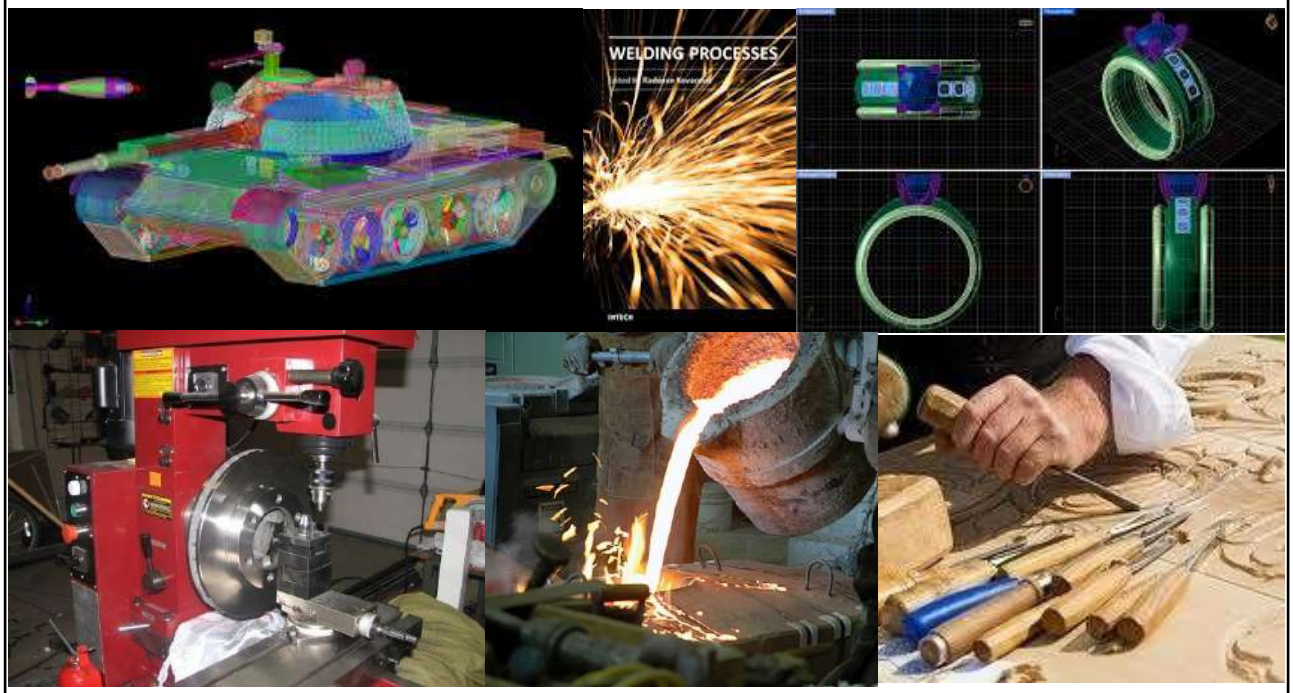
National Skills Qualification Framework (NSQF)
Competency Based Curriculum
Level 1 (Class 9) to Level 4 (Class 12)

MECHANICAL TECHNOLOGY

Job Roles: Welder (ASC/Q3103), Fitter (ASC/Q3601), Turner, Machinist, CNC Operator (ASC/Q1903), Sheet Metal Worker, Carpenter



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NCERT

Vetted By
PSS Central Institute of Vocational Education, Bhopal
(a constituent unit of NCERT, under Ministry of Human Resource Development, Govt. of India)

CURRICULUM:
Mechanical Technology for NSQF Level 1 (Class 9) to Level 4 (Class 12)

Job Roles: Welder (ASC/Q1903), Fitter (ASC/Q3601), Turner, Machinist, CNC Operator (ASC/Q1903), Sheet Metal Worker, Carpenter

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Preface

Ministry of Human Resource Development, Government of India developed the National Skill Qualification Framework (NSQF) to introduce vocational courses from class 9th onwards. The NSQF organizes qualifications according to a series of levels of knowledge and skills. These levels are defined in terms of learning outcomes i.e. the competencies (knowledge, skills and attitude) which the learners must possess regardless of whether they were acquired through formal, non-formal or informal education and training system. Qualifications are made up of occupational standards for specific areas of learning units or unit of competency. Units of competency are the specification of knowledge and skill and the application of that knowledge and skill to the standard of performance expected in the workplace. The unit of competency or National Occupation Standards comprising generic and technical competencies an employee should possess are laid down by the Sector Skill Council of the respective economic or social sector.

Competency is defined in terms of what a person is required to do (performance), under what conditions it is done (conditions) and how well it is to be done (standards). It can be broadly categorized into foundational, practical and reflexive competencies. Generic competencies are considered essential for a person to participate effectively in the workforce, whereas technical competencies are an individual's knowledge and expertise in the specific group task and its processes and its rules and regulations.

The competency based curriculum is broken down into coherent parts known as Units. Each unit is further broken down into knowledge and skills on the basis of which evidence is to be provided by the learner and the evaluation is to be done by the teacher or trainer.

PSSCIVE which is part of NCERT New Delhi is mandated by Government of India as a apex R&D Institute for Vocational Education. The institute has taken up development of Curriculum and course-ware for NSQF Level 1 (class 9) to Level 4 (class 12) to introduce vocational courses in Secondary and senior secondary schools in the country.

The above curriculum on Mechanical Technology is developed by a team of experts deputed by Directorate of Vocational Education and Training, Mumbai, Maharashtra and vetted by PSSCIVE faculty and coordinator. It is expected that the student workbook and teacher guide will be developed soon to start the course from this academic year 2015-16.

Dr. R. B. Shivagunde
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Contents

Introduction

The National Skills Qualification Framework (NSQF) developed by the Ministry of Human Resource Development (MHRD), Government of India is a descriptive framework that provides a common reference for linking various qualifications. It is used for setting common principles and guidelines for a nationally recognized qualification system covering Schools, Vocational Education and Training Institutions, Technical Education Institutions, and Universities/Colleges.

The NSQF organizes qualifications according to a series of levels of knowledge and skills. These levels are defined in terms of *learning outcomes* i.e., the *competencies* (knowledge, skills and attitude) which the learners must possess regardless of whether they were acquired through *formal, non-formal or informal* education and training system. *Qualifications* are made up of *occupational standards* for specific areas of learning units or unit of competency. *Units of competency* are the specification of knowledge and skill and the application of that knowledge and skill to the *standard of performance* expected in the workplace. The Unit of competency or National Occupation Standards comprising generic and technical competencies an employee should possess are laid down by the Sector Skill Council of the respective economic or social sector.

The **competency based curriculum** is broken down into coherent parts known as **Units**. Each unit is further broken down into knowledge and skills on the basis of which evidence is to be provided by the learner and the evaluation is to be done by the teacher or trainer.

After successful completion of this course from Level 1 (Class 9) to level 4 (Class 12), students will be able to perform job role of Mechanical Technology. Student can also go for higher education in degree courses in engineering and science science stream.

About the Sector

Manufacturing sector is the backbone of any economy that fuels growth, employment generation and acts as a catalyst for agriculture and service sector. The Manufacturing sector has the scope for creating jobs for millions of people. Manufacturing sector is broadly divided into Capital Goods & Engineering, Chemicals, Petroleum, Chemicals & Fertilizers, Packaging, Consumer non-Durables, Electronics, IT Hardware & peripherals, Gems & Jewellery, Leather & Leather Products, Mining, Steel & non-Ferrous Metals, Textiles & Apparels and Water Equipment.

Manufacturing is a broad field and involves the role of many disciplines. The creation of product passes through many stages right from innovation of ideas, testing of ideas by converting it into the working prototype, techno-economic design, establishing Manufacturing processes, testing of final product, sales and marketing etc. The Manufacturing is usually done on the shop floor. Manufacturing processes are the steps through which raw materials are transformed into a final product, or parts into finished goods that meet a customer's expectations or specifications. The Manufacturing process begins with the creation of the materials. These materials are then modified through manufacturing processes to become the required part. Manufacturing commonly employs a man-machine setup with division of labour in a large scale production. Manufacturing processes include casting, machining, or reshaping the material, joining, heat treating, coating etc.

Depending on the qualification, specialization and experience there are numerous job roles in the Manufacturing sector. This curriculum is for the production workers who actually work on the shop floor, operate the machine tools and convert the raw material into useable part or product.

After successful completion of level-I, the students will be able to perform the job roles of wood working technician or carpenter, fitter after the completion of level-II the job roles of welder, turner or machinist, after the completion of level-III the job roles of fitter and sheet metal worker and after the completion of level-IV the job roles of welder, heat treatment technician and quality control technician. After completion of all the levels the students can select the vocation of his choice or pursue higher studies including diploma, graduation, post graduation or obtain specialized diploma in any of the job roles to become supervisor in the industry.

Objectives of the Course

Upon completion of this course, students will be able to:

- To provide an overview of the concepts, theory, operation, and application of Manufacturing processes with an emphasis on the production of simple components from engineering materials.
- Develop understanding of basic Manufacturing processes, their capabilities and machine tools used in the process.
- Prepare students about various activities related to Manufacturing processes and workshop technology.
- Orient students about various methods and techniques used in manufacturing operations.

Classroom Activities: Classroom activities are an integral part of this programme and interactive lecture sessions, followed by discussions should be conducted by trained teachers. Teachers should make effective use of a variety of instructional aids, such as Videos, Colour Slides, Charts, Diagrams, Models, Exhibits, Handouts, Recorded Compact Discs, etc. to transmit knowledge in projective and interactive mode.

Practical Activities: Activities that provide practical experience through case based problems, role play, games, etc. and practical exercises using props, tools and equipment should be regularly organized off-the-job and on-the-job. Equipment and supplies should be provided to enhance hands-on experiences to students in the chosen occupation. Trained personnel should teach specialized techniques such as dismantling and assembling of computer parts, servicing of computers, operating Web programming, etc.

On-the-Job Training: On-the-job training (OJT) occurs whenever more experienced employee or supervisor teaches less experienced person on how to do one or more tasks of a job. The training utilizes actual equipment and materials. OJT should be undertaken in a structured manner with a training plan under the supervision of an experienced trainer or supervisor. A training plan that reflects tasks to be performed and competencies to be imparted should be prepared and signed by the student, teacher, and supervisor at the workplace for training of the students in the organization/industry. The trainer should break down all the steps of the job and train the students as per the training plan. In a structured OJT, the following steps should be followed:

Step 1: The Instructor or the trainer tell, show, demonstrate, and explain. The trainer gives an overview of the task while explaining the constructional details and use of the tools, equipment, materials, etc. in performing the tasks.

Step 2: The Instructor or the trainer demonstrates each step in detail, actually doing the steps of the task and explaining each step, one at a time, while the trainee watches. The steps may not necessarily be demonstrated in the sequence of actual operation, as sometimes it is better that simple tasks are demonstrated first to build confidence. Showing finished products at each appropriate step will help the leaner understand what is required as outcome. While demonstrating, the trainer explains why each step is done in the way it is done.

Step 3: It involves direct trainee participation. The trainer monitors the progress on a checklist of competencies and offers feedback and pointers where and when needed.

Step 4: The trainee practices with clearly defined targets for performance standards.

Certification: Upon successful completion of this course, the State Education Board and the IT-ITeS Sector Skill Council will provide a certificate to the student verifying the competencies acquired by the student. For more details about SSC visit the website at http://www.asdc.org.in

Competency Based Curriculum for NSQF Level 1 (Class 9)

Sector: Mechanical Technology

Job Roles: Mechanical Fitter, Welder, Carpenter

Module Overview: Student should be able to know, identify and understand the important Manufacturing processes used in converting the raw material into the product used by the consumers. They will be introduced to various aspects of Manufacturing Processes, Hand Tools and Machine Tools used in production of the components/products.

Course Structure: This course (vocational qualification package) is a planned sequence of instructions consisting of the following modules, called as Units.

Sn	Unit Code	Unit Title	Duration(Hours)
1	MT-101	Engineering Drawing – 1	50
2	MT-102	Fitting	50
3	MT-103	Joining Processes – 1 (Welding-Arc and oxy-Fuel)	50
4	MT-104	Carpentry	50
5	MT-105	OJT / Project work	50
		Total Hours	**250**

Element Code	MT-101: Engineering Drawing – 1	Duration(Hours)
MT-101-E1	Introduction to engineering drawing (ED) and its applications	2
MT-101-E2	Drawing instruments ,accessories& their uses, Sizes of drawing sheets	5
MT-101-E3	Pattern of lines, lettering and numbers	4
MT-101-E4	Basic geometric constructions	9
MT-101-E5	Drawing scale	3
MT-101-E6	Dimensioning techniques	3
MT-101-E7	Concept of projections	4
MT-101-E8	Projection methods – Projection of solids (cylinder , cone ,prism and pyramid and composite objects)	12
MT-101-E9	Introduction to CAD	8
	Total duration in hours	**50**

UNIT CODE & NAME	**MT-101: Engineering Drawing – 1**	
DURATION	50 Hours	
UNIT OVERVIEW	Student will be able to use drawing & drafting instruments properly & prepare engineering drawings with appropriate convention.	
MT-101-E1	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Introduction to engineering drawing (ED) and its applications	Able to understand the importance of engineering drawing (ED) and its applications	Introduction to engineering drawing (ED) and its applications
MT-101-E2	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Introduction to drawing instruments and accessories	Able to use drawing instruments and accessories	Identification drawing instruments accessories& their uses, sizes of drawing Sheets
MT-101-E3	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Pattern of lines , lettering & numbers	Able to draw different types of lines, lettering & numbering pattern according to applications	Identification and Use of different pattern of lines , lettering & numbers
MT-101-E4	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Basic geometric constructions	Able to draw the geometrical constructions of – division of line & angle, triangle, quadrilateral, polygons, circles etc.	Basic geometric constructions
MT-101-E5	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Drawing scale	Able to apply appropriate scale in Drawings	Application drawing scale
MT-101-E6	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Dimensioning techniques	Able to apply appropriate dimensioning techniques In engineering drawing	Dimensioning techniques and application
MT-101-E7	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Concept of projections	Able to draw projections & planes i.e.H.P.,V.P.,A.V.P. & G.L. in first and third angle method	Understanding the concept of projections, projection planes in first and third angle method
MT-101-E8	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Projection methods	Able to draw projection of solids (cylinder, cone, prism and pyramid and composite	Projection methods- first angle and third angle projections

Projection of solids	object) using first and third angle method	Projection of solids (cylinder, cone , prism and pyramid and composite object)using first and third angle method
MT-101-E9	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Introduction to CAD	Able to start CAD, modify tool bar and setting up drawing area	Introduction to CAD ,advantages, getting started with CAD, windows, drawing properties and coordinate system

Skills

- Use of drawing & drafting Instruments
- Prepare drawings selecting appropriate scale, proper dimensioning with lettering and numbering
- Understanding the graphic projections,
- Applications of CAD in drawing

Evaluation/Assessment

- Oral
- Visual
- Test
- Demonstration

Element Code	MT-102: Fitting	Duration (Hours)
MT-102-E1	Introduction to workshop practices	02
MT-102-E2	Common hand tools	04
MT-102-E3	Holding tools and cutting tools	04
MT-102-E4	Cutting, chiselling, filing, drilling, tapping, dyeing, reaming, hand grinding processes.	18
MT-102-E5	Pipe cutting, threading, bending & joining of various accessories	18
MT-102-E6	Measuring& marking tools used in fitting shop	04
	Total duration in hours	**50**

UNIT CODE & NAME	**MT-102: Fitting**	
DURATION	50 Hours	
UNIT OVERVIEW	Student will be able to perform various filing& fitting operations using different tools	
MT-102-E1	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Introduction to workshop practices	Able to demonstrate importance of safety precautions, environment & hygiene	Understanding to workshop practices

	awareness in workshop	safety precautions, environment & hygiene awareness
MT-102-E2	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Common hand tools-types, specifications & use	Able to use various hand tools in fitting shop Able to use spanners and wrenches Able to use different types of pliers Able to use striking tools	Identification of hand tools-types, specifications & applications
	Able to use marking tools used in machine shop Able to use measuring tools	Identification of measuring tools-types, specifications & applications(scale,venire calliper, micro meter inside/ outside)
MT-102-E3	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Holding tools and cutting tools	Able to use cutting tools in fitting shop Able to use vices and clamps Able to use hand hacksaw Able to use files Able to use chisels Able to use scrapers and reamers	Identification of different types of cutting tools, their specifications and applications Identification of vices and clamps their specifications & applications Identification of hand hacksaw and blade their specifications and applications Identification of different types of files their specifications & applications Materials of files for different applications Identification of different types of chisels their specifications and applications Identification of scrapers and reamers their specifications and applications
MT-102-E4	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Cutting, chiselling, filing, drilling, tapping, dyeing, reaming, off hand grinding processes	Able to do marking & cutting as per drawing Able to do chiselling as per marking Able to do straight, parallel, angular, radius filing as per drawing Able to perform drilling& reaming operations on bench/pedestal drilling machine Able to do tapping & dyeing, manually	Fitting operations – marking, cutting, chiselling, diff types of filing, tapping, dyeing etc. Bench & pillar type drilling machines-their construction & working .Selection of speed & feed for drilling, reaming & tapping Performing drilling reaming & tapping operations on bench & pillar type

	Able to perform off hand grinding on pedestal grinder following safety precautions	drilling machines Pedestal grinders – their construction & working. off hand grinding on pedestal grinder
MT-102-E5	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Pipe cutting, threading, bending& joining of various accessories	Able to do pipe cutting, threading, bending & joining the various accessories with pipe fitting Able to use angular measurement tools Able to use marking and layout tools Able to carry out drilling and grinding operations	Measurement concepts and systems Linear measurement tools Angular measurement tools marking and layout tools
MT-102-E6	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Measuring & Marking tools used in fitting shop	Able to demonstrate importance of measurement Able to use linear measurement tools	Dimensioning techniques and application

Skills

- Identification of hand tools, marking, measuring, holding & cutting tools.
- Measurement skill
- Marking skill
- Handling of hand tools
- Handling of cutting tools
- Handling of workshop machine tools

Evaluation/Assessment

1. Practical test
2. Oral test
3. Demonstration

Element Code	MT-103: Joining Processes – 1 (Welding-Arc and Oxy-Fuel)	Duration (Hours)
MT-103-E1	Introduction to welding and safety precautions	05
MT-103-E2	Types of welding processes and its applications	05
MT-103-E3	Welding terms, definitions and welding symbols	05
MT-103-E4	Arc welding, power sources and its applications	18
MT-103-E5	Soldering and brazing process	05
MT-103-E6	Oxy-fuel welding and cutting	12
	Total duration in hours	**50**

UNIT CODE & NAME	**MT-103: Joining Processes – 1 (Welding-Arc and Oxy-Fuel)**	
DURATION	50 Hours	
UNIT OVERVIEW	Student will be able to identify the types welding terms symbols, identify and use of tools to carry out welding work.	
MT-103-E1	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Introduction to welding, safety in welding shop	Able to demonstrate the importance of safety in welding shop	Introduction to welding, safety in welding shop
MT-103-E2	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Types of welding processes and its applications	Able to demonstrate different types of welding and their applications	Understanding of types of welding and their materials
MT-103-E3	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Welding terms, definitions and welding symbols	Able to demonstrate the welding terms, definition and symbols and its applications	Introduction to welding terms, definition and symbols
MT-103-E4	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Arc welding, power sources and its applications	Should able to perform the following on AC power source Striking an arc and depositing straight and wearing beads on MS in flat position Produce arc welded filet lap & T joints in mild steel in flat position Produce arc welded filet lap & T joints in mild steel in flat position Produce arc welded Inside corner joint in mild steel in flat position Produce arc welded square butt joint in mild steel in flat position Produce arc welded single V but joint in mild steel in flat position Produce arc welded single V but joint in mild steel in flat position Able to operate DC rectifiers for diff joints Able to operate DC generator for different welding joints Able to select welding electrode in	Introduction and understanding of metal arc welding and different types of joints, , power sources and its applications Arc welding process by using DC welding rectifiers. Arc welding joints by using generators Type, specification, coding of electrode. Selection criteria. Selection of various section for shed fabrications Calculation of bill of materials, costing, operating cost, and sale cost, profit.

	accordance with welding process Able to perform pipe welding Able to fabricate window grill/gate trusses etc.	
MT-103-E5	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Types of brazing and soldering process	Able to perform, brazing and soldering operations	Brazing, soldering processes, applications, advantage, disadvantages
MT-103-E6	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Oxy-fuel welding and cutting	Able to understand importance of oxy-fuel welding and cutting Able to identify components of oxy-fuel welding outfit Able to understand, identify and prepare and oxy-fuel welding joints Able to adjust and operate oxy-fuel welding outfit Able to weld simple joints Able to cut thin sheets by oxy-fuel welding outfit	Oxy-fuel welding and cutting process Oxy-fuel welding outfit Oxy-fuel welding joints Oxy-fuel welding outfit Oxy-fuel welding operation Oxy-fuel cutting operation

Skills

- Identification of basic material
- Measurement skill
- Handling of welding tools and accessories
- Handling of welding outfits
- Marking skill
- Observation for defects in joints

Evaluation/Assessment

1. Oral
2. Visual
3. Test
4. Demonstration
5. Inspection

Element Code	MT-104: CARPENTRY	Duration (Hours)
MT-104-E1	Introduction to carpentry, safety in carpentry shop	03
MT-104-E2	Types of common woods, plywood and other carpentry materials	07
MT-104-E3	Measuring and marking tools, and hand tools	10
MT-104-E4	Common wood joints, wood fasteners and adhesives, cabinet furniture making.	30
	Total duration in hours	**50**

UNIT CODE & NAME	**MT-104: CARPENTRY**	
DURATION	50 Hours	
UNIT OVERVIEW	Student will be able to identify the carpentry material, identify and use marking and layout tools, hand tools, and carry out carpentry work	
MT-104-E1	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Introduction to carpentry, safety in carpentry shop	Able to Understand the importance of carpentry and safety in carpentry shop	Introduction to carpentry, safety in carpentry shop
MT-104-E2	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Common woods, plywood and other carpentry materials	Able to identify the common woods and their applications Able to identify plywood, block board, particle board and chip board used in carpentry and their applications	Types of common woods, plywood and other carpentry materials; their brand name and common applications.
MT-104-E3	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Measuring and marking tools, and hand tools	Able to understand the working of sawing and cutting tools Able to understand the working of marking and layout tools Able to use sawing and cutting tools Able to understand the working of planning and shaping tools Able to use planning and shaping tools Able to understand the working of drilling, boring, holding and clamping tools Able to use drilling, boring, holding and clamping tools Able to understand working of striking tools	Marking and layout tools Planning and shaping tools Drilling and boring, holding and clamping tools Striking tools

	Able to use striking tools	
MT-103-E4	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Common wood joints, wood fasteners and adhesives and cabinet making	Able to perform various joints used in carpentry Able to make simple wooden composite jobs involving all joints Able to make cabinet furniture using plywood and sun mica Able to make small partition by using aluminium channel and hardboard	Wood joints, their application, strength and weakness Calculation of bill of material, operating cost, sale cost and profit Understanding fasteners, adhesives and their applications Aluminium channels, types specification applications, channel cutting machines

Skills

- Marking skill
- Measuring skill
- Handling of hand tools
- Handling of cutting tools
- Handling of machine tools

Evaluation

1. Inspection – visual
2. Oral
3. Test
4. Demonstration

Competency Based Curriculum for NSQF Level 2 (Class 10)

Sector: Mechnical Technology, Job Role: Turner, Welder, Draftsman, Fabricator

Module Overview: Student should be able to know, identify and understand the important metal turing processes used in converting the raw material into the product used by the consumers. They will be introduced to various aspects of metal turing processes, Hand tools and machine tools used in production of the products.

Course Structure: This course (vocational qualification package) is a planned sequence of instructions consisting of the following 05 modules, called as Units.

Sn	Unit Code	Unit Title	Duration (Hours)
1	MT-201	Engineering Drawing – 2	50
2	MT-202	Joining Processes – 2	50
3	MT-203	Sheet metal work	50
4	MT-204	Material removal process – 1	50
5	MT-205	OJT and Project Work	50
		Total Hours	**250**

Element Code	MT-201: Engineering Drawing – 2	Duration (Hours)
MT-201-E1	Orthographic projections	15
MT-201-E2	Isometric projections	15
MT-201-E3	Sectioning (simple machine parts)	05
MT-201-E4	Assembly drawing and reading drawings	05
MT-201-E5	Application of CAD	10
	Total duration in hours	**50**

UNIT CODE & NAME	**MT-201: Engineering Drawing – 2**	
DURATION	50 Hours	
UNIT OVERVIEW	Student will be able to understand engineering drawing and use drawing instruments to draw the drawing	
MT-201-E1	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Orthographic projections	Able to draw orthographic views from pictorial views Able to draw orthographic views of simple machine elements	Orthographic projections- I & III angle of projections Method of drawing orthographic views from pictorial views
MT-201-E2	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**

Isometric projections	Able to draw isometric views from orthographic views	Method of drawing isometric views from orthographic views
MT-201-E3	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Sectioning	Able to understand types of sections & sectional views Able to draw the sectional views from cut section of given machine parts	Concept of sectioning cutting plane lines Type of sections and sectional views
MT-201-E4	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Assembly drawing and reading of drawings	Able to understand concept of assembling & dissembling Able to draw assembly drawings of simple assemblies Able to read & interpret drawings/ blue prints of simple machine components	Assembly drawing Concept of assembling & dissembling Introduction to blue print Importance of reading of drawings
MT-201-E1	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Applications of CAD	Able to draw simple object by using CAD	Introduction to various tool bar (draw, modify, view etc.) used in CAD

Skills

- Use of drawing & drafting instruments
- Prepare drawings selecting appropriate scale, proper dimensioning with lettering & numbering

Evaluation/Assessment

- Oral
- Visual
- Test
- Demonstration

Element Code	MT-202: Joining Processes – 2 (Advanced Welding)	Duration (Hours)
MT-202-E1	MIG and TIG welding	10
MT-202-E2	Resistance welding	10
MT-202-E3	Submerged and thermit welding	10
MT-202-E4	Plasma welding	10
MT-202-E5	Mechanical joining and adhesive bonding	10
	Total duration in hours	**50**

UNIT CODE & NAME	**MT-202: MT-202: Joining Processes – 2 (Advanced Welding)**	
DURATION	50 Hours	
UNIT OVERVIEW	Student will be able to identify the types of welding like MIG,TIG, resistance, submerged& thermit weldings, introduction to plasma welding, mechanical bonding.	
MT-202-E1	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
MIG and TIG Welding	Able to understand the principle and working of MIG welding process Able to identify components of MIG welding machine Able to adjust and operate MIG welding machine and weld simple joints Able to understand the principle and working of TIG welding Able to identify components of TIG welding machine Able to adjust and operate TIG welding machine and weld simple joints	MIG welding process MIG welding machine MIG welding operation TIG welding process TIG welding machine TIG welding operation
MT-202-E2	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Resistance welding	Able to understand importance of resistance welding Able to identify components of spot welding machine Able to adjust and operate spot welding machine Able to weld lap joints	Resistance welding process Spot welding machine Resistance welding operation
MT-202-E3	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Submerged and thermit welding	Able to understand the principle and working of submerged arc welding process Able to list the applications of submerged arc welding Able to understand the principle and working of thermit welding process Able to list the applications of thermit welding	Submerged arc welding process Thermit welding process Thermit welding applications
MT-202-E4	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Introduction to plasma	Able to understand the principle and	Plasma welding process

welding	operation of plasma welding	
MT-202-E5	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Mechanical joining and adhesive bonding	Able to understand the application of mechanical joining of metals Able to identify different types of fasteners Able to prepare a mechanical joint by using portable electric drill and hand tools Able to understand the application of adhesive bonding of metals Able to identify different types of adhesives Able to prepare an adhesive joint	Mechanical joining Different types of fasteners Hand and portable electric tools Adhesive bonding process Adhesives Adhesives joint

Skills

- Identification of basic material
- Measurement skill
- Handling of welding tools and accessories
- Handling of welding outfits
- Marking skill
- Observation for defects in joints

Evaluation/Assessment

- Oral
- Visual
- Test
- Demonstration
- Inspection

Element Code	MT-203: Sheet Metal Work	Duration (Hours)
MT-203-E1	Importance of sheet metal work	02
MT-203-E2	Types of sheet metals	02
MT-203-E3	Sheet metal product shapes and drawing	02
MT-203-E4	Geometric construction and drafting	04
MT-203-E5	Sheet metal marking, layout & hand tools	04
MT-203-E6	Types of sheet metal joints	08
MT-203-E7	Development of pattern layout	08
MT-203-E8	Machines used in sheet metal shop	05
MT-203-E9	Sheet metal operations	15
	Total	**50**

UNIT CODE & NAME	**MT-203: Sheet Metal Work**	
DURATION	50 Hours	
UNIT OVERVIEW	Student will be able to understand the importance of sheet metal work and carry out sheet metal work operations.	
MT-203-E1	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Importance of sheet metal work	Able to understand importance of sheet metal work and identify sheet metal products	Importance of sheet metal work
MT-203-E2	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Types of sheet metals	Able to understand and identify sheet metals, specifications, and sheet metal material	Sheet metal and their materials
MT-203-E3	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Sheet metal product shapes and drawing	Able to understand and identify shapes of sheet metal components Able to understand and interpret 2-D drawing Able to prepare drawing of simple objects Able to identify and use drawing instruments	Sheet metal component shapes Concept of working drawing Drawing instruments
MT-203-E4	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Geometric construction and drafting	Able to understand importance of geometric construction for pattern development Able to make simple geometric construction	Geometric constructions
MT-203-E5	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Sheet metal marking layout tools & hand tools	Able to understand importance of marking and layout tools Able to identify and use marking and layout tools Able to understand importance of hand tools Able to identify and use hand tools for making sheet metal products	Marking and layout tools Hand tools
MT-203-E6	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Types of sheet metal joints	Able to understand importance of sheet metal joints	Sheet metal joints

	Able to identify and explain sheet metal joints in the sheet metal products	
MT-203-E7	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Development of pattern layout	Able to understand importance of pattern layout Able to make pattern layout of simple products Able to use drawing instruments for making layout	Pattern layout Drawing instruments
MT-203-E8	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Machines used in sheet metal shop	Able to understand the importance of sheet metal machines Able to identify and explain the working of manual and power operated machines Able to operate manual and power operated machines for carrying out sheet metal work	Sheet metal machines Manual and power operated sheet metal machines
MT-203-E9	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Sheet metal operations	Able to understand the importance of sheet metal operations Able to carry out simple sheet metal operations Able to use marking and layout tools Able to use hand tools Able to make pattern development Able to make simple sheet metal products	Sheet metal operations

Skills

- Identification of basic material
- Marking & measurement skill
- Drawing and drafting skill
- Handling of hand tools ,cutting tools
- Handling of workshop machine tools

Evaluation/Assessment

- Oral
- Visual &Test
- Demonstration
- Inspection

Element Code	MT-204: Material removal process – 1	Duration (Hours)
MT-204-E1	Lathe machine parts and functions	05
MT-204-E2	Accessories and safety precaution	05
MT-204-E3	Cutting tools and its nomenclature	05
MT-204-E4	Lathe operations	35
	Total	**50**

UNIT CODE & NAME	**MT-204: Material removal process – 1**	
DURATION	50 Hours	
UNIT OVERVIEW	Students will be able to understand material removal process of turning.	
MT-204-E1	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Lathe machine parts and functions	Demonstrate types lathe its parts and its functions	Introduction, importance of lathe machine & various types & its accessories and functions.
MT-204-E2	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Accessories and safety precaution	Demonstrate accessories and safety at lathe shop	Various accessories and their use, safety precaution specific to turning on the lathe.
MT-204-E3	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Cutting tools and its nomenclature	Able to identify various angles and cutting edges on cutting tools	Understanding cutting tool, geometry, its nomenclature and importance.
MT-204-E4	**PERFORMANCE CRITERIA**	**KNOWLEDGE CRITERIA**
Lathe operations	Operate machine and adjust controls & loading and unloading of parts Checking alignment of lathe centers, mounting job in between centre Parallel turning practice- measurement with scale and caliper Facing, centring, straight turning , step turning, taper turning, drilling , boring threading, within ± 0.1 mm whenever applicable and should be able to measure with vernier caliper	Familiarization the use of speed , feed, chart available on the machine and selection & setting of speed & feed for turning operation Understanding of holding the Job in job holding devices like, chuck Understanding of between centre and other work holding devices Understanding different lathe operation of facing, centering, straight turning, step turning, taper turning, threading and drilling and boring operations.

Skills

- Identification of basic material
- Measurement skill
- Marking skill
- Handling of hand tools
- Handling of cutting tools
- Handling of lathe machine tools and accessories

Evaluation/Assessment

- Oral
- Visual
- Test
- Demonstration
- Inspection