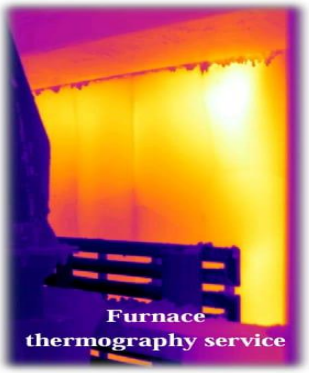
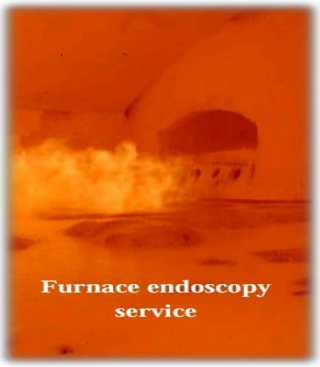
सूक्ष्म, लघु एवं मध्यम उद्यम मंत्रालय
DEVELOPMENT COMMISSIONER
MINISTRY OF MICRO, SMALL & MEDIUM ENTERPRISES
MSME TECHNOLOGY CENTRE

MODEL CURRICULUM





Qualification Name: Glass Manufacturing Technician

Qualification Code: QG-04-GC-04164-2025-V1-MSMETC

Version: 1

NCrF/NSQF Level: 4

Model Curriculum Version: 1

Submitted By:

MSME TECHNOLOGY CENTRE

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

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NOS / MODULE TEMPLATE

SEM-I

NOS /Module: BASIC SCIENCE AND MATHS

NOS /Module Code: MSME/TGM/ 01 & Version 1.0

Outcomes:

After completion of course Student should be able to

1. Understanding facts, concept, of physics to develop new technology.
2. Use of physics technique to solve engineering technique.
3. Knowledge of science which helps the students to develop by applications of newer technologies.
4. Understanding facts, concept, of chemistry to develop new structure and properties of matter.
5. Learning about changes in structure and properties in all engineering process changes.
6. Use of chemistry to solve engineering activities and processes.

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

Unit No.	**Unit Name**	**Unit level outcomes**	**Contents (chapters/topics)**	**PR hours**	**PR Marks**
Unit I	Physics and its importance in technical education. & S.I unit	• After completion of course Student should be able to understand importance of fundamental science • Purpose of learning physics • Applications in daily life • After completion of course Student should be able to understand types of unit and its importance	• Introduction to physics • Purpose of learning physics • Applications in daily life • S.I units, base and supplementary units, derived units. • Units and dimensions with symbols, abbreviation & precaution.	03	08
UNIT-II	Gravitation	• After completion of course Student should be able to understand what is gravity • Newton’s principle • principle and technique of launching of artificial satellite ,natural and man-made satellite	• Newton's law of gravitation, • gravitation field, • relation between 'G' and 'g'. factors influencing 'g'. • Conditions for overloading and weightlessness in space	5	08

UNIT-III	Molecular phenomena in solid liquid and gases	• After completion of course Student should be able to understand what is matter, its classifications and properties • Kinetic theory of matter • relation of internal energy with quantity of heat and temperature.	• Order of mass, size, and speed of motion of a molecule in matter, • Molecular theory • Brownian motion and diffusion of gases, liquid and solid. • Random motion of mole • kinetic and potential energy of moles, internal energy.	05	08
Unit IV	Surface tension& Viscosity	• After completion of course Student should be able to understand the effect of temperature on ST of liquids and gases. • Experimental determination of ST of liquid by capillary rise • After completion of course Student should be able to understand by experimental determination by Posethic's method, • dependence of viscosity of liquids on temperature, application	• Molecular forces, cohesive and adhesive forces. • Free still surface of a liquid tries to contract and its behavior as a stretched membrane. • Definition of surface tension. • Capillarity phenomena in science and engineering, • Concept of viscosity of fluids. • steady streamline flow and turbulent flow, • viscous flow, • Critical velocity. • Newton's law of viscous flow.	05	10
Unit V	Heat, work And Heat transfer	• After completion of course Student should be able to understand first law of thermodynamics • mechanical equivalent of heat, • concept of latent heat of fusion of ice & vaporization of water • After completion of course Student should be able to understand natural and forced convection • ventilation of buildings • radiation • good and bad radiations • absorbers	• Nature of heat energy, • Relation of temperature of a substance with K.E of the motion of the molecules. • Relation of internal energy of a body with quantity of heat • Modes of heat transfer • concept of conduction, convection, radiation and evaporation transfer of heat. • variable and steady state of heat conduction thermal conductivity	05	10

Unit - VI	Colligative properties and chemical energies	• After completion of course Student should be able to understand effect of temperature catalysis.	• Osmosis & osmotic pressure • Relative vapour pressure &Routl's law • Internal energy, entropy and enthalpy	03	05
Unit VII	Chemical equilibrium	• After completion of course Student should be able to understand Le- chateliers principle • Effect of temperature, pressure & concentration in NH3	• Rate of reaction • factors effecting rate of reaction, • reversible reaction • law of mass action & its application to reversible reaction.	03	05
Unit - VIII	Periodic classification of elements	• After completion of course Student should be able to understand classification on basis of, p, d, f model • Actinide and lanthanide series.	• Dobernior, newland, luther-mayer, Mendeleev laws of classification • Advantages and disadvantages and limitation, periodicity, electron affinity • Modern periodic table	05	10
Unit - IX	Symbol and Molecular Formulae of Elements	• After completion of course Student should be able to understand symbol and molecular formula of different type of elements.	Hydrogen Lithium, Beryllium, Boron, Carbon, Nitrogen, Oxygen, Fluorine, Sodium, Magnesium, Aluminum, Silicon, Phosphorous, Sulfur, Chlorine, Potassium, Calcium, Chromium, Barium, Iron, Lead, Nickel, Copper, Gold, Selenium, Cobalt, Manganese, Tin, Arsenic and Antimony) Carbon dioxide, Silicon Dioxide, Cabonates and Sulphate, Carbonates, Dolomite,	03	05
Unit X	Pollution and Control	• After completion of course Student should be able to understand effect of waste and waste products in the environment.	• Introduction and chemical toxicology, • Air and Water pollution, • Control of air and water pollution.	03	05
UNIT-XI	Arithmetic's Geometry	• At the end of this unit Student should be able to understand tools and materials required and their use in industry • Type of Material-Ferrous & non-ferrous • SafetyApplication, safety rules, Precaution of accidents • Safety Precaution and	• Percentages • Ratio and Proportion • Factors and Multiples • Integers • Basic Algebra • Measurements • Time and Money	10	10

		safety rule			
Unit - XII	Algebra	• After completion of course Student should be able to understandwhat is sequence and series. • general terms of a series, • formulation of series. • Factorial notation. • Principle of partial fraction. • Determinants and matrices • Permutation and combination • Exponents and its series.	• Sequence and series • Arithmetic progression • Geometrical progression • Harmonica progression • Permutation • Combination • Binomial theorem • Partial fractions • Determinants • Exponential series	05	08
Unit - XIII	Trigonometry	• After completion of course Student should be able to understand the properties of triangle. • Relation between sides & angle of triangle. • Sums& difference formula.	• Trigonometric ratio • Properties of triangle • Trigonometric equations	05	08

NOS /Module: GLASS RAW MATERIALS & BATCH PREPARATION

NOS /Module Code: MSME/TGM/ 02 & Version 1.0

Outcomes:

After completion of course Student should be able to

1. Get knowledge about practical work in glass plant batch house.
2. Acquiring practical knowledge and hand skill in operating the types of machines used in batch house.
3. Get knowledge about different machine used in workshop like belt conveyor, batch mixer, seiving, etc.
4. Find out different problems during manufacturing of different parts and using different machine.

THEORY HOURS: -90 PRACTICAL HOURS: 60 THEORY MARKS:100 PRACTICAL MARKS:100

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	PR hours	PR Marks
Unit-I	Introduction to Glass Raw Materials	• At the end of this unit Student should be able to understand different types of glass raw materials. • Their commercial and scientific name.	• Importance of Raw Materials in Glass Manufacturing. • Commercial and Scientific Names of Glass Raw Materials. • Categories of Raw Materials	10	14
Unit- II	Properties and Selection of Glass Raw Materials	• At the end of this unit Student should be able to understand different properties of glass raw materials. • Like physical, chemical and mechanical properties. • Selection criteria for raw materials.	• Introduction • Physical and Mechanical Properties of Glass Raw Materials. • Chemical Properties. • Impurities in Glass Raw Materials and Their Effects • Selection Criteria for Glass Raw Materials.	08	12

Unit -III	Impurities and Beneficiation of Raw Materials	• After completion of course Student should be able to understand impurities present in glass raw materials and beneficiation of glass raw materials.	• Introduction • Common Impurities in Glass Raw Materials. • Impurities in Limestone and Dolomite. • Impurities in Feldspar. • Impurities in Soda Ash and Other Fluxes. • Effects of Impurities on Glass Quality. • Beneficiation of Raw Materials • Beneficiation Methods	08	12
Unit- IV	Storage and Handling of Raw Materials	• After completion of course Student should be able to understand classification, storage, storage method, booking and inventory management.	• Introduction • Classification of Glass Raw Materials Based on Storage Requirements. • Hygroscopic vs. Non-Hygroscopic Materials. • Bulk vs. Bagged Storage. • Storage Methods for Different Glass Raw Materials. • Handling Procedures for Raw Materials. • Bookkeeping and Inventory Management	08	14
Unit -V	Batch Preparation and Processing Techniques	• After completion of course Student should be able to understand batch preparation and processing techniques, batch calculation, batch processing techniques.	• Introduction • Components of a Glass Batch. • Steps in Glass Batch Preparation. • Batch Calculation of glass raw materials. • Batch Processing Techniques. • Importance of Batch Homogeneity.	08	16
Unit -VI	Glass Composition and Types of Glass	• After completion of course Student should be able to understand glass batch composition, types and deference between glass.	• Introduction • Basic Composition of Glass. • Types of Glass and Their Composition • Special Types of Glass. • Differentiate between different types of glass.	10	20

Unit -VII	Coloring Oxides and Their Applications in Glass	• After completion of course Student should be able to understand colouring oxide and their application in glass.	• Introduction • Mechanism of Glass Coloring. • Common Coloring Oxides and Their Effects. • Special Color Effects in Glass. • Applications of Colored Glass	08	12

NOS /Module: GLASS MELTING PROCESS

NOS /Module Code: MSME/TGM/ 03 & Version 1.0

Outcomes:

After completion of course Student should be able to

1. Use the fundamental features and history of glass melting process
2. Understand the function and name of different types of furnaces used in glass plant
3. Understand the glass melting process and make melting glass process in this furnaces
4. Understand and use if different type of furnaces

THEORY HOURS: 60 PRACTICAL HOURS: - 60 THEORY MARKS: 100 PRACTICAL MARKS: - 100

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH hours	Marks
Unit I	Fundamentals of Glass Melting	• After completion of course Student should be able to understand fundamental of glass melting process like raw materials, burner ,furnaces , storage of raw materials and factor effecting of raw materials.	• Introduction to Glass Melting • Raw Materials and Their Role in Melting. • Stages of Glass Melting • Heat Transfer Mechanisms in Glass Melting • Factors Affecting Glass Melting Efficiency • Importance of Controlling Glass Melting	8	14
Unit II	Glass Melting: Chemistry and Reactions.	• After completion of course Student should be able to understand glass melting chemistry including chemical reaction like decomposition, formation of silicate, refining etc.	• Introduction to Glass Melting Chemistry. • Chemical Reactions during Glass Melting. • Decomposition Reactions (100°C – 800°C) • Formation of Silicates (Fusion Reactions) (900°C – 1400°C) • Refining Reactions (Bubble Removal Process) (1400°C – 1600°C) • Factors Affecting Glass Melting Chemistry.	10	16

Unit III	Types of Glass Melting Furnaces.	• After completion of course Student should be able to understand different type of glass melting furnaces like continuous and discontinuous furnaces • Classification of glass furnaces.	• Introduction to Glass Melting Furnaces. • Classification of Glass Melting Furnaces. • Special Types of Glass Melting Furnaces. • Comparison of Different Furnaces.	08	14
Unit IV	Batch Charging and Thermal Reactions	• After completion of course Student should be able to understand different type of batch charger or batch feeder, batch transportation, factor affection batch charging and thermal reaction etc.	• Introduction to Batch Charging. • Batch transportation • Thermal Reactions in Glass Melting • Factors Affecting Batch Charging and Thermal Reactions. • Different type of batch charger	08	14
Unit V	Refining and Homogenization in Glass Melting	• After completion of course Student should be able to understand how to melted glass homogenize during melting and refining of melted glass their effect on during glass product shaping.	• Introduction • Refining in Glass Melting • Refining Reactions and Agents • Homogenization in Glass Melting • Factors Affecting Refining and Homogenization.	08	14
Unit VI	Energy Efficiency in Glass Furnaces	• After completion of course Student should be able to understand energy efficiency in glass furnaces and importance of energy efficiency.	• Introduction • Importance of Energy Efficiency • Factors Affecting Energy Efficiency • Strategies for Improving Energy Efficiency • Renewable and Alternative Energy Sources	08	14
Unit VII	Defects in Glass Melting and Their Solutions	• After completion of course Student should be able to understand different type of glass occurring during melting and shaping of glass raw materials and shaping of glass product and their prevention.	• Bubbles (Seeds, Blisters, and Fining Bubbles) • Striae and Streaks • Stones and Crystals • Scum and Surface Defects • Cord Defects (Refractive Index Variations) • Color Variation Defects • Preventive Measures for Glass Defects. • Defect occurring from mould and machine and preventions.	10	14

NOS /Module: GLASS FORMING TECHNIQUES

NOS /Module Code: MSME/TGM/ 04 & Version 1.0

Outcomes:

After completion of course Student should be able to

1. Understand the Properties of Glass
2. Identify Various Glass Forming Methods like- blowing, pressing, blow & press, blow & blow
3. Glass manual and machinery forming techniques
4. Apply Safe Working Practices: Demonstrate knowledge of workplace health and safety procedures related to glass forming (e.g., handling hot materials, PPE use).
5. Operate Glass Forming Equipment
6. Produce Glass Objects Using Selected Techniques
7. Explore Aesthetic and Functional Design
8. Analyze Sustainability and Innovation in Glass Forming

THEORY HOURS: 60 PRACTICAL HOURS: NA THEORY MARKS: 100 PRACTICAL MARKS: - 100

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH hours	Marks
Unit I	Introduction to Glass Forming Methods	• After completion of course Student should be able to understand different type of glass forming methods. • Affecting physical and chemical properties during glass forming.	• Overview of glass forming processes • Physical and chemical properties of molten glass affecting forming techniques. • Classification of forming methods: • Influence of viscosity, temperature, and cooling rate on forming. • Key applications of various forming methods in industry.	07	12
Unit II	Manual and Traditional Glass Forming Techniques	• After completion of course Student should be able to understand Manual and Traditional glass forming method like hand pressing slumping and fusion etc.	• Glassblowing Techniques: • Hand Pressing and Slumping • Lamination and Fusion Methods • Challenges and Limitations of manual forming.	07	12

Unit III	Automated Glass Forming Processes	• After completion of course Student should be able to understand automated glass forming methods like blowing, pressing, bolw & blow, press and blow methods etc.	• Evolution of automation in glass production. • Blow-and-Blow Process. • Press-and-Blow Process. • Rotary and Centrifugal Forming • Future trends in automation and smart manufacturing.	08	14
Unit IV	Blow Molding and Pressing Techniques	• After completion of course Student should be able to understand complete knowledge of blow moulding and pressing techniques. • Materials and mold required for this process.	• Blow Molding Methods • Press Molding Techniques • Materials and mold considerations for effective molding. • Quality control parameters in molding and pressing. • Advantage and disadvantage of this techniques	07	12
Unit V	Float Glass Manufacturing Process	• After completion of course Student should be able to understand introduction of float process advantages and disadvantages for this and over other methods.	• Introduction to the Pilkington Float Process. • Complete process steps • Advantages of float glass over other methods • Applications: Windows, automotive glass, mirrors, and solar panels.	08	12
Unit VI	Fiber Glass Production Techniques	• After completion of course Student should be able to understand introduction of fiber glass production advantages and disadvantages for this and over other methods. • Complete process steps for fiber glass production techniques.	• Introduction to fiber glass and its properties • Continuous Filament Process • Staple Fiber Process • Thermal and chemical resistance considerations. • Applications: Reinforced plastics, construction materials, insulation.	08	12

Unit VII	Casting and Molding of Glass	• After completion of course Student should be able to understand general overview of casting and molding of glass and molds and materials. • Challenges in glass casting and molding process.	• Overview of Casting Techniques • Types of Molds and Materials Used • Glass Slumping and Thermoforming • Applications in architecture, art, and specialized industries. • Challenges in glass casting and mold design.	07	12
Unit VIII	Advanced and Specialty Glass Forming Techniques	• After completion of course Student should be able to understand other type of glass forming methods like- Fusion forming, Sol-Gel Processing, 3D printing of glass, CVD methods etc.	• Fusion Forming • Sol-Gel Processing • 3D Printing of Glass • Electroforming and Chemical Vapor Deposition (CVD) Methods. • Smart Glass and Coated Glass Production.	08	14

NOS /Module: ENTREPRENEURSHIP DEVELOPMENT AND QUALITIY MANAGEMENT SYSTEM

NOS /Module Code: MSME/TGM/ 05 & Version 1.0

Outcomes:

After completion of course Student should be able to

1. Understand the Concept of Entrepreneurship.
2. Identify Entrepreneurial Traits and Skills.
3. Explore the Business Environment.
4. Develop a Business Idea.
5. Create a Business Plan: Draft a comprehensive business plan including, Executive summary, Business model,
6. Use Understand Legal and Financial Aspects.
7. Apply Strategic and Managerial Skills.
8. Evaluate Business Performance.
9. Explore Ethics and Social Responsibility
10. Develop a Pitch: Create and deliver a persuasive business pitch to potential investors or stakeholders.

THEORY HOURS: 90 PRACTICAL HOURS: NA THEORY MARKS: 100 PRACTICAL MARKS: NA

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH hours	Marks
Unit I	Introduction to Entrepreneurship	• After completion of course Student should be able to understand the general idea of entrepreneurs, characteristics, types, role and Entrepreneur vs Intrapreneure.	• Definition and nature of entrepreneurship • Characteristics and types of entrepreneurs • Role of entrepreneurship in economic development • Entrepreneur vs. Intrapreneur	09	10
Unit II	Entrepreneurial Environment and Policy	• After completion of course Student should be able to understand Entrepreneurial environment and policy. • Government policies and support for entrepreneurship. • Institutional support system like-MSME, SIDBI, DIC, NSIC etc.	• External and internal environment • Government policies and support for entrepreneurship • Institutional support systems (MSME, SIDBI, DIC, NSIC, etc.) • Legal environment for business	09	10
Unit III	Business Opportunity Identification and Project Formulation	• After completion of course Student should be able to understand business opportunity identification and project an also source of business, project report preparation and their evaluation.	• Sources of business ideas • Idea generation techniques • Market survey and feasibility analysis • Project report preparation and evaluation	09	10
Unit IV	Business Plan and Financing	• After completion of course Student should be able to understand business plan financing including some other topics steps in business plan, source of finance etc.	• Components of a business plan • Steps in business plan preparation • Sources of finance – institutional and non-institutional • Venture capital, angel investors, crowd funding	09	10

Unit V	Entrepreneurial Development Programs (EDPs)	• After completion of course Student should be able to understand what is EDPs and their objectives, role of NGOs and also challenges in entrepreneurial development.	• Objectives and phases of EDPs • Role of NGOs and institutions in promoting entrepreneurship • Women and rural entrepreneurship • Challenges in entrepreneurial development	09	10
UNIT-VI	Introduction to Quality Management	• After completion of course Student should be able to understand: • Define quality and its dimensions. • Trace the evolution of quality concepts. • Assess the business importance of quality. • Calculate and interpret the cost of quality.	• Definition and dimensions of quality • Evolution of quality management (Inspection to TQM) • Importance of quality in business • Cost of quality		
Unit VII	Quality Tools and Techniques	• After completion of course Student should be able to understand: • Apply basic quality tools for problem-solving. • Monitor and control process variation using SPC. • Perform FMEA to identify process risks. • Analyze capability of manufacturing processes.	• Seven basic quality tools (e.g., Pareto chart, control charts, fishbone diagram) • Statistical Process Control (SPC) • Process capability analysis • Failure Mode and Effect Analysis (FMEA)	09	10
Unit VIII	Quality Standards and Certification	• After completion of course Student should be able to understand: • Understand ISO quality standards. • Describe the steps in the certification process. • Prepare quality	• ISO 9000 family of standards • Certification process and audit • Documentation requirements • Internal vs. external audits	09	10

		documentation. • Differentiate between audit types.			
Unit IX	Total Quality Management (TQM)	• After completion of course Student should be able to understand: • Explain the core principles of TQM. • Understand leadership's role in quality. • Apply continuous improvement strategies. • Use benchmarking to enhance performance.	• Principles and elements of TQM • Role of leadership and employee involvement • Continuous improvement (Kaizen) • Benchmarking and best practices	09	10
Unit X	Quality in Manufacturing and Services	• After completion of course Student should be able to understand: • Implement QFD to translate customer needs. • Utilize Six Sigma for defect reduction. • Apply lean tools for waste minimization. • Evaluate service quality using established models.	• Quality Function Deployment (QFD) • Six Sigma methodology • Lean principles and waste reduction • Service quality models (e.g., SERVQUAL)	09	10

SEM-II

NOS /Module: INTRODUCTION TO OPERATION OF GLASS PLANT MACHINERY / EQUIPMENTS

NOS /Module Code: MSME/TGM/ 06 & Version 1.0

Outcomes:

After completion of course Student should be able to:

1. Understand the complete process flow of glass manufacturing.
2. Identify and describe the function of major equipment used in glass plants.
3. Operate basic machinery such as furnaces, forming units, annealing lehrs, and packaging systems.
4. Perform routine maintenance and troubleshoot common issues in equipment.
5. Follow standard safety procedures and use appropriate PPE in a plant environment.
6. Maintain quality standards throughout the production process.

Theory Hours: 30 **Practical Hours: 60** **Theory Marks: -** **Practical Marks: 100**

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH hours	PR hours	PR Marks
UNIT-I	Overview of Glass Manufacturing Process.	• After completion of course Student should be able to understand general idea of glass manufacturing process including some important topics like raw materials used in glass production, batch preparation and types of glass.	• Introduction to glass and its properties • Raw materials used in glass production • Batch preparation process • General layout and workflow of a glass plant • Types of glass (soda-lime, borosilicate, lead glass, etc.)	5	10	17
UNIT-II	Glass Melting Furnace	• After completion of course Student should be able to understand different type of glass melting furnaces including their structure, use of refractory, type of furnace, furnace maintenance and troubleshooting.	• Melting furnaces (Tank furnace, day tank, pot furnace) • Fuel-fired vs. electric furnaces • Refractories used in furnace linings • Temperature control and energy efficiency in melting • Furnace maintenance and troubleshooting.	5	10	17

UNIT-III	Forming Machinery	• After completion of course Student should be able to understand forming machinery like IS Machine, Float bath, molds and forming tools, automation and robotics in forming section.	• Methods of forming (blowing, pressing, drawing, rolling, float process) • Machines used in container glass (IS machine, press and blow, blow and blow) • Sheet/float glass production lines • Moulds and forming tools • Automation and robotics in forming section	5	10	17
UNIT-IV	Annealing and Cooling Equipment	• After completion of course Student should be able to understand annealing and cooling equipment used in glass industry and also purpose and process of annealing. • Design of annealing lehr and temperature controles.	• Purpose and process of annealing • Annealing lehr: design, zones, and temperature control • Types of defects due to improper annealing • Cooling conveyors and handling systems • Energy recovery from annealing process	5	10	17
UNIT-V	Inspection, Cutting, and Packaging Systems	• After completion of course Student should be able to understand about inspection, Cutting and packaging system including this unit some important point also discus visual and automated inspection, detection of defect, safety systems and handling protocordsls.	• Visual and automated inspection systems • Detection of common glass defects (bubbles, cracks, seams) • Cutting machines for flat glass • Edge finishing and tempering (for flat glass) • Packaging systems – wrapping, stacking, palletizing • Safety systems and handling protocols	5	10	16
UNIT-VI	Maintenance and Safety in Glass Plant Operations	• After completion of course Student should be able to understand maintenance and safety in glass plant operation like preventive and predictive maintenance of equipment, Lubrication systems and mechanical upkeep, PPE and hazard	• Preventive and predictive maintenance of equipment • Lubrication systems and mechanical upkeep • Fire safety and high-temperature operation protocols • PPE and hazard management in glass production • Emergency shutdown procedures	5	10	16

		management in glass.				

NOS /Module: FURNACE OPERATION

NOS /Module Code: MSME/TGM/ 07 & Version 1.0

Outcomes:

After completion of course Student should be able to

1. To understand fundamentals of furnace operation in glass plant
2. Understanding different types of furnace components and design
3. To understand different of fuels and energy system in glass furnace operation
4. To understand furnace operation their maintenance.
5. To understand safety during furnace operation

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

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH Hours	PR Hour	PR Marks
UNIT-I	Fundamentals of Furnace Operation	• After completion of course Student should be able to understand different type of glass furnace during the glass furnace operation also heat transfer mechanism in glass furnace operation. • Purpose an application of furnaces in various industries.	• Definition and classification of furnaces • Types: batch vs. continuous, fuel-fired vs. electric • Basic combustion principles and heat transfer (conduction, convection, radiation) • Purpose and applications of furnaces in various industries • Overview of thermal processes: melting, heat treating, sintering, annealing	5	10	17
UNIT-II	Furnace Components and Design	• After completion of course Student should be able to understand different type furnace components and design also understand different type refractories used in glass furnaces with their important properties.	• Furnace structure and insulation materials • Refractories: types, properties, and selection criteria • Burners and combustion chambers • Heating elements in electric furnaces (resistance, induction) • Chimneys, flues, and exhaust	5	10	17

			systems			
UNIT-III	Fuel and Energy Systems	• After completion of course Student should be able to understand fuel and energy system which is used during furnace operation with their calorific value and also understand emission and environmental consideration.	• Types of fuels used: natural gas, oil, electricity, hydrogen • Fuel handling and feeding systems • Calorific value and efficiency calculations • Energy conservation methods in furnaces • Emissions and environmental considerations	5	10	17
UNIT-IV	Temperature Measurement and Control	• After completion of course Student should be able to understand temperature measurement and control system in glass plant like temperature sensor, thermocouple, pyrometer, PID control panels, SCADA system.	• Temperature sensors: thermocouples, pyrometers, infrared sensors • PID controllers and furnace automation • Control panels and SCADA systems • Temperature distribution and uniformity • Safety interlocks and emergency shutdown systems	5	10	17
UNIT-V	Furnace Operation and Maintenance	• After completion of course Student should be able to understand furnace operation and their maintenance and glass furnace heat-up procedure. • Also understand charging and tapping techniques, furnace loading and heat cycling with routine maintenance task and checklists.	• Start-up and shutdown procedures • Charging and tapping techniques (for melting furnaces) • Furnace loading and heat cycling • Routine maintenance tasks and checklists • Troubleshooting common issues (uneven heating, refractory damage, burner failure)	5	10	17
UNIT-VI	Safety and Environmental Management	• After completion of course Student should be able to understand safety and environmental management including heat, fire, gas leaks, and pressure. • Handling of hot materials and emergency and protocols and also pollutions.	• Hazards in furnace operation: heat, fire, gas leaks, pressure • Personal protective equipment (PPE) and safety practices • Handling of hot materials and emergency protocols • Air pollution control (bag filters, scrubbers) • Waste heat recovery and sustainability measures	5	10	16

NOS /Module: AUTOMATIC PROCESS OF GLASS MANUFACTURING

NOS /Module Code: MSME/TGM/ 08 & Version 1.0

Outcomes:

After completion of course Student should be able to

1. Understand automation in glass manufacturing industry.
2. To understand automation in separate department in glass manufacturing industry like raw materials and batch preparation, Furnace automation, forming section.
3. To understand automation process and related basic component with relate department.

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

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH Hours	PR Hour	PR Marks
UNIT-I	Introduction to Automation in Glass Manufacturing	• After completion of course Student should be able to understand automation in glass industry and basic component used in glass industry like actuators, controllers and sensors. • Also understand manually automation and fully automation in glass industry.	• Evolution of automation in the glass industry • Benefits of automation: consistency, efficiency, safety, productivity • Overview of automated systems in glass production • Manual vs. semi-automatic vs. fully automatic processes • Basic components of automation: actuators, controllers, sensors	5	10	17
UNIT-II	Automation in Raw Material Handling and Batch Processing	• After completion of course Student should be able to understand different type of automation component used in raw materials and batch preparation section like sensor and actuators ERP/MES systems for inventory control.	• Automated raw material storage and handling systems • Weighing, dosing, and mixing control systems • Batch house automation – software and control panels • Integration with ERP/MES systems for inventory control • Safety mechanisms in automated handling systems	5	10	17
UNIT-III	Furnace Automation	• After completion of course Student should be able to understand automation in furnace department because monitoring and control of SCADA and PLC in furnace control. • To understand or measure	• Furnace temperature monitoring and control systems • Combustion control and burner management systems • Real-time temperature, pressure, and gas analysis • SCADA and PLC in furnace control	5	10	17

		real-time temperature and gas analysis.	• Predictive maintenance and furnace diagnostics			
UNIT-IV	Forming Section Automation	• After completion of course Student should be able to understand automation process in forming section for IS machine sensors, gob feeding system, mould operating, air pressure controllers, robotic and conveyor handling system for container glass.	• IS (Individual Section) machine automation in container glass • Servo-controlled gob feeding systems • Synchronization of mould opening/closing, air pressure control • Robotic arms and conveyors in handling hot glass articles • Monitoring forming defects using vision systems	5	10	17
UNIT-V	Annealing and Cold-End Automation	• After completion of course Student should be able to understand automation in annealing and cold end section for cooling curve optimization and defect prevention. • Inspection system-optical sensors, cameras, AI-based quality checks, automated cutting, edge grinding and defect marking.	• Automated control of annealing lehr (temperature zones, belt speed) • Cooling curve optimization and defect prevention • Inspection systems: optical sensors, cameras, AI-based quality checks • Automated cutting, edge grinding, and defect marking • Packaging line automation: wrapping, stacking, palletizing	5	10	17
UNIT-VI	Integrated Control Systems and Industry 4.0 in Glass Plants	• After completion of course Student should be able to understand automation in integrated control system and industry 4.0 in glass plants like different type of equipment PLC, SCADA AND DCS. • Predictive analytics for maintenance and process improvement with cyber security in automated environments.	• Role of PLC, SCADA, and DCS (Distributed Control Systems) • Data acquisition and remote monitoring • Industrial Internet of Things (IIoT) in glass manufacturing • Predictive analytics for maintenance and process improvement • Cyber security in automated environments	5	10	17

NOS /Module: PROJECT WORK-GLASS MANUFACTURING INDUSTRY

NOS /Module Code: MSME/TGM/ 09 & Version 1.0

Outcomes:

After completion of course Student should be able to

1. Get knowledge about practical work in workshop.
2. Acquiring practical knowledge and hand skill in operating the types of machines used in workshop

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

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	PR hours	Marks
Unit I	Project Work	Skill Development	• Assign a small project related to the course. • Apply the skills learned during the internship to complete the project. • Regular check-ins with mentors and supervisors.	45	75
Unit II	Documentation and Presentation	Skill Development	• Learn how to document your work, create technical reports, and maintain records. • Prepare a final presentation on the project work.	10	25
Unit III	Conclusion and Evaluation	-	• Final evaluation of the internship program. • Feedback session with mentors and supervisors.	5	-

NOS /Module: ON JOB TRAINING (OJT)

NOS /Module Code: MSME/TGM/ 10 & Version 1.0

Outcomes:

After completion of course Student should be able to

1. Understand about how to work with Team.
2. Understand about how to Behavior with customer.
3. Get knowledge about how to work as a Service Engineer
4. Get knowledge about how to work as a Furnace Engineer.

THEORY HOURS: NA PRACTICAL HOURS: -THEORY MARKS: NAPRACTICAL MARKS: 100

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	OJT hours
UNIT-I	On job training (OJT)	• At the end of this unit Student should be able to get practical field knowledge. Trainee's works in different type of glass manufacturing industry get practical skill and knowledge. Understand how to behavior with the customer Trainees helps to service engineer and get extra skill for furnace.	Installation Demonstration servicing Repairing Troubleshooting	240

COURSES / MODULE TEMPLATE

NOS /Module: Employability Skills

NOS /Module Code: MSME/ES/10

Module Hours: 120