) Perform Impression Die Forging (Cold/Hot) Perform precision / flash less forging operation Perform forging machine maintenance	6	51	57	5.7
17. Perform Hydrostatic Extrusion Process	LU.1 LU.2 LU.3	Perform cold hydrostatic extrusion Perform hot hydrostatic extrusion Carryout inspection of finished production	12	96	108	10.8
18. Perform Wire Drawing Process	LU.1 LU.2 LU.3 LU.4	Arrange tools and equipment for wire drawing through draw plate Perform Annealing of the given wire to be drawn Carryout pulling of wire through drawplate Perform wire drawing operation on metal blank	12	51	63	6.3
19. Perform Heat Treatment of Ferrous Materials	LU.1 LU.2 LU.3 LU.4 LU.5 LU.6	Perform hardening on carbon steel Perform tempering of hardened carbon steel Perform annealing on steel Perform normalizing of steel Perform carburizing of steel Perform stress relieving of Metal	10	48	58	5.8
20. Perform Heat Treatment of Non- Ferrous Materials	LU.1 LU.2	Perform Solution Treatment Perform Aging	10	36	46	4.6
21. Carryout Hardness Testing	LU.1 LU.2	Measure hardness of the specimen by Brinell Hardness Test Measure hardness of the specimen by Rockwell Hardness Test	10	42	52	5.2





		Total	186	1014	1200	120
24. Perform Torsion Test and Fatigue test	LU.1 LU.2	Measure torsion strength of specimen Measure fatigue strength of specimen	9	45	54	5.4
23. Perform Mechanical Testing on Universal Testing Machine	LU.1 LU.2 LU.3 LU.4	Measure tensile properties of the specimen Measure Compressive strength of the specimen Measure the Bending strength of specimen Measure Shear strength of the specimen	10	60	70	7
22. Carryout Impact Testing	LU.3 LU.1 LU.2	Measure hardness of the specimen by Vickers Hardness Test Measure toughness of the specimen by Izod Impact Test Measure Toughness of the specimen by Charpy Impact Test	10	36	46	4.6





3. Modules

0715-MF&P 01 Module: Manage the meetings

Objective: This module covers the knowledge and skills required to manage a range of meetings including overseeing the meeting preparation processes, chairing meetings, organizing the minutes and reporting meeting outcomes.

Duration: 18 Hours Theory: 6 Hours Practice: 12 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare for meetings	 Develop an agenda in line with the stated meeting purpose Ensure the style and structure of the meeting are appropriate to its purpose Identify meeting participants and notify them in accordance with organizational procedures Confirm meeting arrangements in accordance with the requirements of meeting Dispatch meeting working papers to participants 	 Knowledge about the objective and agenda of the meeting Description of meeting terminology, structure and arrangements Knowledge about the arrangement of meeting as per the requirements Dispatch procedure regarding minutes of the meeting to the participants. Practical Activity Develop meeting agenda as per the requirement of 	Theory-2 Hrs. Practical-3 Hrs. Total-5 Hrs.	Stationary Information communication technology (ICT) resources	Class Room and Lab

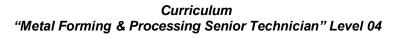






	within designated timelines	structure and notify other team members accordingly.			
LU2. Conduct meetings	 Trainee will be able to: Conduct meetings in accordance with organizational requirements, agreed conventions for type of meeting and legal and ethical requirements Conduct meetings to ensure they are focused, time efficient and achieve the required outcomes Ensure meeting facilitation enables participation, discussion, problem-solving and resolution of issues Record minutes of meeting in accordance with organizational requirements. Brief other minute-taker on method for recording meeting minutes in accordance with organizational requirements and 	 Description of the legal and ethical requirement of meetings Importance of MOM (minutes of meeting) recording Describe the mediums for meetings including Inperson/physical, teleconferencing, web-conferencing and using webcams Explain the relevant organizational procedures and policies regarding meetings Practical Activity Conduct a practice meeting and record MOM 	Theory-2 Hrs. Practical-3 Hrs. Total-5 Hrs.	Information communication technology (ICT) resources	Class Room and Lab







LU3. Follow up meetings	conventions for type of meeting • Check transcribed meeting notes to ensure	Explain the actions required for follow up		Stationary Information
	they reflect a true and accurate record of the meeting and are formatted in accordance with organizational procedures and meeting conventions Distribute and store minutes and other follow-up documentation within designated timelines, and according to organizational requirements Report outcomes of meetings as required, within designated timelines	of meetings Importance of follow up of meeting regarding the tasks assigned Understanding about reporting the outcome of meeting Practical Activity Prepare a report containing outcome of a practice meeting	Theory-2 Hrs. Practical-6 Hrs. Total-8 Hrs	communication technology (ICT) resources





0715-MF&P 02 Module: Manage workforce planning

Objective: This module covers the knowledge and skills required to manage planning in relation to an organization's workforce including researching requirements, developing objectives and strategies, implementing initiatives and monitoring and evaluating trends.

Duration: 18 Hours Theory: 6 Hours Practice: 12 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Identify workforce	 Trainee will be able to: Review current data on staff turnover and demographics Assess factors that may affect workforce supply Develop organization's requirement for skilled workforce 	Explain the factors affecting workforce supply Knowledge about the organizational requirement related to the skilled workforce Description of labor force analysis and forecasting skills Practical Activity Prepare a report containing information related to the staff turnover in the organization	Practical-3 Hrs. Total-4 Hrs.	Stationary Information communication technology (ICT) resources	Class Room and Lab





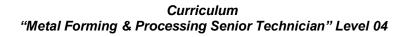
LU2. Develop workforce objectives and strategies	 Trainee will be able to: Review organizational strategy and establish aligned objectives for modification Prepare strategies to address unacceptable staff turnover, if required Develop objectives to retain required skilled labor develop objectives for workforce diversity and cross-cultural management Set targets as per organizational requirement Develop contingency plans to cope with extreme situations 	Explain organizational objectives and strategy related to the workforce Description about the objectives of staff retention Understanding of cross-cultural management Knowledge about the contingency plans related to the extreme situations Practical Activity Prepare a report containing objectives related to the workforce retention and discuss with the management	Theory-2 Hrs. Practical-3. Total- 5 Hrs.	Stationary Information communication technology (ICT) resources	Class Room and Lab
LU3. Implement initiatives to support workforce planning	 Trainee will be able to: Implement action to support agreed objectives for recruitment, training, 	 Explain the process of recruitment and training of the workforce 	Theory-2 Hrs. Practical-3 Hrs. Total-5 Hrs	 Stationary Information communication technology (ICT) resources 	





objectives	redeployment and redundancy Develop and implement strategies to assist workforce to deal with organizational dynamics Implement succession planning model to ensure desirable workers are developed and retained Implement programs to ensure workplace is an employer of choice	description about the strategies and planning to assist and deal the workforce Practical Activity Practice to implement the objectives at the organization suggested by the management related to the workforce.			
LU4. Monitor and evaluate workforce trends	 Trainee will be able to: Evaluate workforce plan against patterns in exiting employee and workforce changes Monitor labor supply trends for areas of high turnover in external environment Monitor effects of labor trends on demand for labor Survey organizational 	 Understanding about the evaluation plans related to the workforce Importance of monitoring and evaluation Knowledge about the monitoring process Understanding about the government 	Theory-1 Hrs. Practical-3 Hrs. Total-4 Hrs	Stationary Information communication technology (ICT) resources	







	 climate to gauge worker satisfaction Refine objectives and strategies in response to national and international changes and make recommendations in response to global trends. Regularly review government policy on labor jobs according to labor rights. Evaluate effectiveness of change processes against agreed objectives 	policies related to the workforce Practical Activity Practice to prepare a report that contains effectiveness related to the implementation of organizational objectives			
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0715-MF&P 03 Module: Undertake project work

Objective: This module covers the knowledge and skills required to undertake a straightforward project or a section of a larger project. It covers developing a project plan, administering and monitoring the project, finalizing the project and reviewing the project to identify lessons learned for application to future projects. This unit applies to individuals who play a significant role in ensuring a project meets timelines, quality standards, budgetary limits and other requirements set for the project.

Duration: 18 Hours Theory: 6 Hours Practice: 12 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Identity project	 Trainee will be able to: Assess project scope and other relevant documentation Identify project stakeholders Seek clarification of discrepancies from delegating authority related to project and project parameters Determine and access available resources to undertake project 	 Understanding about the scope of the project and all the required documentation Knowledge of available resources relate to the project Description of sources of information commonly used in defining the parameters of a project Explain project management tools 	Theory-2 Hrs. Practical-3 Hrs. Total-5 Hrs.	Stationary Information communication technology (ICT) resources	Class Room and Lab





LU2. Develop project plan	 Trainee will be able to: Develop project feasibility report Develop project plan in line with the project parameters Develop and approve project budget Formulate risk management plan for project, including Workplace Health and Safety (WHS) 	Practical Activity Practice to prepare a report on available resources that can be utilized in the project. Understanding about the project plans, parameters and feasibility reports Explain the risk management plan for the project Understanding about the Workplace health and safety requirements Practical Activity Practice to prepare project feasibility report	Theory-2 Hrs. Practical-3 Hrs. Total-5 Hrs.	Stationary Information communication technology (ICT) resources	Class Room and Lab
LU3. Control and monitor project	 Trainee will be able to: Ensure project team members are clear about their responsibilities and 	 recordkeeping Procedure Importance of recordkeeping 	Theory-1 Hrs. Practical-3 Hrs. Total-4 Hrs	Stationary Information communication technology (ICT)	Class Room and Lab





	 the project requirements Ensure outcomes and documented time lines of the project are met Maintain required recordkeeping systems throughout the project Implement and monitor plans of project finances and resources Prepare project progress reports as required to stakeholders Monitor risk management as required to ensure project outcomes are met 	 identification of the stakeholders Identification of risk which may affect outcomes Practical Activity Practice to prepare project progress reports as required by the stakeholders 		resources	
the project	 Trainee will be able to: Assess project scope and other relevant documentation Identify project stakeholders Seek clarification of discrepancies from delegating authority related to project and project parameters Determine and access available resources to undertake project 	 Knowledge of the documents required for finalization of project Knowledge about the Quality assurance Practical Activity Practice to prepare a report addressing issues in the project and their appropriate solutions 	Theory-1 Hrs. Practical-3 Hrs. Total-4 Hrs	 Stationary Information communicatio n technology (ICT) resources 	





0715-MF&P 04 Module: Identify and communicate trends in career development

Objective: This module covers the knowledge and skills required to conduct research to identify and communicate career trends.

Duration: 15 Hours Theory: 3 Hours Practice: 12 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Researc h and explore career trends	Trainee will be able to: • Apply knowledge of changing organizational structures, lifespan of careers and methods of conducting work	 Description about the organizational structures Knowledge about the recruitment and selection methods Understanding 		 Stationary Information communication technology (ICT) resources 	
	search, recruitment and selection processes • Analyze changing worker and employer issues, rights and responsibilities in context of changing work practices • Examine importance of quality careers development services • Maintain all research, documentation, sources and	about the Diversity and its potential effects on career choices Practical Activity	Theory-1 Hrs. Practical-3 Hrs. Total-4 Hrs.		Class Room and Lab
		Practice to prepare a document for the recruitment and selection process of the organization			





LU2. Assess and confirm	references (digital or physical). • Analyze implications of relevant policy, legislation, professional codes of practice and national standards relating to worker and employer issues • Confirm cluster employability skills and preferences that may open employment options in other career pathways Trainee will be able to:	Description of the relevant policy,		Stationary Information	
ongoing career development	 Assess success of previous career development services Maintain privacy and security of all data, research and personal records according to relevant policy Establish existing worklife balance and friendly environment 	legislation, codes of practice and standards relevant to career development understanding about the privacy	Theory-1 Hrs. Practical-3 Hrs. Total-4 Hrs.	communication technology (ICT) resources	Class Room and Lab





LU3. Maintain quality of	Trainee will be able to:	 Practice to prepare a report to maintain a suitable work environment Explain the human 		Stationary Information
career development series and professional practice	 Analyze and review relevance of career theories, models, frameworks and SOPs Incorporate into career development services and professional practice Comply with all relevant policies 	psychological development and needs in relation to career development Description of framework and SOP's of the organization related to the career development Practical Activity Practice to write a report on the importance of quality careers	Theory-1 Hrs. Practical-6 Hrs. Total-7 Hrs	communication technology (ICT) resources





0715-MF&P 05 Module: Apply interpersonal skills

Objective: This module covers the knowledge and skills required to use advanced and specialized communication skills in the client-counselor relationship.

Duration: 15 Hours Theory: 3 Hours Practice: 12 Hours

L coming Huit	Lagraina Outagness	Learning Flaments	Downstians	Materials	Learning
Learning Unit	Learning Outcomes	Learning Elements	Duration	Required	Place
LU1. Commu nicate effectively	 Identify communication barriers and use strategies to overcome these barriers in the client-counselor relationship Facilitate the client-counselor relationship through selection and use of micro skills Observe and respond to non-verbal communication cues Integrate case note taking with minimum distraction 		Theory-1 Hrs. Practical-3 Hrs. Total-4 Hrs .	Stationary Information communication technology (ICT) resources	Class Room and Lab
LU2. Apply	Trainee will be able to: • Select and use	Knowledge about impact of trauma and		Personal Protective	Class Room
specialized		stress on the	Total-4 Hrs	Stationary	and





counseling interviewing skills	communication skills according to the sequence of a counseling interview • Identify points at which specialized counseling interviewing skills are appropriate for inclusion • Use specialized counseling communication techniques based on their impacts and potential to enhance client development and growth • Identify and respond appropriately to strong client emotional reactions	communication process Description of specialized counseling interviewing skills Knowledge about the challenges in the counseling sessions Practical Activity Practice to performed the counseling session using verbal mode of communication		Information communication technology (ICT) resources	Lab
LU3. Evaluate own communication	Trainee will be able to: • Reflect on and evaluate own communication with clients	Explain self- evaluation processImportance of self- evaluation		 Stationary Information communication technology (ICT) 	QI.
	 Recognize the effect of own values and beliefs on communication with clients Identify and respond to the need for development of own skills and knowledge 	 Practical Activity Write a report on self-evaluation and record the improvement areas. 	Theory-1 Hrs. Practical-6 Hrs. Total-7 Hrs	resources	Class Room and Lab





0715-MF&P 06 Module: Work safely in an office environment

Objective: This module covers the knowledge and skills required to prepare for test equipment, apply check and test methods and Check the Accessories

Duration: 15 Hours Theory: 3 Hours Practice: 12 Hours

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Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1:Ensure safe work environment	Trainee will be able to: Follow established safety procedures when conducting work Carry out pre-start systems and equipment checks in accordance with workplace procedures	 Explain the standard working procedure related to Safety and symbols Understanding about the equipment, tools and Its safety procedures Practical Activity Practice to perform the inspection of the required equipment before usage 	Theory-0.5 Hrs. Practical-3 Hrs. Total- 3.5 Hrs	Stationary Information communication technology (ICT) resources	Class Room and Lab





LU2:Implement workplace safety requirements	Trainee will be able to: Identify designated persons for reporting queries and concerns about safety in the workplace Identify existing and potential hazards in the workplace, report them to designated persons and record them in accordance with workplace procedures Follow organizational SOP's Report emergency incidents and injuries to designated persons Maintain emergency contact list	 Explain the reporting procedures Knowledge about the hazard identification and risk assessment describe the risk control methods Understanding about the emergency response procedure Practical Activity Perform the activity of risk assessment at workplace 	Theory-0.5 Hrs. Practical-3 Hrs. Total- 3.5 Hrs	Stationary Information communication technology (ICT) resources	Class Room and Lab
LU3. Particip ate in OHS consultative processes	Trainee will be able to: Contribute to workplace meetings, inspections or other consultative activities Raise OHS issues with designated persons in	 Understanding about safety related contribution at the workplace Reporting procedure Understanding about the hazard 	Theory-1 Hrs. Practical-3 Hrs. Total- 4Hrs	Stationary Information communication technology (ICT) resources	





	accordance with organizational procedures Take actions to eliminate workplace hazards or to reduce risks	and risk elimination/reductio n techniques at workplace Practical Activity Perform the activity of hazard elimination at the workplace		
LU4. Follow safety procedures	Trainee will be able to: Identify and report emergency incidents Follow organizational procedures for responding to emergency incidents Check safety tools	 Describe the incident/accident reporting system Understanding about SOP.s of emergency incidents response Inspection techniques of equipment and tools Practical Activity Perform mock activity related to inspection of equipment before usage for a given task 	Theory-1 Hrs. Practical-3 Hrs. Total- 4Hrs	Stationary Information communication technology (ICT) resources





0715-MF&P 07 Module: Maintain professionalism in workplace

Objective: This module covers the knowledge and skills required to use advanced and specialized communication skills in the client-counselor relationship.

Duration: 15 Hours Theory: 3 Hours Practice: 12 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Respect work timeframes	 Trainee will be able to: Demonstrate punctuality in meeting, set working hours and times. Utilize working hours only for working and follow company regulations. Complete work tasks within deadlines according to order of priority Perform extra ordinary during working hours 	 understanding about workplace timeframe/working schedules and deadlines importance of adhering to the deadline 	Theory-1 Hrs. Practical-3 Hrs. Total- 4Hrs	Stationary Information communication technology (ICT) resources	Class Room and Lab
LU2: Maintain personal appearance and hygiene	Trainee will be able to: Clean hair, body and nails regularly.	Understanding about the Personal hygiene	Theory-1 Hrs. Practical-3 Hrs. Total- 4Hrs	StationaryInformation communication	Class Room and Lab







	 Wear suitable cloths for the workplace, and respect local and cultural contexts Meet specific company dress code requirements Keep smiling and have positive body language during working hours 	 Importance of personal hygiene Description of suitable and mandatory cloths at workplace 	technology (ICT) resources
LU3. Maintain adequate distance with colleagues and clients	Trainee will be able to: Respect personal space of colleagues and clients with reference to local customs and cultural contexts. Avoid cross transmission of infections (especially through respiration).	 understanding of the adequate distance of colleagues and clients Importance of the personal space at the workplace Practical activity: Demonstrate to avoid transmission of infections especially through respiration 	Stationary Information communication technology (ICT) resources
LU4. Work in	Trainee will be able	Understanding of Theory-0.5 Hrs.	Stationary
an ethical	to:	SOPs of Practical-3 Hrs.	Information
manner	 Follow company 	organization related Total- 3.5Hrs	communication





values/ethics codes of	to the ethical	technology (ICT)	
ethics and/or conduct,	manners and	resources	
policies and guidelines.	values		
 Use company 	 Importance of 		
resources in	organizational		
accordance with	values		
company ethical	 Importance of 		
standards.	reporting unwanted		
 Undertake work 	activities at the		
practices in compliance	workplace		
with company ethical			
standards,	Practical Activity		
organizational policy			
and guidelines.	Perform Tool box talk		
 Instruct co-workers on 	related to ethical		
ethical, lawful and	responsibilities with your		
reasonable directives.	co-worker		
 Share Company 			
values/practices with			
co-workers using			
appropriate behavior			
and language.			
Report work			
incidents/situations			
and/or resolved in			
accordance with			
company			
protocol/guidelines.			





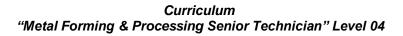
0715-MF&P 08 Module: Perform Lathe Machine and Shaper Operations

Objective: This module covers the knowledge and skills required to to Perform centering operations, Perform facing Operations, Perform turning Operations, Perform drilling and boring operations, Perform step turning operations, Perform knurling Operations, Perform Internal and External threading Operations and make a Rack Gear on shaper machine

Duration: 57 Hours Theory: 09 Hours Practice: 48 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Perform centering operations on lathe machine	 Trainee will be able to: Mount and set the required work-holding devices Mount and set the required work piece Mount and set the required cutting tools. Select safe procedures and tools to accomplish the work. Adjust the operating parameters (e.g. speed and feed) of machine tool for centering the job. Follow all safety rules required for the machine. 	 Describe the calculation of speed and feed Description of the operating parameters of centering operations Knowledge about the safety precautions involved in the work Practical Activity Perform activity of centering operation on given job 	Theory-1 Hrs. Practical-3 Hrs. Total- 4Hrs	 Lathe Machine and accessories Measuring Tools Cutting Tool Inspection Tools Personal Protective Equipment 	Class Room and Lab

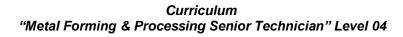






LU2: Perform facing operations	 Trainee will be able to: Mount and set the required work-holding devices Mount and set the required work piece. Select facing tools according to job requirement. Select safe procedures and tools to accomplish the work. Adjust the operating parameters (e.g. speed and feed) of machine tool to achieve the work specification. Follow all safety rules required for the machine. 	 Explain the methods and techniques of mounting and setting of workpiece Description of the adjustment of feed and speed Understanding about the techniques to adjust operating parameters of machine tool. Practical Activity Perform activity of facing operation on given job 	Theory-1 Hrs. Practical-6 Hrs. Total- 7Hrs	 Lathe Machine and accessories Measuring Tools Cutting Tool Inspection tools Personal Protective Equipment 	Class Room and Lab
LU3. Perform turning operations	Trainee will be able to: Follow work specifications, drawings or sketches to accomplish the turning operation. Set up and adjust the machine as per work	 Knowledge about Reading and interpreting work specifications, drawings and sketches. Describe the 	Theory-1 Hrs. Practical-6 Hrs. Total- 7Hrs	 Lathe Machine and accessories Measuring Tools Cutting Tool Inspection tools Personal Protective 	







	specifications and procedures. Inspect the components produced have the required quality and within the specified dimensional accuracy by turning operation. Shut down the machine and equipment on conclusion of the	cutting speed and RPM calculations • Explain the Method and technique of adjusting RPM of lathe machine. Practical Activity Perform activity of turning operation on given job		Equipment	
LU4. Perform drilling and boring operations	machining activities. Trainee will be able to: Maintain safe working condition at workplace. Follow work specifications, drawings or sketches to accomplish the turning operation. Mount and set the required work-holding devices Mount and set the required work piece Adjust the drill bit in the tail stock.	precautions and F	Theory-1 Hrs. Practical-6 Hrs. Total- 7Hrs	 Lathe Machine and accessories Measuring Tools Cutting Tool Inspection tools Personal Protective Equipment 	





	 Adjust the RPM of machine according to the cutting speed. Make the hole according to given drawing. Perform the boring operation according to the drawing. Check quality of the component produced at different intervals. 	component produced Practical Activity Perform activity of drilling on given job			
LU5. Perforn turning operati	to:	 Understanding about the selection of left hand and right hand turning tool as per job requirement Knowledge about checking accuracy and quality of the component in the step Turing operations Knowledge about the health and safety rules for the required task. Practical Activity Perform activity of step	Theory-1 Hrs. Practical-6 Hrs. Total- 7Hrs	 Lathe Machine and accessories Measuring Tools Cutting Tool Inspection tools Personal Protective Equipment 	





		 Check quality of the component produced at different intervals. Follow safety precautions to ensure safe work and to avoid any injury. 	turning operation on given job			
LU6.	Perform knurling operations	 Trainee will be able to: Maintain safe working condition at workplace. Select the knurling tool according to requirement. Set the tool and work piece in the machine according to procedure. Use right methods and techniques to produce proper knurling on work piece. Select and adjust appropriate speeds and feeds of lathe machine. Use coolants during knurling to achieve smooth impression on 	 Understanding about the knurling methods Explain the types of knurling tools Importance of using coolant during the knurling operations Practical Activity Perform activity of knurling operation on given job 	Theory-1 Hrs. Practical-3 Hrs. Total- 4Hrs	 Lathe Machine and accessories Measuring Tools Cutting Tool Knurling Tool Inspection tools Personal Protective Equipment 	





		work piece.			
LU7.	Perform internal and external threading operations	 Trainee will be able to: Mount and set the required work-holding devices Mount and set the required work piece Use Proper cutting to to cut the threads with required dimensions. Select and adjust appropriate speeds and feeds of turning machine. Produce a componer which matches the work specifications using appropriate methods and techniques. Check quality of the component produced at different intervals. Follow safety precautions to ensure safe work and to avo any injury 	threading Description of the procedure of setting tools and work piece in the machine Practical Activity Perform activity of external threading operation on given job	Theory 1 Hrs	 Lathe Machine and accessories Measuring Tools Cutting Tool Knurling Tool Inspection tools Threading Tools Personal Protective Equipment





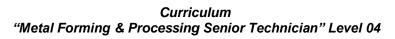
LU8.	Perform squaring of workpiece on shaper machine	machine as per requirements.(feed, speed, depth of cut and length of stroke) Perform squaring of the job on shaper machine	Measuring Tools Cutting Tool Inspection tools Personal Protective Equipment Shaper Machine and accessories neory-1 Hrs. factical-6 Hrs. otal- 7Hrs
		 Mount cutting tool and work piece in the machine. Perform Squaring operation Check quality of the component at suitable intervals. Shut down the machine at safe position after finishing the work. 	





1110	Do uto uno	Shut down the machine at safe position after finishing the work. Trained will be able.				
LU9.	Perform slotting on shaper machine	 Identify safety hazards related with shaping operations and take appropriate steps to avoid any injury or accident. Interpret the drawings as per job requirement Install the machine vice according to job requirement. Set cutting tool and set machine as per requirements.(feed, speed, depth of cut and length of stroke) Mount cutting tool and work piece on the machine. Cut a slot on the work piece as per given drawing. Check quality of the 	Practical Activity	Theory-1 Hrs. Practical-6 Hrs. Total- 7Hrs	 Measuring Tools Cutting Tool Inspection tools Personal Protective Equipment Shaper Machine and accessories 	







i	component at suitable ntervals. Shut down the		
l t	machine at safe position after finishing he work.		





0715-MF&P 09 Module: Perform Milling and Hobbing Operations

Objective: This module covers the knowledge and skills required to arrange Tools, Equipment and material for milling operation, prepare work piece for milling operation, perform setting of milling machine, carryout milling operations, arrange tools, equipment and material for Hobbing to make the gear, set Hobbing Machine for operations, and carry out Hobbing operations to make gear.

Duration: 63 Hours Theory: 12 Hours Practice: 51 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Arrange tools, equipment and material for milling operation	 Identify tools, equipment and material for milling operation Select the tool, equipment, material (type, shape and size of cutter) according to the job requirements Arrange the measuring instruments and holding devices 	 Explain milling operations and its types Knowledge about the equipment & tools used for milling operations 	Theory-2 Hrs. Practical-6 Hrs. Total- 8 Hrs	 Universal milling machine with standard accessories Measuring tools Marking tools Work holding devices Pedestal grinder Files Coolants and lubrications oils Personal protective equipment First aid box Maintenance tool kit Hands tool kit 	Class Room and Lab







LU2: Prepare work piece for milling operation	Trainee will be able to: Interpret drawing as per job requirement Prepare the work-piece by required machining (sawing and filing etc.) Check and verify the dimensions of blank for making gear as per drawing.	 Describe the application of milling operations description about the interpretation of drawing Knowledge about the sawing and filing Practical Activity Perform the activity to prepare work piece for milling operation 	Theory-2 Hrs. Practical-6 Hrs. Total- 8 Hrs	 Work piece Material Measuring tools Marking tools Work holding devices Pedestal grinder Files Coolants and lubrications oils Personal protective equipment First aid box Maintenance tool kit General repairing tool kit Hands tool kit Power hacksaw machine with blade 	Class Room and Lab
LU3. Perform setting of milling machine	Trainee will be able to: Clamp the blank workpiece and tool into its holding devices as per SOPs Maintain the safe distance between work-piece and cutter	 Describe the procedure of safe clamping the workpiece Understanding of milling machine and its accessories 	Theory-2 Hrs. Practical-6 Hrs. Total- 8 Hrs	 Universal milling machine with standard accessories Measuring tools Marking tools Coolants and lubrications oils 	





	as per prescribed method Adjust the revolution per minute(rpm) of spindle according to the specifications of work piece Adjust parameters of speed and feed from control unit as per prescribed methods	 Explain the speed and feed of milling machine Understanding about the adjustment of RPM Practical Activity Perform activity of setting RPM, speed and feed for the given job 	 Personal protective equipment First aid box Maintenance tool kit General repairing tool kit Hands tool kit
t milling operations	 Trainee will be able to: Check the alignment of work piece Locate the cutter at work piece as per standard practice Start the milling operation as per drawing and job specifications Verify the dimensions of work piece as per drawing 	 Explain the preparation of workpiece for milling operation Knowledge about alignment process Practical Activity Perform the activity of Theory-3 Hrs. Practical-6 Hrs. 	 Universal milling machine with standard accessories Measuring tools Marking tools Coolants and lubrications oils Personal protective equipment First aid box

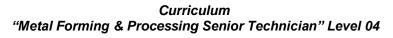






LU5. Arrange tools, equipment and material for hobbing to make the gear	material for hobbing operation	milling operation for given job • Explain the hobbing operation • Understanding about the equipment and tools used in hobbing operation • Description of the measuring and marking tools Theory-2 Hrs. Practical-09 Hrs. Total- 11 Hrs	 Maintenance tool kit General repairing tool kit Hobbing machine and its accessories Power hacksaw machine with blade Measuring and marking tools Hob cutter sets Lathe machine along with standard accessories Work holding devices Pedestal grinder with tools cutting angle support Files Coolants and lubrications oils Personal protective







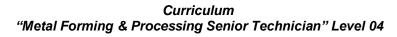
LU6. Set hobbing machine for operations	 Clamp the gear blank in their holding devices as per the standard practice Attach the Hob cutter as per the standard practice Maintain safe distance 	 Describe the procedure of safe clamping the blank Understanding of hobbing machine and its 	 Maintenance tool kit General repairing tool kit Hands tool kit Hobbing machine and its accessories Power hacksaw machine with blade Measuring and marking tools Hob cutter sets
	between gear blank and hob cutter as per prescribed method • Adjust the Revolution Per Minute (RPM) of hob cutter • Adjust feed from control unit as per prescribed method • Adjust the table according to the specifications of work piece	accessories Knowledge about the speed and feed of hobbing machine Theory-3 Hrs. Practical-6 Hrs. Total- 9 Hrs Total- 9 Hrs And the adjustment of RPM for hobbing machine	 Lathe machine along with standard accessories Work holding devices Pedestal grinder with tools cutting angle support Files Coolants and lubrications oils Personal protective





			Practical Activity Perform setting of hobbing machine for making gear	equipment First aid box Maintenance tool kit General repairing tool kit Hands tool kit
LU7.	Carryout hobbing operations to make gear	 Produce simple/ angled/differential indexing and divide the gear into required number of divisions Check the position of hob cutter and the gear blank and adjust them, if required Operate Hobbing machine according to given specifications Ensure the parameters of the gear as per requirement Check and confirm the measurements with given specifications and finalize the gear 	 Knowledge about the structure and functions of hobbing machine Understanding about the material type for the preparation of gears Description of the calculation of machine speed Knowledge about the method of positioning hob cutter 	 Hobbing machine and its accessories Power hacksaw machine with blade Measuring and marking tools Hob cutter sets Lathe machine along with standard accessories Work holding devices Pedestal grinder with tools cutting angle support Files Coolants and lubrications oils







and work piece in the hobbing machine Practical Activity Operate hobbing machine to make gear as per instructions	 Personal protective equipment First aid box Maintenance tool kit General repairing tool kit Hands tool kit
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0715-MF&P 10 Module: Perform Shielded Metal Arc Welding (SMAW)

Objective: This module covers the knowledge and skills required to Prepare Welding Machine and Accessories for SMAW, 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)], and perform Post Welding Operations.

Duration: 76 Hours Theory: 10 Hours Practice: 66 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Prepare welding machine and accessories for SMAW	 Identify welding requirements of the job, Welding Procedure Specifications (WPS) and/or technical drawings Carry out the precleaning of base metal as per requirement. Prepare SMAW welding machine in accordance with WPS/manufacturer instructions Set-up welding 	 Explain the SMAW process Understanding about the parameters of SMAW Describe the accessories required for the process of SMAW Knowledge about the applications of SMAW 	Theory-2 Hrs. Practical-12 Hrs. Total- 14 Hrs	 Shielded Metal Arc Welding plant Welding plant accessories PPEs Welding Electrodes Electrode baking Oven Measuring tools Inspection tools 	Class Room and Lab





	machine accessories and consumables as per job requirements, WPS and/or manufacturer's instructions Connect welding machine to an independent power supply Perform baking of electrode in an Oven as per standard. Set polarity indicated in the WPS	Perform activity to prepare welding machine for SMAW			
LU2: Make Welds on Carbon Steel Plate Flat (1F) and Flat (1G)	Trainee will be able to: • Adjust welding parameters (current, voltage etc.) as per WPS/job requirements to produce acceptable weld by maintaining gap between electrode and base metal as per standard practices	 Knowledge about the different types of joints Describe the various position of welding Understanding about the difference of flat and groove 	Theory-2 Hrs. Practical-12 Hrs. Total- 14 Hrs	 Shielded Metal Arc Welding plant Welding plant accessories PPEs Welding Electrodes Electrode 	Class Room and Lab





LU3. Make	 Deposit root pass as per WPS/job requirements Deposit filling passes as per WPS/job requirements Deposit capping pass as per WPS/job requirements Follow applicable manufacturing codes and standards for acceptance criteria of visual welding defects Trainee will be able 	Perform weld on carbon steel plate, Flat (1G) • Knowledge	Theory-1 Hrs.		
	per WPS/job requirements Deposit filling passes as per WPS/job requirements Deposit capping pass as per WPS/job requirements	Perform weld on carbon steel plate,		 baking Oven Measuring tools Inspection tools 	







Welds on Carbon Steel Plate Horizontal (2F)	 Adjust welding parameters (current, voltage etc.) as per welding procedure 	about horizontal (2F) and (2G)	Hrs. Total- 10 Hrs	Arc Welding plant Welding plant accessories
Horizontal (2F) and Horizontal (2G)	welding procedure specifications/job requirements to produce acceptable weld. Carry out pre-heating of the given job, if needed. Maintain distance between electrode and base metal as per standard practices. Carry out welding in Horizontal (2F) and Horizontal (2G) positions following standard procedures Deposit root pass as per welding procedure specifications/job requirements Deposit filling passes as per welding procedure specifications/job requirements Deposit capping pass as per welding	welding positions Practical Activity Perform weld on carbon steel plate, Horizontal (2F)		 PPEs Welding Electrodes Electrode baking Oven Measuring tools Inspection tools





	procedure specifications/job requirements Carry out the cleaning of passes as per requirement Check root, filling and capping passes for any visual discontinuities as per acceptance standards Follow applicable manufacturing codes and standards for acceptance criteria of visual welding defects				
LU4. Make Welds on Carbon Steel Plate Vertical (3F) and Vertical (3G)	acceptable weld	Knowledge about the vertical 3F and vertical 3G welding positions Practical Activity Perform weld on carbon steel plate, Vertical (3G)	Theory-1 Hrs. Practical-12 Hrs. Total- 13 Hrs	 Shielded Metal Arc Welding plant Welding plant accessories PPEs Welding Electrodes Electrode baking Oven Measuring tools Inspection tools 	





standard practices Carry out welding in Vertical (3F) and Vertical (3G) positions following standard procedures Deposit root pass as per welding procedure specifications/job requirements Deposit filling passes as per welding procedure specifications/job requirements Deposit capping pass		
requirements • Carry out the cleaning of passes as per		
requirement Check root, filling and capping passes for any visual discontinuities as		
per acceptance standards • Follow applicable		
manufacturing codes and standards for		







	acceptance criteria of visual welding defects			
LU5. Make Welds on Carbon Steel Plate Overhead (4F) and Overhead (4G)	 Trainee will be able to: Adjust welding parameters (current, voltage etc.) as per WPS/job requirements to produce acceptable weld Carry out pre-heating of the given job, if needed. Maintain distance between electrode and base metal as per standard practices Carry out welding in Overhead (4F) and Overhead (4G) positions following standard procedures Deposit root pass as per WPS/job requirements Deposit filling passes as per WPS/job requirements Deposit capping pass as per WPS/job 	Knowledge about the overhead 4F and overhead 4G welding positions Practical Activity Perform weld on carbon steel plate, overhead (4F)	Theory-2 Hrs. Practical-09 Hrs. Total- 11 Hrs	 Shielded Metal Arc Welding plant accessories PPEs Welding Electrodes Electrode baking Oven Measuring tools Inspection tools





LU6. Perform Post Welding Operations	requirements Carry out the cleaning of passes as per requirement Check root, filling and capping passes for any visual discontinuities as per acceptance standards Follow applicable manufacturing codes and standards for acceptance criteria of visual welding defects Trainee will be able to: Carry out finishing work of welds following standard procedures Inspect weld visually and mark any defects, if any Carry out repair work in accordance with approved procedures, if required Perform post weld heat treatment operation as	 Description of the difference 	Theory-2 Hrs. Practical-12 Hrs. Total- 14 Hrs	 Shielded Metal Arc Welding plant Welding plant accessories PPEs Welding Electrodes Electrode baking Oven Measuring tools Inspection tools
	treatment operation as per requirement.			Inspection tools







 Clean work area in accordance with workplace safety practices Maintain tools/equipment/consu mable materials in accordance with organization guidelines Store tools/equipment/consu mable materials in accordance with organization guidelines 	Perform the activity of post weld heat treatment operation as per requirement			
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0715-MF&P 11 Module: Perform Submerged Arc Welding (SAW)

Objective: This module covers the knowledge and skills required to Prepare Welding Machine and Accessories for SAW, Make Fillet Weld on Carbon Steel Plate, Make Groove Weld on Carbon Steel Plate and Perform Post Welding Operations.

Duration: 58 Hours Theory: 10 Hours Practice: 48 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Prepare welding machine and accessories for SAW	 Trainee will be able to: Identify welding requirements from the job, Welding Procedure Specifications (WPS) and/or technical drawings Prepare Submerged Arc Welding (SAW) power supply unit in accordance with WPS/manufacturer instructions Set up welding machine accessories as per job requirements, WPS and/or manufacturer instructions Set up welding machine's wire feeding unit as per 	 Describe the SAW process Description of the parameters of SAW Knowledge about the accessories requried for the process of SAW explain the applications of SAW Practical Activity Perform activity to prepare welding machine for SAW	Theory-3 Hrs. Practical-12 Hrs. Total- 15 Hrs	 SAW Welding plant Welding plant accessorie s PPEs Measuring tools Inspection tools 	Class Room and Lab





I II 2. Maka Fillat wald	 WPS Set Granular flux hopper as per requirement Connect welding machine to an independent power supply Set polarity indicated in the WPS 				
LU2: Make Fillet weld on Carbon Steel plate	 Trainee will be able to: Adjust welding parameters (current, voltage, wire feed speed, welding speed etc.) as per welding procedure specifications/job requirements to produce acceptable weld Maintain gap between electrode and base metal as per standard practices Carry out pre-heating of the given job, if needed. Carry out welding in 1F, 2F, 3F positions following standard procedures Carry out the cleaning of root pass as per requirement Carryout the re-usage of 	 Describe the characteristics of ferrous material, carbon steel and stainless steel Explain the components and features of the SAW equipment Understanding about the characteristics of electric arc used for welding Knowledge about the re-usage of flux in welding 	Theory-3 Hrs. Practical-12 Hrs. Total- 15 Hrs	 SAW Welding plant Welding plant accessorie s PPEs Measuring tools Inspection tools 	Class Room and Lab







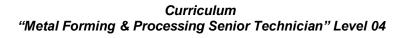
	granular flux during welding Follow applicable manufacturing codes and standards for acceptance criteria of visual welding defects	Practical Activity Perform activity of fillet weld on carbon steel plate			
LU3. Make Groove weld on carbon steel plate	 Trainee will be able to: Adjust welding parameters (current, voltage, wire feed speed, welding speed etc.) as per welding procedure specifications/job requirements to produce acceptable weld Maintain gap between electrode and base metal as per standard practices Carry out pre-heating of the given job, if needed. Carry out welding in 1G position following standard procedures Deposit root pass as per WPS/job requirements Deposit filling passes as per welding procedure specifications/job requirements Deposit capping pass as 		Theory-2 Hrs. Practical-12 Hrs. Total- 14 Hrs	 SAW Welding plant Welding plant accessories PPEs Measuring tools Inspection tools 	





LU4. Perform	per welding procedure specifications/job requirements Carry out the cleaning of passes as per requirement Check root, filling and capping passes for any visual discontinuities as per acceptance standards Follow applicable manufacturing codes and standards for visual welding defects Trainee will be able to:	Describe the		• SAW	
post welding operations	 Carry out finishing work of welds following standard procedures Inspect weld visually and mark any visual defects, as required Perform Post Weld Heat Treatment of weld as per requirement Carry out repair work in accordance with approved procedures, as required Clean work area in accordance with workplace safety practices 	 Describe the various tools and equipment used for post welding operating for SAW Explain the common welding defects produced in SAW Knowledge about the remedies of welding defects produced in SAW Practical Activity	Theory-2 Hrs. Practical-12 Hrs. Total- 14 Hrs	Welding plant • Welding plant accessories • PPEs • Measuring tools • Inspection tools	
	Maintain	Perform the activity of post			







tools/equipment/consuma ble materials in accordance with organization guidelines • Store tools/ equipment/consumable materials in accordance with organization guidelines	weld heat treatment operation as per requirement		
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0715-MF&P 12 Module: Perform Metal Die Casting Operations

Objective: This module covers the knowledge and skills required to arrange material for die casting, conduct preoperational checks on machine, prepare the casting molds, operate die casting machine, inspect final product and perform workplace cleaning.

Duration: 102 Hours Theory: 6 Hours Practice: 96 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Arrange material for die (cold chambered high pressure) casting	 Interpret the drawing/process sheet for material requirement Select tools and equipment. Prepare the melting furnace as per SOPs (Crucible). Prepare Holding furnace as per SOPs (Crucible). Set die casting machine Parameters as per job specification. 	 Describe the die casting and its types Description of various types of die casting materials Explain the application of die casting Knowledge about the difference between sand casting and die casting Understanding about the standard SOPs related to the 	Theory-1 Hrs. Practical-15 Hrs. Total- 16 Hrs.	 Die Casting Machine Die Casting Mould Holding furnace Melting furnace (Crucible) Lifting chains Shackles Fork lifter Lifting Hoist Different sizes of plunger Measuring tools First aid box 	Class Room and Lab





		melting furnace		PPEsPyrometer	
LU2: Conduct pre- operational checks on machine	 Trainee will be able to: Inspect all electrical connections. Check all mechanical fittings of mould (Bush water leakage nozzles, etc.) coolants 'lubricants, pasts, gate breaking Fixture etc. Check operation of emergency switches. Check plunger rod tip, moment, cooling system. Check cleaning, descaling of cooling lines of mould. Check and maintain proper lubrication of plunger rod, sleeve, and mould. Check air pressure of safety door, spray 	Description about the various parts of die casting machine Understanding about the different parts of die Practical Activity Prepare a list to conduct pre operational checks on machine	Theory-1 Hrs. Practical-15 Hrs. Total- 16 Hrs.	 Die Casting Machine Die Casting Mould Holding furnace Melting furnace (Crucible) Lifting chains Shackles Fork lifter Lifting Hoist Different sizes of plunger Measuring tools First aid box PPEs First aid box PPEs 	Class Room and Lab







LU3. Prepare the high pressure die casting molds	 head, Check all water connections Trainee will be able to: Lift mould with standard lifting equipment. Place the mould between both side (fixed and movables) of mould platen. Align mould in the center of platen. Connect hydraulic and water connections. Clamp mould with bolts/ hydraulic Couplings. Check spray head nozzles position as per mould, core requirements. Apply die releasing agent/ paste spray/beads. Make a three to Shots on Intensification on off position for preheating of mould 	Explain the types of molds Understanding about the alignment process Knowledge about various types of cores used in die casting Knowledge about types of clamps used in die casting molds Practical activity: Install the die casting mold on machine and perform required operational setting	Theory-1 Hrs. Practical-18 Hrs. Total- 19 Hrs.	 Die Casting Machine Die Casting Mould Holding furnace Melting furnace (Crucible) Lifting chains Shackles Fork lifter Lifting Hoist Different sizes of plunger Measuring tools First aid box PPEs
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die casting machine (cold chambered high, HP pressure)	 Trainee will be able to: Set all operating parameters of machine as per SOP Adjust Quantity of molten metal from holding furnace in machine ladle as per mould size for auto Liddle. Check all lubrication of mould, tip, and tie bars on auto. Pour the casting material in the sleeve of plunger rod. Preheat mould with burner. Make de hydration of molten material in holding furnace. Preheat mould sleeve by pouring molten metal in sleeve. Proceed with die casting operation on auto run. Brake risers, air vents flashes, gate of mould 	Explain the different parameters in die casting Advantages of die casting Limitation of die casting Practical Activity Perform the activity to operate die casting machine and perform post casting operation on product	Theory-1 Hrs. Practical-15 Hrs. Total- 16 Hrs.	 Die Casting Machine Die Casting Mould Holding furnace Melting furnace (Crucible) Lifting chains Shackles Fork lifter Lifting Hoist Different sizes of plunger and sleeves Measuring tools First aid box PPEs





	breaking fixture of mould Make air blow on mould face, Spray die release agent in mould with spray head/manual spray gun, and dry with air as per mould requirement. Monitor operations to ensure compliance with job requirements.		
LU5. Inspect final product	 Trainee will be able to: Perform visual inspection for defects, if any. Cut shot from different positions of casting to check blowholes, pinholes in casting Check dimensions of the product as per drawing for first production only. Check part on checking fixture if any. Complete inspection report. 	 Explain the common defects produced in die casting Describe the remedies of defects produced in die casting Knowledge about the inspection of the final product 	





LU6. Perform workplace cleaning	 Trainee will be able to: Maintain all check sheets and work instructions. Perform cleaning, and descaling of mould cooling lines, machine and floor after job completion. Perform Lubrication on slides, tie bar and mould. Apply anti-rust spray/cleaning agent. Store the tools and equipment. Return excess material to store. Transfer waste material into designated area. 	Explain the standard cleaning procedure Understanding about the lubrication Practical Activity Perform die machine cleaning activity	Theory-1 Hrs. Practical-18 Hrs. Total- 19 Hrs.	Cleaning equipment and Accessories
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0715-MF&P 13 Module: Perform Centrifugal Casting Process

Objective: This module covers the knowledge and skills required to prepare mold for casting, cast the molten metal, remove the Casting from molds and perform post casting operations.

Duration: 51Hours Theory: 6 Hours Practice: 45 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Prepare Mold for casting	 Trainee will be able to: Arrange material for centrifugal casting process Apply refractory ceramic coating to cylindrical mold walls Perform rotation of mold to spread coating properly Perform drying of ceramic coat as per standard operating procedures Rotate mold about its axis at required speeds 	 Describe centrifugal casting process Knowledge about the material requried for the centrifugal casting process Explain the refractory ceramic coating of cylindrical mold walls Explain the types of centrifugal casting 	Theory-1 Hrs. Practical-12 Hrs. Total- 13 Hrs.	 Centrifugal Casting Machine & accessories Centrifugal Casting Mold Moving and fixed platen Measuring Devices 	Class Room and Lab







LU2: Cast the molten metal	 Trainee will be able to: Pour molten metal directly into the rotating mold without the use of runners or a gating system. Pour the molten metal into the mold Carryout pouring of molten metal as per standard Follow safe handling practice during pouring of molten metal Perform solidification of molten metal at room temperature Trim the casting to the desired shape. 	parameters of centrifugal casting • Knowledge about the safety precaution for the centrifugal casting Practical Activity Perform the activity	Theory-1 Hrs. Practical-12 Hrs. Total- 13 Hrs.	 Centrifugal Casting Machine & accessories Centrifugal Casting Mold Melting furnace (Crucible) Plungers Pot Goose neck Ladle Moving and fixed platen Lifting chains Measuring devices First aid box PPEs 	Class Room and Lab
LU3. Remove the casting from molds	Trainee will be able to: Take the metal out of the mold as per standard practice Remove the solidified casting from mold Inspect the molted part for defects, if any	 Knowledge about the casting removal from the molds Explain the inspection process in centrifugal casting 	Theory-2 Hrs. Practical-12 Hrs. Total- 14 Hrs	 Centrifugal Casting Machine & accessories Centrifugal Casting Mold Melting furnace (Crucible) Plungers 	





	Prepare the inspection report as per SOPs	 Perform the activity of removing solidified casting from the mold Prepare the inspection report as per the standard procedure 		 Pot Goose neck Ladle Moving and fixed platen Lifting chains Measuring devices First aid box PPEs 	
LU4. Perform post casting operations	 Trainee will be able to: Clean less dense impurities or bubbles at the inner surface of the casting. Perform shot blasting to smooth the inner diameter of the part. Execute proper shut down of the machine Perform regular cleaning process as prescribed by manufacturer 	 Explain the process of post casting operations Knowledge about the shot blasting Understanding about the standard cleaning process Practical Activity Perform the activity of shot blasting to smooth the inner diameter of the given part 	Theory-2 Hrs. Practical-9 Hrs. Total- 11 Hrs	 Centrifugal Casting product Measuring tools Inspection tools Shot blasting Plant First aid box PPEs 	





0715-MF&P 14 Module: Perform Shell Mold Casting

Objective: This module covers the knowledge and skills required to arrange pattern for casting, prepare the mold for casting, assemble mold for casting, cast molten metal in mold and remove the casting from mold.

Duration: 57 Hours: Theory: 6 Hours Practice: 51 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Arrange pattern for casting	 Trainee will be able to: Handle two-piece metal pattern as per job requirement Use Aluminum pattern for mass production of patterns Use Graphite pattern for casting of reactive materials. 	 Describe shell mold casting process Knowledge about the material requried for the shell mold casting process Knowledge about graphite pattern for casting reactive material 	Theory-1 Hrs. Practical-12 Hrs. Total- 13 Hrs	Shell MoldPPEs	Class Room and Lab
LU2: Prepare the mold for casting	Trainee will be able to: Heat up the pattern as per job requirements Coat the pattern with a lubricant to facilitate removal. Clamp the heated	 Explain the mold creating techniques Knowledge to prepare the mold for casting 	Theory-1 Hrs. Practical-12 Hrs. Total- 13 Hrs	 Squeezing and jolting Machine Steam Plant Adhesive Materials 	Class Room and Lab





	pattern to a dump box (containing a mixture of molding material). Invert the dump box allowing molding material (Sand-resin mixture) to coat the pattern. Make a shell around the heated pattern Eject the shell from the pattern	Practical Activity Prepare mold for shell casting		 Dump box Shell Mold Crucible Dies Die coats Metal holding pot Clamping device PPEs
LU3. Assemble mold for casting	Trainee will be able to: Join the two shell together as per job requirement Insert core in the mold, if required. Clamp mold parts to form the complete shell mold. Place the shell mold into a flask supported by a backing material.	 Knowledge about the assembly of molding Practical Activity Perform the activity to assemble molds for casting 	Theory-1 Hrs. Practical-09 Hrs. Total- 10 Hrs	 Dump box Shell Mold Tongs Crucible Dies Die coats Metal holding pot Clamping device PPEs Ultrasonic machine for binding both halves of mold







LU4. Cast molten metal in mold	Trainee will be able to: Pour molten metal from ladle through gating system Fill the mold cavity completely with the molten metal Perform cooling of molten metal as per SOPs Carryout solidification of molten metal into final casting	Knowledge of pouring techniques Explain the standard procedure to safely cool the molten metal Practical Activity Pour molten metal into the mold	Theory-1 Hrs. Practical-12 Hrs. Total- 13 Hrs	 Melting Furnace and accessories Dump box Shell Mold Transfer Ladles Tongs Crucible Mold coats Metal holding pot Clamping device Transfer ladles PPEs
the casting from mold	 Trainee will be able to: Break the mold after the metal is cool down Trim excess metal from the feed system, if any Remove any sand from the mold, if any Perform post casting inspection for any defect, if any Prepare the inspection report as per SOPs 	Describe the types of process of removing casting from the molds Explain the inspection process in shell casting Practical Activity Remove casted metal from the mold	Theory-2 Hrs. Practical-6 Hrs. Total- 8 Hrs	 Inspection tools Shell Mold Tongs Metal holding pot Clamping device PPEs





0715-MF&P 15 Module: Perform Investment Casting

Objective: This module covers the knowledge and skills required to arrange pattern for Casting, prepare mold for casting, perform casting and perform post-casting operations.

Duration: 68 Hours: Theory: 8 Hours Practice: 60 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Arrange pattern for casting	 Arrange wax patterns as per requirement Use cores to form internal features within the pattern, if required Attach patterns to a central wax gating system (sprue, runners, and risers) to form a tree-like assembly 	 Describe the investment casting Knowledge about the steps involved in investment casting limitation of investment casting Knowledge of material used in investment casting Practical Activity Prepare pattern for investment Casting 	Theory-2 Hrs. Practical-15 Hrs. Total- 17 Hrs	 Melting Furnace and Accessories Wax Injector Flask Ladle Wax patterns Shell Coater Slurry Tanks Shell Handlers Casting Handlers Barrel Sanders Grinders Casting Positioner 	Class Room and Lab







LU2: Prepare mold for casting	Trainee will be able to: Place wax tree-like assembly into mold flask Prepare slurry by mixing ceramic powder with water and stir it homogenously Perform degassing of slurry in vacuum chamber Pour slurry into the flask to coat the wax pattern tree Bake the shell as per standard to form a ceramic shell around the patterns and gating system Remove the wax leaving a hollow ceramic shell that acts as a one-piece mold Apply protective coating to mold as per standard	 Explain the mold creating techniques in investment casting Knowledge of preparation the mold for investment casting Understanding about the protective coating for the mold Practical Activity Prepare mold for investment casting Theory-2 Hrs. Practical-15 Hrs. Total- 17 Hrs. 	 Melting Furnace and Accessories Wax Injector Flask Ladle Wax patterns Shell Coater Slurry Tanks Shell Handlers Casting Handlers Barrel Sanders Grinders Casting Positioner Chass Room and Lab
LU3. Perform casting	Trainee will be able to: • Pre-heat mold in a	 Knowledge to perform the perform the Practical-15 Hrs. 	Melting Furnace and





	 furnace as per SOP Pour molten metal from a ladle into the gating system of the mold Carry out complete filling of the mold cavity with liquid melt as per standard operating procedure 	investment casting and steps involved • Describe the gating system Practical Activity Perform investment casting	Total- 17 Hrs	Accessories Wax Injector Flask Ladle Wax patterns Shell Coater Slurry Tanks Shell Handlers Casting Handlers Barrel Sanders Grinders Casting Positioner
LU4. Perform post-casting operations	Trainee will be able to: Perform cooling of molten metal as per SOPs Carryout solidification of molten metal into final casting Remove casting flask as per standard procedure	 Explain the process of post casting operations Understanding about the standard cleaning process Describe the standard procedure to dispose-off the waste material 	Theory-2 Hrs. Practical-15 Hrs. Total- 17 Hrs	 Melting Furnace and Accessories Wax Injector Flask Ladle Wax patterns Shell Coater Shell Shell







 Separate the caparts from gating system either by sawing or cold breaking (using nitrogen) Perform post capinspection for an defect, if any Prepare the inspector as per SC Clean up work a and equipment Dispose-off was designated place 	liquid Practical Activity Perform post- investment casting operations pection Ps pread te at	Handlers Casting Handlers Barrel Sanders Grinders Casting Positioner
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0715-MF&P 16 Module: Perform Die Forging Process

Objective: This module covers the knowledge and skills required to perform Open Die Forging (Cold, Hot), perform Closed/Impression Die Forging (Cold, Hot), perform precision/flash less forging operation, and Perform forging machine maintenance.

Duration: 57 Hours: Theory: 6 Hours Practice: 51 Hours

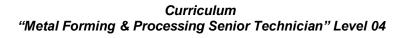
Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Perform open die forging (cold/hot)	 Trainee will be able to: Identify the tools and equipment required for the task. Calculate the material volume based on task requirements. Select open die as per requirement of forging Setup the Forging machine in accordance with the Standard Operating Procedure and specifications. Heat up the charge / billet to the specified temperature in case of 	 Explain different types of forging dies Understanding about the accessories of forging hammers and presses Knowledge about the usage of various forging dies Calculations of the forging loads for open die Describe different parameters of forging operations Understanding about the difference between forging 	Theory-2 Hrs. Practical-12 Hrs. Total- 14 Hrs.	 Forging machine and accessories Forging hammer Forging dies Anvil Heating furnaces PPEs Clamping devices Tongs Punch Fuller Swage 	Class Room and Lab





	 hot die forging Carryout pre-forming / Edging operation Carryout forging operation as per requirement Perform trimming operation as per requirement Carryout inspection of the finish product. 	hammers and forging press • Knowledge about the tools and equipment required for the forging process Practical Activity Perform open die forging (cold/hot) as per instruction		 Swage block Measuring tools 	
LU2: Perform Impression Die Forging (Cold/Hot)	Trainee will be able to: Identify the tools and equipment required for the task. Calculate the material volume based on task requirements. Select close/impression die as per the requirement of forging Setup the Forging machine in accordance with the Standard	 Knowledge about the close die forging (cold/hot) Identification of Tools and equipment required in close die forging Calculations of the forging loads for close die Understanding about the formation of flash Knowledge about the advantages and 	Theory-2 Hrs. Practical-12 Hrs. Total- 14 Hrs .	 Forging machine and accessories Forging hammer Forging dies Anvil Forging hardies Heating furnaces PPEs Clamping 	Class Room and Lab

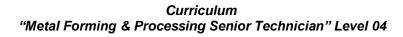






	Operating Procedure and specifications. Heat up the charge / billet to the specified temperature in case of hot die forging Carryout pre-forming / Edging operation Carryout forging operation as per requirement Perform trimming operation as per requirement Carryout inspection of the finish product.	disadvantages of flash Practical Activity Perform impression die forging (cold/hot)		devices Tongs Punches Fullers Flatters Swages Swage block Measuring tools
LU3. Perform precision / flash less forging operation	 Trainee will be able to: Select the tools and Equipment required for the given task. Calculate the material volume based on task requirements. Use tools and formers according to the standard operating procedure. Setup the forging machine in accordance 	 Understanding about the process of precision/ flash less forging operation Explain the process of inspection related to the final product Describe the advantages of precision forging 	Theory-1 Hrs. Practical-15 Hrs. Total- 16 Hrs	 Forging machine and accessories Forging hammer Forging dies Anvil Heating furnaces PPEs Clamping devices

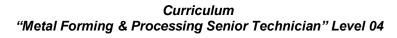






	with the Standard Operating Procedure and specifications. Operate the forging machine in accordance with the Standard Operating Procedure Carryout inspection of the finish produce.	 Knowledge about the tools and equipment required for precision/flash less forging operation Understanding about the special types of precision forging Practical Activity Perform the activity of precision / flash less forging operation as per instructions 	 Tongs Punch Fuller Flatter Swage Swage block Measuring tools
LU4. Perform forging machine maintenance	 Trainee will be able to: Carryout Preventive maintenance of the machine. Check the moving parts of the machine for excessive play. Calibrate forging load of the machine as per 	 Knowledge about the maintenance of forging machine Understanding about the personal protection equipment required for the forging operations Theory-1 Hrs. Practical-12 Hrs. Total- 13 Hrs	 Forging machine and accessories Inspection tools Measuring tools Forging presses







• (SOPs Clean, align and ubricate die load of the	Practical Activity		
• (Use required PPEs during maintenance of	Perform the activity of forging machine preventive maintenance as per the given instructions		





0715-MF&P 17 Module: Perform Hydrostatic Extrusion Process

Objective: This module covers the knowledge and skills required to perform cold hydrostatic extrusion, perform hot hydrostatic extrusion and carryout inspection of finished product

Duration: 108 Hours: Theory: 12 Hours Practice: 96 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Perform cold hydrostatic extrusion	 Arrange metal-forming dies as per standard Select the suitable raw material for cold Hydrostatic Extrusion process Inspect tools for correct installation Carryout the cold hydrostatic extrusion process as per SOPs Store the extruded product as per SOPs Turn off the cold hydrostatic extrusion machine as per SOPs 	 Explain the extrusion process Knowledge about the types of extrusion Understanding about the hydrostatic extrusion Describe the cold hydrostatic extrusion Knowledge about the cold hydrostatic machine and its accessories Understating about the application of cold hydrostatic extrusion 	Theory-4 Hrs. Practical-33 Hrs. Total- 37 Hrs.	 Hydrostatic Extrusion Machine with accessories Dies Hand tools Lubricants Measuring tools 	Class Room and Lab





	Carryout inspection of the finish product.	Practical Activity Perform the activity of Cold hydrostatic extrusion as per the instructions			
LU2: Perform hot hydrostatic extrusion	 Trainee will be able to: Arrange metal-forming dies as per standard Select the suitable raw material for Hot Hydrostatic extrusion process Inspect tools for standard installation Pre-heat the Die prior to the hot Hydrostatic Extrusion process Adjust the temperature of the Die, if required. Carryout the hot extrusion process Store the extruded product as per SOPs Turn off the Hot hydrostatic extrusion machine as per SOPs 	 Describe the hot hydrostatic extrusion Knowledge about the hot hydrostatic machine and its accessories Understating about the application of hot hydrostatic extrusion Practical Activity Perform the activity of Hot hydrostatic extrusion as per given instructions 	Theory-4 Hrs. Practical-33 Hrs. Total- 37 Hrs.	 Hydrostatic Extrusion Machine with accessories Dies Hand tools Lubricants Measuring tools 	Class Room and Lab





LU3. Carryout inspection of finished product	 Trainee will be able to: Select samples to check conformance as per the requirement Verify the dimensions of the finished products as per the given drawing Carry out inspection of the finished extruded product as per Quality Standards. Record the deviations, if any, with the given specifications Report the deviations for corrective measures. 	 Understanding about the inspection of extruded product Knowledge about the extrusion defects Knowledge about the remedies of extrusion defects Practical Activity Prepare inspection report for extruded job	Theory-4 Hrs. Practical-30 Hrs. Total- 34 Hrs	 Inspection tools Measuring tools 	
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0715-MF&P 18 Module: Perform wire drawing process

Objective: This module covers the knowledge and skills required to arrange tools and equipment for wire drawing through draw plate, Perform annealing of the given wire to be drawn, carryout pull through drawplate and perform wire drawing operation on metal blank.

Duration: 63 Hours: Theory: 12 Hours Practice: 51 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Arrange tools and equipment for wire drawing through draw plate	Trainee will be able to: Arrange the required tools and equipment required for the process Arrange raw material wire for wire drawing process as per requirement Select the required tools and equipment for wire drawing process	Describe the process of wire drawing Knowledge about the difference of wire drawing and deep drawing Knowledge about the tools and equipment required for wire drawing process Describe the same and the same are described to the same are drawing process.	Theory-3 Hrs. Practical-12 Hrs. Total- 15 Hrs	 Drawplate & Dies Bench vise Draw tongs Wire rolling mill Blank holders Heating furnace and accessories 	Class Room and Lab
	Inspect the working condition of tools and	Practical Activity Perform the activity of arranging tools for the			





	equipment	process of wire drawing			
LU2: Perform Annealing of the given wire to be drawn	Trainee will be able to: Heat the wire in the heating furnace up to required temperature Set standard soaking time of the heat treatment furnace as per requirements Stop the heating once the required temperature and soaking time is achieved. Perform the cooling of raw material wire in furnace	 Describe the annealing process Understanding about the Importance of annealing of the wire to be drawing Practical Activity Perform the activity to set the furnace for annealing of the wire 	Theory-3 Hrs. Practical-12 Hrs. Total- 15 Hrs.	 Heating furnace and accessories Long tongs PPEs 	Class Room and Lab
LU3. Carryout pulling of wire through drawplate	Trainee will be able to: Install the draw plate as per standard Fix the draw plate in the vise Taper the proper	 Understanding about the draw plate Knowledge about the importance of lubrication of wire to be drawn 	Theory-3 Hrs. Practical-15 Hrs. Total- 18 Hrs	DrawplateBench viseDraw tongsWire rolling mill	





	 length of the wire to be drawn Lubricate the wire to be drawn Select a hole in the draw plate slightly smaller than the diameter of raw material wire Insert the taper end of wire in the back side of draw plate Grasp the wire from the front of the plate with a draw tong or heavy duty pliers Pull the wire through the plate Maintain the constant speed to ensure the uniformity Repeat the process with successively smaller holes until the desired diameter is achieved 	Describe the process of wire tapering Understanding about the importance of wire tapering Calculation of draw load Practical Activity Perform activity of wire drawing through draw plate as per given instructions		Blank holders	
LU4. Perform wire drawing operation on	Trainee will be able to: • Prepare the metal blanks as per	 Knowledge about the preparation of metal blank Understanding 	Theory-3 Hrs. Practical-12 Hrs. Total- 15 Hrs	Metal BlanksDiesBench vise	





metal blank	requirement Check the property of Blank as per standards Set number of Dies according to requirement. Set the drawing load as per requirement Pull the wire through the metal blank Carry out wire drawing as per standard Measure the diameter of wire and confirm it with requirements.	about the process of wire drawing using metal blank • Knowledge about the application of wire drawing • Knowledge about the inspection processes Practical Activity Perform activity of wire drawing using metal blank as per given instructions		 Draw tongs Wire rolling mill Blank holders 	
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0715-MF&P 19 Module: Perform Heat treatment of Ferrous Materials

Objective: This module covers the knowledge and skills required perform hardening on Carbon Steel, perform tempering of hardened carbon steel, perform annealing on steel, perform normalizing of steel, perform Carburizing of Steel and perform stress relieving of Metal.

Duration: 58 Hours: Theory: 10 Hours Practice: 48 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Perform hardening on carbon steel	 Trainee will be able to: Prepare the samples of required size. Place the sample in the furnace Adjust the temperature of furnace and soaking time of the furnace according to steel grade. Select a suitable quenching media. Quench the samples in quenching media. Interpret the results as per requirement 	with respect to heat	Theory-2 Hrs. Practical-6 Hrs. Total- 08 Hrs	 Heating furnace and accessories Hardness tester Long tongs Quenching media Carburizing media Quenching bath PPEs 	Class Room and Lab





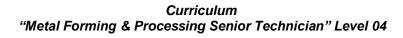
LU2: Perform	Trainee will be able	Practical Activity Perform the activity of hardening of carbon steel		Heating	
Tempering of hardened carbon steel	 Take hardened sample (as prepared in above experiment). Place the sample in the furnace Adjust the tempering temperature of furnace and soaking time of the furnace according to require microstructure. Cool the specimen as per SOPs Interpret the results as per requirement 	 Knowledge about the purpose of tempering Describe tempering of hardened steel Understanding about the types of tempering Knowledge about tempering bath Practical Activity Perform the activity of tempering of hardened carbon steel as per given instructions 	Theory-2 Hrs. Practical-9 Hrs. Total- 11 Hrs	furnace and accessories Hardness tester Long tongs Quenching media Quenching bath PPEs	Class Room and Lab
LU3. Perform annealing on steel	Trainee will be able to: • Prepare the samples of required size.	Describe the annealing processUnderstanding	Theory-2 Hrs. Practical-6 Hrs. Total- 08 Hrs	Heating furnace and accessories	





	 Place the sample in the furnace Adjust the temperature and soaking time of the furnace according to steel grade. Turn of the furnace and let the samples to cool in the furnace. Remove the samples from furnace once the temperature drops to near room temperature. Interpret the results as per requirement 	types of annealing process Explain the purpose of		 Hardness tester Long tongs PPEs
LU4. Perform normalizing of steel	Trainee will be able to: Prepare the samples of required size. Place the sample in the furnace Adjust the temperature and soaking time of the furnace according to steel grade. Turn off the furnace Remove the samples from furnace and let	Understanding about the phase transformation of	Theory-2 Hrs. Practical-9 Hrs. Total- 11 Hrs	 Heating furnace and accessories Hardness tester Long tongs PPEs







them to cool in the a Interpret the results per requirement Cut and prepare the samples of required sizes. Pack the samples in carbonaceous mate in steel box and seathe boxes by suitable method. Place the boxes in the furnace Heat the samples for suitable time and temperature. Turn off the furnace and remove the steel boxes from furnace and recover the specimen. Check hardness of the sample's core and case. Interpret the results hardness and microstructure. Lu6. Lu6. Cut and prepare the samples for samples of required sizes. Pack the samples in carbonaceous mate in steel box and seathe boxes by suitable method. Turn off the furnace and remove the steel boxes from furnace and recover the specimen. Check hardness of the sample is core and case. Interpret the results hardness and microstructure.	Perform the activity of normalizing on steel as per job requirements Explain the process of case hardening Knowledge about the types of case hardening Understanding of the carburizing process Knowledge about the types of carburizing Understanding of hardness test Practical Activity Perform the activity of carburizing of steel as per given instructions.	Theory-2 Hrs. Practical-9 Hrs. Total- 11 Hrs	 Heating furnace and accessories Hardness tester Long tongs Carburizing mediaPPEs Heating 	
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Perform stress relieving of metal	of required size. Place the sample in the furnace. Adjust the temperature and soaking time of the furnace as required Turn off the furnace and let the sample to cool in the furnace Remove the samples from furnace once the temperature reaches near room temperature. Check hardness of the sample	 Understanding about the disadvantages of residual stress Knowledge about the residual stress removal process Practical Activity Perform the activity of residual stress removal 	Practical-9 Hrs. Total- 10 Hrs	furnace and accessories Hardness tester Long tongs PPEs
		residual stress removal on given sample as per given instructions.		





0715-MF&P 20 Module: Perform Heat treatment of Non- Ferrous Materials

Objective: This module covers the knowledge and skills required to Perform Solution Treatment and Aging of Non-Ferrous materials.

Duration: 46 Hours: Theory: 10 Hours Practice: 36 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Perform solution treatment	 Trainee will be able to: Handle the workpiece with appropriate care Place the workpiece in the furnace Adjust the temperature and soaking time of the furnace according to the material type/size. Turn of the furnace once the required temperature and soaking time is achieved. Remove the workpiece from the furnace and quench into the 	 Describe properties of common nonferrous metals Understanding about the purpose of heat treatment of non-ferrous metals Explain the solution treatment of nonferrous metal Knowledge about the study of phase transformation of nonferrous metal Describe the anodizing of Aluminum and its types. 	Theory-5 Hrs. Practical-18 Hrs. Total- 23 Hrs.	 Heating furnace and accessories Solution treatment bath Hardness tester Long tongs Quenching bath PPEs 	Class Room and Lab





LU2: Perform	 Handle the workpiece with appropriate care Place the workpiece in the furnace Adjust the temperature and soaking time of the furnace according to the type and size of the material. Turn of the furnace once the required temperature and soaking time is achieved Let the workpiece to cool in the furnace. Remove the workpiece from the furnace, once the temperature drops to room temperature. 	 Explain the purpose of aging Practical Activity Perform the activity of aging on given non-ferrous metal as per given 	Theory-5 Hrs. Practical-18 Hrs. Total- 23 Hrs	 Heating furnace and accessories Hardness tester Long tongs Quenching bath PPEs 	Class Room and Lab
	the temperature drops				





0715-MF&P 21 Module: Carryout hardness testing

Objective: This module covers the knowledge and skills required to Measure hardness of the specimen by using Brinell Hardness Test, Measure hardness of the specimen by using Rockwell Hardness Test and Measure hardness of the specimen by using Vickers Hardness Test

Duration: 52 Hours: Theory: 10 Hours Practice: 42 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Measure hardness of the specimen by Brinell hardness test	 Trainee will be able to: Prepare the surface of standard specimen as per requirement. Inspect the working mode of the Brinell Hardness Testing Machine. Select the indenter and Load as per standard. Place the specimen on anvil with safety precautions. Apply load on the specimen for standard 	 Understanding about the hardiness of materials Knowledge about the destructive test Describe the types of hardness test Understanding about the different parts of Brinell hardness testing machine Knowledge about the standard load and time of Brinell hardness test Calculation of 	Theory-3 Hrs. Practical-15 Hrs. Total- 18 Hrs	 Brinell Hardness Testing Machine Measuring instruments Accessories for surface cleaning 	Class Room and Lab





	time period. Calculate the Brinell hardness number with formula or directly note from the gauge according to design of the machine.	Brinell hardness number • Explain the limitation of Brinell hardness test Practical Activity Determine the Brinell hardness number for given sample			
LU2: Measure hardness of the specimen by Rockwell hardness test	 Trainee will be able to: Prepare the surface of standard specimen as per requirement. Inspect the working mode of the Rockwell Hardness Testing Machine. Select the Scale of the machine (A, B or C) depending upon the material. Place the specimen on anvil with safety precautions and apply minor load. Apply major load on the specimen according to the scale of the machine. 	 Describe the different scales of Rockwell hardness test Knowledge about the standard minor load, major load and different types of indenters of Rockwell hardness testing machine. Describe the comparison of Brinell and Rockwell hardness test Understanding about the different parts of Rockwell hardness testing machine 	Theory-3 Hrs. Practical-15 Hrs. Total- 18 Hrs	 Rockwell Hardness Testing Machine Measuring instruments Accessories for surface cleaning 	Class Room and Lab





	Note the Rockwell Hardness number from gauge.	Practical Activity Determine the Rockwell hardness number for the given sample			
LU3: Measure hardness of the specimen by Vickers Hardness test	 Trainee will be able to: Prepare the surface of standard specimen as per requirement. Inspect the working mode of the Vickers Hardness Testing Machine. Select the Load as per standard depending upon the material. Place the specimen on anvil with safety precautions. Apply load on the specimen for standard time period. Note the Vickers Hardness number from the gauge. 	 Knowledge about the different parts of Vickers hardness testing machine Explain the shape and size of indenter Understanding about the standard load and time for different materials Describe the calculations of Vickers hardness numbers Practical Activity Determine the Vickers hardness numbers of given sample 	Theory-4 Hrs. Practical-12 Hrs. Total- 16 Hrs.	 Vickers Hardness Testing Machine Measuring instruments Accessories for surface cleaning 	





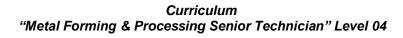
0715-MF&P 22 Module: Carryout Impact testing

Objective: This module covers the knowledge and skills required to Measure toughness of the specimen by using Izod Impact Test and Measure Toughness of the specimen by using Charpy Impact Test

Duration: 46 Hours: Theory: 10 Hours Practice: 36 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Measure Toughness of the specimen by Izod impact test	 Trainee will be able to: Check the dimensions of Izod specimen with the help of measuring instrument as per ASTM standard. Inspect the working mode of the izod impact testing machine. Adjust the initial position of the hammer. Calculate the initial potential energy of the hammer. Clamp the standard specimen in the anvil 	 Understanding about toughness of materials Knowledge about the basic principle of impact test Describe the standard size of Izod impact test specimen Knowledge about the parts of Izod impact testing machine Describe the method of clamping and hammering of specimen 	Theory-5 Hrs. Practical-18 Hrs. Total- 23 Hrs	 Izod impact testing machine Measuring devices 	Class Room and Lab







	 by keeping standard length out of the anvil. Drop the hammer to strike it with standard specimen. Calculate the final potential energy of the hammer. Calculate the toughness of the specimen material by calculating difference of initial and final energy of the hammer. 	Practical Activity Measure toughness of the specimen by Izod Impact Test			
LU2: Measure Toughness of the specimen by Charpy Impact Test	 Trainee will be able to: Check the dimensions of Charpy specimen, received from workshop, with Vernier calliper as per ASTM standard. Inspect the working mode of the charpy impact testing machine. 	 Understanding about the difference of Izod and charpy impact test Knowledge about the basic principle of impact test Describe the standard size of Charpy impact test specimen 	Theory-5 Hrs. Practical-18 Hrs. Total- 23 Hrs	 Charpy impact testing machine Measuring devices 	Class Room and Lab





 Adjust the initial position of the hammer. Calculate the initial potential energy of the hammer. Clamp the standard specimen in the anvil by keeping standard length out of the anvil. Drop the hammer to strike it with standard specimen. Calculate the final potential energy of the hammer. Calculate the toughness of the specimen material by calculating difference of initial and final energy of the hammer. 	Knowledge about the parts of Charpy impact testing machine Describe the method of clamping and hammering of specimen Practical Activity Measure Toughness of the specimen by Charpy Impact Test		
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0715-MF&P 23 Module: Perform mechanical testing on universal testing machine

Objective: This module covers the knowledge and skills required to Measure tensile properties of the specimen, Measure Compressive strength of the specimen, Measure the Bending strength of specimen and Measure Shear strength of the specimen

Duration: 70 Hours: Theory: 10 Hours Practice: 60 Hours





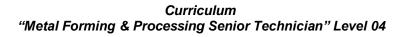
Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Measure tensile properties of the specimen	 Inspect the dimensions of standard specimen with the help of measuring instruments. Mark the gauge length points on the specimen. Measure the initial cross sectional area of the specimen. Select the gripping device as per standard specimen. Inspect the functioning condition of the gripping device. Grip the specimen in gripping device according to standard. Attach the extensometer with the specimen if required. Apply the load on the specimen up to fracture. Note the values of applied load after specific intervals. 	 Describe the hook's law Understanding about the yield stress, ultimate tensile stress and breaking stress Knowledge about the different parts of universal testing machine Describe the standard size of different shapes of tensile specimen Understanding about the stress and strain Knowledge about the sketching and labeling of stress stain curve Knowledge about gauge length Knowledge about the clamping of the specimen in machine for 	Theory-3 Hrs. Practical-15 Hrs. Total- 18 Hrs.	 Universal Testing Machine & Accessories Measuring Instruments Specimens Computer with software Extensometer Gripping Jaws Holders 	Class Room and Lab





	 Note the extension produced against the noted applied load. Calculate stress and strain from the values of load and extension. Sketch stress strain curve. Calculate the required mechanical properties. 	Practical Activity Perform the activity to determine the tensile strength of given specimen and plot the stress strain diagram.			
LU2: Measure Compressive strength of the specimen	 Trainee will be able to: Inspect the dimensions of standard specimen with the help of measuring instruments. Calculate the initial cross sectional area of the specimen. Prepare the end surfaces of the specimen. Inspect the working condition of fixtures used for compression. Fix the specimen, 	 Describe compressive strength Knowledge about the compression test Understanding about the standard size of specimen for compression test Practical Activity Measure Compressive strength of the specimen 	Theory-3 Hrs. Practical-15 Hrs. Total- 18 Hrs	 Universal Testing Machine & Accessories Measuring Instruments Specimens Computer with software Extensometer Gripping Jaws Holders 	Class Room and Lab







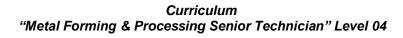
	 between fixtures, in the machine. Apply the load on the specimen up to surface failure. Note the value of load at which surface get failure. Calculate compressive stress. Record the results. 	and plot the stress strain diagram.			
LU3: Measure the Bending strength of specimen	 Inspect the dimensions of standard specimen with the help of measuring instruments. Inspect the working condition of bend test fixture. Fit the bend test fixture in the machine. Adjust the span between two rollers of the fixture according to the length of the specimen. Fit the mandrel in the 	 Knowledge about the bending strength of different materials Knowledge of Bending equation Describe different ways of applying bending loads Practical Activity Measure the Bending strength of given specimen 	Theory-2 Hrs. Practical-15 Hrs. Total- 17 Hrs	 Universal Testing Machine & Accessories Measuring Instruments Specimens Computer with software Extensometer Gripping Jaws Holders 	





LU4: Measure Shear strength of the specimen	 Machine. Place the specimen on the rollers of the fixture. Apply the load on the specimen up to maximum selected bend. Note the bending force. Measure bending strength by using formula. Record the results. Inspect the dimensions of standard specimen with the help of measuring instruments. Calculate the cross sectional area of the Specimen. Prepare the machine for test. Install the fixture of shear test. Place the sample within the fixture. Apply the load for 	 Knowledge about the shear load and shear stress Understanding about the shear modulus of different materials Describe the calculation of shear strength Specimen techniques for shearing test 	Theory-2 Hrs. Practical-15 Hrs. Total- 17 Hrs	 Universal Testing Machine & Accessories Measuring Instruments Specimens Computer with software Extensometer Gripping Jaws Holders 	
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single shear or double	Practical Activity		
 shear test. Set the machine speed according to sample. Note the maximum/breaking force. Calculate shear strength. Record the results. 	Measure Shear strength of the given specimen		





0715-MF&P 24 Module: Perform Torsion test and Fatigue test

Objective: This module covers the knowledge and skills required to Measure torsion strength of specimen and Measure fatigue strength of specimen

Duration: 54 Hours: Theory: 9 Hours Practice: 45

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Measure torsion strength of specimen	 Inspect the Prepared sample according to the requirements of machine and standard. Check the working mode of the machine. Fix the sample in the fixture. Adjust speed, torque angle and time of machine as per material requirement. Draw torque vs angle graph. Calculate torsion strength. Observe fractured 	 Knowledge about the torque Describe Moment of Inertia Knowledge about the torsion equation Understanding of torsion test process Practical Activity Measure Torsion Strength of given material 	. Theory-5 Hrs. Practical-21 Hrs. Total- 26 Hrs.	 Torsion test machine Measuring Instruments 	Class Room and Lab





LU2: Measure	surface of the specimen. • Record the results. Trainee will be able				
fatigue strength of specimen	 to: Inspect the Prepared specimen according to standard. Check the working mode of the machine. Grip the samples in fixture. Apply load as per material requirement. Re-zero rotation counter. Turn on the machine and start the test. Observe number of rotation once the material breaks. Calculate fatigue strength by using formula. 	 Knowledge about the phenomena of fatigue Understanding about the stages of fatigue Describe fatigue strength Knowledge about the procedure of fatigue test Practical Activity Measure Fatigue Strength of given material 	Theory-4 Hrs. Practical-24 Hrs. Total- 28 Hrs.	 Fatigue test machine Measuring Instruments 	Class Room and Lab





4. Supportive Notes

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

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: 29th November - 03rd 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





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