सूक्ष्म, लघु एवं मध्यम उद्यम मंत्रालय
DEVELOPMENT COMMISSIONER
MINISTRY OF MICRO, SMALL & MEDIUM ENTERPRISES
MSME TECHNOLOGY CENTRE

MODEL CURRICULUM

Qualification Name:

JR. TECHNICIAN - Heat Treatment

Qualification Code:

Version: 2.0

NSQF Level: 3.5

Model Curriculum Version: 2.0

Submitted By:

MSME TECHNOLOGY CENTRE

O/o DC MSME, Ministry of Micro, Small and Medium Enterprises

Govt. of India

A-Wing, 7th Floor, Nirman Bhawan, Maulana Azad Road

New Delhi-110108

Contact No. +91-674-2654700

Email- msmetcab@gmail.com

NOS / MODULE TEMPLATE

NOS /Module: Read and Construct the Orthographic Projection of part

NOS /Module Code: MSME/CCMTHT/01

Outcomes:

After completion of course Student should be able to:

- To scale, line and lettering drawing and practical in different lines and lettering. Drawing of different line and letters in drawing book.
- Understand procedure for drawing, straight line, angles, polygons, circle, all drawing drawn in sketch book.
- Drawing of object as per 1st & 3rd angle projection method
- Drawing projection of plane and point. Drawing of isometric view of different object. Conversion of Isometric view to orthographic projection understand
- Assembly and detail drawing any object.

Theory Hours: 30 **Practical Hours: 30** **Theory Marks: - 00** **Practical Marks: 100**

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	PR hours	PR Marks
UNIT-I	**Introduction**	After completion of unit Student should be able to: • Observation of ED. • Definition of sketch mechanical and comp. generated drawing (Identification	Understand about • Introduction and observation of ED in mfg. industry. • Definition of drawing importance of drawing. Need of dry. General awareness of drawing. Drawing sheet & equipment required in drawing classification of drawing set, imp. Equipment related information. • Drawing instrument, concept of standard drawing	3	10
UNIT-II	**Scale, lines and lettering**	At the end of this unit Student should be able to Understand: • To scale, line and lettering drawing • Drawing of different line and letters in drawing book.	• Introduction to scale, line and lettering. • Classification of line and lettering. • Choice and use of BIS norms for scale, line and lettering. • Selecting of Various scales, line and lettering.	4	10

UNIT-III	**Geometric Construction**	At the end of this unit Student should be able to Understand: • Procedure for drawing, straight line, angles, polygons, circle, all drawing drawn in sketch book.	• Introduction & Advance geometrical Construction Definition: Straight line angles, polygons, circle areas. • Conic Sections: Ellipse, Parabola, Hyperbola. • Other Curves: helix, Cycloid, involutes.	5	10
UNIT-IV	**Orthographic Projection**	At the end of this unit Student should be able to Understand: ● Drawing of object as per 1st & 3rd angle projection method, ● Procedure for drawing different view in 1st & 3rd angle.	Introduction to orthographic, Different view and plane-identification. Definition of plots, lines, planes, solids. Principal of quadrants and panes. Drawing of difference view of paints in 1st and 3rd angle projection, Introduction to dimension	6	20
UNIT-V	**Isometric view**	At the end of this unit Student should be able to Understand: ● Drawing projection of plane and point ● Drawing of isometric view of different object. ● Conversion of Isometric view to orthographic projection.	Introduction to Isometrics drawing, definition of Isometric projection of planes, prisms, pyramids, cylinders, cones, irregular object. Dimensioning of Isometric drawing chain dimension parallel dimension Oblique dimension Align Dimension Drafting of object. Isometric part drawing drafted in orthographic view as per 1st & 3rd angle projection method.	6	25
UNIT-VI	**Elements of assembly**	At the end of this unit Student should be able to Understand ● Practical drawing in different temporary joints as per BIS standard which is used for assembly	Definition & introduction of element of assembly Definition of temporary joints, Screw Thread, bolts, nuts, dowels, washers, spring Permanent joints. standard elements as per BIS being used for assembly Section and representation of different elements in used in assembly.	6	25

NOS /Module: Use and Application of Engineering Materials

NOS /Module Code: MSME/CCMTHT/02

Outcomes:

After completion of course Student should be able to:

- Understand about ferrous and non-ferrous metals
- Classify materials into metal and non-metals
- Understand about physical properties of metals
- Understand about ferrous metals and their properties
- Understand the difference between steel, plain carbon steel and alloy steel
- Explain different mechanical properties
- Explain stress-strain curve and elastic behavior of different materials

Theory Hours: 60 **Practical Hours: NA** **Theory Marks: 100** **Practical Marks: NA**

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH Hours	TH Marks
UNIT-I	**Crystal and its formation**	At the end of this Unit the student should be able to: ● Crystal and its formation ● Understand Structure of metals and non-metals ● Identify crystal structure	crystalline and non-crystalline structure. Structure of metals and non-metals. Different crystal structures. Identification of crystal structure.	12	20
UNIT-II	**Ferrous and non-ferrous**	At the end of this Unit the student should be able to: able to: ● Understand about ferrous and non- ferrous metals ● Classify materials into metal and non- metals ● Understand about physical properties of metals ● Understand about ferrous metals and their properties and Non-Ferrous metals. ● Mechanical properties of Ferrous metals like cast iron and steel ● Plasticity, elasticity, hardness, toughness, ductility, brittleness	Classification of material, Physical properties of Ferrous and Non-Ferrous metals. Mechanical properties of Ferrous metals like cast iron and steel, Plasticity, elasticity, hardness, toughness, ductility, brittleness	18	30

UNIT-III	**Iron & steel and Industrial application**	At the end of this Unit the student should be able to: ● Classify steel and different grade of steel ● Explain about Plain Carbon & alloy Steel ● Show samples of different Steels ● Explain plain carbon steel grades. ● Explain alloy steel grades. ● Explain stress-strain curve and elastic behavior of different materials	• Plain carbon and alloy steel, Classification of plain carbon steel Classification of alloy steel General purpose steel • Low alloy and high alloy steel. Non alloy steel • Selection of steel for different applications Industrial application of all grades of steel	18	30
UNIT-IV	**Cast iron and commercial application**	At the end of this Unit the student should be able to: ● Difference between cast iron and steel ● Explain physical properties of Cast iron ● Explain mechanical properties of cast iron ● Identify various applications of cast iron in industries	Cast iron: Its physical and mechanical properties. Difference between cast iron and steel Cast iron vs cast steel Various applications of cast iron Grey cast iron and SG cast iron	12	20

COURSES / MODULE TEMPLATE

NOS /Module: Performs Material testing Activities

NOS /Module Code: MSME/CCMTHT/03

Outcomes:

After completion of course Student should be able to

- Understand about structure of plain carbon steel
- Understand about Stress strain relation
- Understand Effect of alloying elements on spark
- Perform Different Hardness test
- Perform Impact test (Izod and Charpy test)

THEORY HOURS: 30 PRACTICAL HOURS: 60 THEORY MARKS: 100 PRACTICAL MARKS: 100

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH Hours	TH Marks	Pr Hours	Pr Marks
UNIT-I	**Structure of Plain carbon steel**	At the end of this Unit the student should be able to: • Understand about physical properties of plain carbon steel • Understand about Properties of micro constituents • Understand about Formation of different micro constituents	Micro constituents of steel such as ferrite, Pearlite, Cementite, Ausentite, Martensite etc. Properties of micro constituents Formation of different micro constituents	5	20	-	-
UNIT-II	**Mechanical properties**	At the end of this Unit the student should be able to: • Understand about Stress strain relation • Understand about Hardness and Hardenability	Stress strain relation for ductile and non-ductile metals Testing of mechanical properties Tensile and compressive strength Working of Universal Testing Machine Macro and Micro Hardness Testing Hardness and Hardenability	5	20	-	-

		• Perform Different Hardness test • Perform Impact test (Izod and Charpy test)	Different Hardness testers Impact test (Izod and Charpy test)				
UNIT-III	**Measuring Instruments**	At the end of this Unit the student should be able to understand: How to use various Measuring instruments required in Heat Treatment shop.	Vernier Calliper, Micrometer, Dial Indicators (Lever type & Plunger type), straightening machine	5	15	5	10
UNIT-IV	**Material Testing Equipment**	At the end of this Unit the student should be able to understand: How to use Mechanical, Chemical test required in Heat Treatment shop. Perform hardness test on materials	Spectrometer for material chemical composition checking • Universal testing machine. • Rockwell Hardness tester. • Portable hardness tester. • Handy Gun type spectrometer. • Microvicker's hardness tester. • Ultrasonic flaw detector. • Metallurgical microscope • Diamond cutting machine • Polishing machine for micro samples. • Magnetics particle inspection. • Sample moulding machine • Sample polishing machine for spectrometer. • DPT Set up. • Salt spray testing equipment. • Impact testing (charpy /izod)	10	25	40	60

UNIT-V	**Spark testing of steels**	At the end of this Unit the student should be able to: • Identify different materials by spark testing method • Understand Effect of alloying elements on spark • Understand about Pressure for generating spark	• Elements of spark • Carrier lines, colour of spark, carbon burst Spacing of carbon burst and carrier lines Pressure for generating spark • Identification of different grades of steel by spark testing method • Effect of alloying elements on spark	5	20	15	30

COURSES / MODULE TEMPLATE

NOS /Module: Assist in Heat Treatment Processes

NOS /Module Code: MSME/CCMTHT/04

Outcomes:

After completion of course Student should be able to

- Identify different steel grades
- Use the Fe-C diagram for calculating Heat treatment
- Perform Hardening Case Hardening, Surface hardening and Through Hardening, Tempering etc
- Understand about Characteristics of cooling medium
- Understand about Application of TTT curve in Heat Treatment

THEORY HOURS: 90 PRACTICAL HOURS: 300 THEORY MARKS: 100 PRACTICAL MARKS: 100

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH Hours	TH Marks	Pr Hours	Pr Marks
UNIT-I	**Occupational health and safety**	At the end of this Unit the student should be able to: • Understand about safety rules • Understand the use of first aid and safety equipment • Understand the importance of	Health & Safety: Introduction to safety equipment's and their uses, Introduction of first aid, operation of Electrical mains, Occupational Safety & Health, Importance of housekeeping & good shop floor practices, Disposal procedure, Disposal of	5	5	-	-

		occupational health and safety • Understand the environment guidelines • Understand the Waste disposal techniques Understand the use of PPE	waste materials like cotton waste, metal chips/burrs etc, personal protective equipment's (PPE), Basic injury prevention, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message				
Unit-II	**Phase diagram of Iron-Carbon**	At the end of this unit student should be able to: • Use the Fe-C diagram for calculating Heat treatment • Understand about Calculation of heat treatment temperature using Fe-C diagram	Introduction to Fe-C diagram Different curves and points of Fe-C diagram Calculation of heat treatment temperature using Fe-C diagram Application of Fe-C diagram in Heat Treatment	10	8	-	-
Unit-III	**Common Heat Treatment Processes**	At the end of this unit student should be able to: • Understand different Heat treatment process • Perform Hardening Case Hardening, Surface hardening and Through Hardening, Tempering etc.	Different Heat treatment processes such as: Hardening, Case Hardening, Surface hardening and Through Hardening, Tempering, Annealing and its various types, Stress Relieving Chemical Heat treatment Ageing process	15	10	100	25
Unit-IV	**Cooling medium**	At the end of this unit student should be able to: • Understand about cooling stages • Understand about Characteristics of cooling medium • Different cooling mediums	Cooling stages: Characteristics of cooling, medium, Selection of cooling medium Different cooling mediums such as • Water • Oil • Salt • Air/Nitrogen • Polymers	5	8	20	10

Unit V	**TTT-Curve** **(Isothermal transformation)**	At the end of this unit student should be able to: • Understand Different curves and points of TTT curve	Introduction to TTT curve, Different curves and points of TTT curve, Formation of different structures on cooling of material TTT curve of plain carbon and alloy steels, Application of TTT curve in Heat Treatment	5	6	-	-
Unit VI	**Solid / Pack carburizing** **Liquid carburizing** **Gas carburizing**	At the end of this unit student should be able to: Understand about Packing techniques of components for pack carburizing Advantages of Pack Carburizing & Limitations of Pack carburizing Understand about Fixturing techniques of components for Liquid carburizing/cyaniding Understand Time and temperature calculation for Liquid carburizing Understand about Hardening after Gas carburizing Calculate time and temperature for gas carburizing. Gases used in carburizing	Fixturing techniques of components for Gas carburizing/cyaniding Hardening after Gas carburizing Inspection of case depth and carbon potential Time and temperature calculation for Gas carburizing Advantages of Gas carburizing Limitations of Gas carburizing	5	20	-	-
Unit VII	**Furnaces used in Heat treatment**	At the end of this unit student should be able to: • Identify commonly used heat treatment furnaces • Understand the working of Electrical muffle furnace Salt bath furnace Induction furnace Continuous Heat treatment furnace	Introduction to Heat treatment furnaces Classification of furnaces according to: • Fuel used • Design • Applications Commonly used Heat treatment furnaces • Electrical muffle furnace	8	6	50	15

			• Salt bath furnace Induction furnace • Continuous Heat treatment furnace				
Unit VIII	**Surfacing Hardening treatment**	At the end of this unit student should be able to: Understand Material selection for surface hardening Differentiate between flame hardening and induction hardening	Concept of surface hardening Material selection for surface hardening Surface hardening methods and process details: Flame hardening Induction Hardening Comparison of flame hardening and induction hardening	7	8	30	10
Unit IX	**Tool steel**	At the end of this unit student should be able to: Understand about Cold working tool steel Hot working tool steel Shock resistant tool steel Molding tool steels Fatigue tool steel Commonly used tool steel Perform Heat Treatment operation on Tool steels	Introduction to tool steel Characteristics of tool steel Classification of Tool steel according to their applications: Cold working tool steel, Hot working tool steel, Shock resistant tool steel, Molding tool steels, Fatigue tool steel & Commonly used tool steel	10	5	25	10
Unit X	**Alloy Steel**	At the end of this unit student should be able to: Understand properties of Commonly used alloy steels such as: Chromium steel Nickel steel Silicon steel Understand about Effect of alloying elements on properties and heat treatment process of steel	Introduction to Alloy steel Effect of alloying elements on properties and heat treatment process of steel Classification of Alloy steel according to their applications Commonly used alloy steels such as Chromium steel, Nickel steel Silicon steel Tungsten steel etc	5	7	25	10

Unit XI	**Low alloy steels and Heat Treatment**	At the end of this unit student should be able to: Understand about Importance of pre-heating Selection of cooling medium Perform Heat Treatment operation on low alloy steels	Heat treatment cycle of low alloy steels i.e. calculating time and temperature for heating and cooling Importance of pre-heating Selection of cooling medium Tempering after hardening	5	8	20	10
Unit XII	**High alloy steels and Heat Treatment**	At the end of this unit student should be able to: Understand about Importance of multiple tempering Heat treatment defects there causes and remedies Understand about Heat treatment cycle of High alloy steels Perform Heat Treatment operation on High alloy steels	Heat treatment cycle of High alloy steels i.e. calculating time and temperature for heating and cooling Importance of pre-heating Selection of cooling medium Tempering after hardening Importance of multiple tempering Heat treatment defects there causes and remedies	10	8	30	10

COURSES / MODULE TEMPLATE

NOS /Module: Employability Skills

NOS /Module Code: MSME/ES/04

Module Hours: 120

COURSES / MODULE TEMPLATE

NOS /Module: Assist & Perform Heat Treatment operation for Metals

NOS /Module Code: MSME/CCMTHT/05

Outcomes:

After completion of course Student should be able to:

- Understand principle and working of Liquid carburizing
- Understand principle and working of Gas carburizing
- Understand Surface Hardening treatment.
- Understand Tool steels, Alloy steels, Low and High alloy steels and their Heat Treatment
- Understand working of various furnaces used in Heat treatment.
- Understand about Solid / Pack carburizing.

Theory Hours: Nil **Practical Hours: 120** **Viva: 100** **Practical Marks: 100**

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	PR Hours	OJT Hours	PR Marks	Viva
UNIT-I	**Heat Treatment Operations**	At the end of this Unit the student should be able to work on heat treatment of materials on different furnaces.	Heat treatment operation on different materials using following furnaces: • Neural salt bath furnace • Mar-quenching Furnace • Box Type Furnace • Pit Type Furnace • Box Type Furnace • Fulmena furnace • Gas carburizing Furnace • Plasma Nitriding Furnace • Vacuum Furnace	120	360	100	100

COURSES / MODULE TEMPLATE

NOS /Module: Employability Skill

NOS /Module Code: MSME/ES/03

THEORY HOURS: 120 **PRACTICAL HOURS: -** **THEORY MARKS: 100** **PRACTICAL MARKS: -**

Refer Standard Curriculum developed by NCVET _ Employability skills 120 Hrs