



# Model Curriculum

**Qualification Name: Machining and Assembly Technician**

**Version: 1.0**

**NSQF Level: 3.5**

**Model Curriculum Version: 1.0**

Automotive Skills Development Council |  
E-113, Gr Floor, Okhla Industrial Area, Phase – III, New Delhi– 110020

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## Training Parameters

<b>Sector</b>	Automotive
<b>Sub-Sector</b>	Manufacturing
<b>Occupation</b>	Production
<b>Country</b>	India
<b>NSQF Level</b>	3.5
<b>Aligned to NCO/ISCO/ISIC Code</b>	NCO-2015/8211.1201
<b>Minimum Educational Qualification and Experience</b>	10 <sup>th</sup> Pass OR Relevant NSQF Certificate of level 3
<b>Pre-Requisite License or Training</b>	NA
<b>Minimum Job Entry Age</b>	18 years
<b>Last Reviewed On</b>	30-11-2023
<b>Next Review Date</b>	30-11-2026
<b>NSQC Approval Date</b>	30-11-2023
<b>QP Version</b>	1.0
<b>Model Curriculum Creation Date</b>	30-11-2023
<b>Model Curriculum Valid Up to Date</b>	30-11-2026
<b>Model Curriculum Version</b>	1.0
<b>Minimum Duration of the Course</b>	1200 Hours
<b>Maximum Duration of the Course</b>	1200 Hours

# Program Overview

This section summarizes the end objectives of the program along with its duration.

## Training Outcomes

A Diploma in Manufacturing Technology is a specialized educational program that focuses on providing students with practical skills and theoretical knowledge related to various aspects of manufacturing processes and technologies.

At the end of the program, the learner should have acquired the listed knowledge and skills.

- **Technical Competence:**

Graduates of a Diploma in Manufacturing Technology should have a solid understanding of various manufacturing processes, such as machining, welding, casting, moulding, and more. They should be able to operate machinery and equipment effectively and safely.

- **Hands-On Skills:**

Practical training is a key component of such a diploma program. Students should gain hands-on experience in using tools, machines, and software relevant to manufacturing processes. This can include working with CNC machines, 3D printers, CAD/CAM software, and more.

- **Process Knowledge:**

Graduates should have a comprehensive understanding of manufacturing workflows and processes. This includes knowing the sequence of operations, material handling, quality control measures, and workflow optimization.

- **Quality Management:**

Training in quality control and assurance is often included in these programs. Graduates should be able to implement quality standards, perform inspections, and address quality-related issues to ensure the production of high-quality products.

- **Problem-Solving Abilities:**

Manufacturing environments often present challenges that require quick problem-solving. Graduates should be equipped with critical thinking skills to troubleshoot issues that may arise during production.

- **Safety Awareness:**

Safety protocols and practices are crucial in manufacturing settings. Graduates should be familiar with safety guidelines, risk assessment, and proper use of personal protective equipment (PPE).

- **Materials Knowledge:**

A solid understanding of different types of materials, their properties, and their suitability for various manufacturing processes is important. This knowledge helps graduates make informed decisions about material selection.
- **Blueprint Reading and Interpretation:**

Interpreting engineering drawings and blueprints is a fundamental skill in manufacturing. Graduates should be able to understand technical drawings and specifications.
- **Communication Skills:**

Effective communication is essential in manufacturing, especially when collaborating with colleagues, supervisors, and engineers. Graduates should be able to convey ideas and information clearly.
- **Project Management:**

Some programs may include elements of project management, teaching graduates how to manage tasks, timelines, resources, and budgets effectively within a manufacturing context.
- **Automation and Technology:**

Depending on the curriculum, graduates might have knowledge of automation technologies, computerized manufacturing systems, and Industry 4.0 concepts.
- **Environmental and Sustainability Awareness:**

Some programs may cover environmentally friendly manufacturing practices, emphasizing sustainable processes and waste reduction.
- **Career Opportunities:**

Graduates should be prepared for entry-level positions in manufacturing industries such as automotive, aerospace, electronics, consumer goods, and more.
- **Continuing Education:**

A Diploma in Manufacturing Technology can also serve as a stepping stone for further education, such as pursuing a higher-level degree or certifications in specialized areas.

## Mandatory & Elective Modules

The table lists the modules and their duration corresponding to the Mandatory & Elective Subjects of the Curriculum.

Subject Details	NOS Code	Subject Type	Theory Duration	Practical Duration	On-the-Job Training Duration	Total Duration
Metrology (Measurement)	ASC/N6314, V1.0	Core	24	48	48	120
Workshop Technology	ASC/N3545, V1.0	Core	24	48	48	120
Engineering Drawing	ASC/N6458, V1.0	Core	24	48	48	120
Industrial Safety	ASC/N9833, V1.0	Non-Core	18	36	36	90
Machining Skills-Drilling , Milling & Turning	ASC/N3546, V1.0	Core	24	48	48	120
Machining Skills- CNC Milling	ASC/N3547, V1.0	Core	24	48	48	120
Machining Skills – CNC Turning	ASC/N3548, V1.0	Core	24	48	48	120
Applied Mathematics	ASC/N9835, V1.0	Non-Core	18	36	36	90
Employability Skills(120 hours)	DGT/VSQ/0104	Non-Core	48	72		120
Engine Assembly	ASC/N3622, V1.0	Elective	18	36	36	90
Vehicle Assembly	ASC/N3623,V1.0					
Exports and Packaging	ASC/N6112, V1.0	Elective	18	36	36	90
Forklift Driving	ASC/N6113,V1.0					

## Subject Details

### Semester-1

#### Subject: 1 Metrology (Measurements)

*Mapped to ASC/N6314, v1.0*

### Terminal Outcomes:

- The terminal outcome of a study or training in metrology is typically the acquisition of comprehensive knowledge and skills related to measurement science and precision measurement techniques.

<b>Duration: &lt;24:00&gt;</b>	<b>Duration: &lt;48:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li><b>Measurement Concepts:</b> Understand the basic concepts of measurement, including accuracy, precision, repeatability, reproducibility, and trueness.</li> <li><b>International System of Units (SI):</b> Familiarize oneself with the SI units and their definitions, as well as the history and significance of the international measurement system.</li> <li><b>Traceability:</b> Comprehend the importance of traceability, which refers to the establishment of a measurement result's linkage to a recognized reference standard.</li> <li><b>Measurement Processes:</b> Learn about the steps involved in conducting precise measurements, including selection of appropriate instruments, calibration, data collection, and analysis.</li> </ul>	<p><b>Instrument Familiarity:</b> Gain hands-on experience with a variety of measurement instruments, such as calipers, micrometers, gauges, comparators, and coordinate measuring machines (CMMs).</p> <p><b>Instrument Operation:</b> Learn how to operate different measurement instruments correctly, ensuring accurate and consistent results.</p> <p><b>Calibration Techniques:</b> Develop proficiency in calibrating measurement instruments using reference standards, adjusting instruments as needed to ensure accuracy.</p> <p><b>Measurement Setup:</b> Understand how to properly set up measurement systems, ensuring stability, precision, and repeatability.</p>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	
<p><b>Calipers:</b> Used to measure the dimensions of objects, calipers come in various forms, including vernier calipers, digital calipers, and dial calipers.</p> <p><b>Micrometers:</b> These precision instruments measure very small distances with high accuracy. Types include outside micrometers, inside micrometers, and depth micrometers.</p> <p><b>Height Gauges:</b> Used to measure the height of objects and distances between surfaces, height gauges provide accurate vertical measurements.</p> <p><b>Dial Indicators:</b> These devices measure small linear distances and are often used in conjunction with other tools for comparative measurements.</p> <p><b>Gauge Blocks:</b> Precision metal blocks of known dimensions used as a reference for calibrating measuring equipment.</p>	

## Subject: 2 Workshop Technology

### Mapped to ASC/N3545 ,v1.0

#### Terminal Outcomes:

- **Hands-On Skills:** Participants should have developed practical skills in using various tools, machinery, and equipment commonly found in workshop environments. This includes skills such as machining, welding, woodworking, metal fabrication, and more.
- **Safety Awareness:** Understanding and implementing safety protocols and practices is a key outcome. Graduates should be well-versed in using personal protective equipment (PPE) and following safety guidelines to prevent accidents and injuries.
- **Tool Proficiency:** Graduates should be proficient in using a wide range of hand tools, power tools, and specialized equipment relevant to their specific area of study within workshop technology.

<b>Duration: &lt;24:00&gt;</b>	<b>Duration: &lt;48:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• <b>Material Properties:</b> Understand the properties of different materials used in workshop environments, including metals, plastics, ceramics, and composites.</li> <li>• <b>Machine Tools and Operations:</b> Learn about different types of machine tools, their components, and their operational principles for shaping, cutting, drilling, and machining materials.</li> <li>• <b>Manufacturing Processes:</b> Gain knowledge of various manufacturing processes, including casting, forging, welding, machining, and forming, and understands their applications and limitations.</li> <li>• <b>Workshop Safety:</b> Understand safety protocols, hazard identification, risk assessment, and the importance of adhering to safety guidelines in a workshop setting.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Machine Operation:</b> Gain hands-on experience in operating machine tools such as lathes, milling machines, grinders, and drilling machines to shape and finish materials accurately.</li> <li>• <b>Welding and Joining Skills:</b> Acquire skills in various welding and joining techniques, including arc welding, gas welding, and spot welding, for fabricating and repairing metal structures.</li> <li>• <b>Machining Skills:</b> Practice machining processes such as turning, milling, drilling, and grinding to create accurate and precise components.</li> <li>• <b>Fabrication Techniques:</b> Gain experience in fabricating components by using various techniques, including cutting, welding, bending, and assembly.</li> <li>• <b>Assembly and Disassembly:</b> Learn how to assemble and disassemble complex mechanical and structural components accurately and safely.</li> <li>• <b>Safety Practices:</b> Acquire practical knowledge of workshop safety protocols, personal protective</li> </ul>



	equipment (PPE) usage, and hazard identification to ensure a safe work environment.
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	
<ul style="list-style-type: none"> <li>• Hand Tools:</li> <li>• Wrenches: Various types of wrenches for tightening and loosening nuts and bolts.</li> <li>• Screwdrivers: Different sizes and types of screwdrivers for driving screws.</li> <li>• Pliers: Used for gripping, bending, cutting, and holding objects.</li> <li>• Hammers: Different types of hammers for striking, shaping, and driving nails.</li> <li>• Chisels: Used for cutting and shaping materials like wood and metal.</li> <li>• Files: Used for smoothing and shaping surfaces of materials.</li> <li>• Saws: Different saws, including hacksaws and hand saws, for cutting various materials.</li> <li>• Power Tools:</li> <li>• Drills: Electric drills for drilling holes in various materials.</li> <li>• Grinders: Used for grinding, polishing, and shaping materials.</li> <li>• Sanders: Electric sanders for smoothing surfaces.</li> <li>• Power Saws: Circular saws, jigsaws, and reciprocating saws for precise cutting.</li> <li>• Measurement and Layout Tools:</li> <li>• Tape Measures and Rulers: Used for measuring lengths and dimensions.</li> <li>• Squares and Calipers: For accurate measurements and marking right angles.</li> <li>• Levels: Used to ensure level and plumb surfaces.</li> <li>• Marking Tools: Such as pencils, markers, and scribes for marking materials.</li> <li>• Welding and Cutting Tools:</li> <li>• Welding Machines: For joining metal parts through welding processes like MIG, TIG, and arc welding.</li> <li>• Cutting Torches: Used for cutting metal using oxy-fuel processes.</li> <li>• Safety gears: Safety shoes, ear plug, goggles, gloves, helmet, first-aid kit</li> </ul>	

## Subject: 3 Engineering Drawing

### Mapped to ASC/N6458 ,v1.0

#### Terminal Outcomes:

- The terminal outcomes of studying engineering drawing involve achieving a comprehensive understanding of technical drawing principles and acquiring the skills to create accurate and detailed drawings used in engineering, design, and manufacturing processes.
- Technical Drawing Proficiency: Develop the ability to create clear, accurate, and standardized technical drawings that convey design details, dimensions, and other essential information.
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<b>Duration:</b> <24:00>	<b>Duration:</b> <48:00>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Geometric Construction: Develop a strong foundation in geometric</li> </ul>	<ul style="list-style-type: none"> <li>• Drawing Instruments and Tools: Develop proficiency in using drawing</li> </ul>

<p>construction techniques, including the construction of lines, angles, circles, and polygons using basic drawing tools.</p> <ul style="list-style-type: none"> <li>• Orthographic Projection: Understand the principles of orthographic projection, including first-angle and third-angle projection, and how to create multiple views of three-dimensional objects.</li> <li>• Isometric and Oblique Drawings: Learn about isometric and oblique drawings, which provide a three-dimensional representation of objects on a two-dimensional plane.</li> <li>• Dimensioning and Tolerance Principles: Acquire knowledge of dimensioning practices, including placement, types of dimensions, and tolerance methods to communicate design requirements accurately.</li> <li>• Sectional Views and Hatching: Understand how to create sectional views to reveal internal details of objects and how to use hatching patterns to indicate different materials and surface finishes.</li> <li>• Bill of Materials (BOM): Acquire skills in creating and interpreting Bill of Materials, which list all components required for the construction of a product.</li> </ul>	<p>instruments such as pencils, rulers, compasses, protractors, and specialized drafting tools to produce precise and legible technical drawings.</p> <ul style="list-style-type: none"> <li>• Orthographic Projection: Gain practical experience in creating orthographic projections, which involve accurately representing three-dimensional objects in two-dimensional views.</li> <li>• Isometric and Perspective Drawings: Learn to create isometric and perspective drawings to provide a visual representation of objects from different angles, aiding in design visualization.</li> <li>• Dimensioning and Tolerance: Acquire skills in applying accurate dimensions, tolerances, and geometric tolerance to communicate size, shape, and fit requirements effectively.</li> <li>• Sectional Views: Develop the ability to create sectional views that reveal internal features of complex objects, aiding in illustrating their structure and design.</li> <li>• Detail and Assembly Drawings: Learn to create detailed drawings of individual parts and assembly drawings that show how different components fit together in a product.</li> <li>• Technical Symbols and Notations: Familiarize yourself with engineering symbols, abbreviations, and annotations used in technical drawings to convey information clearly.</li> <li>•</li> </ul>
<p><b>Classroom Aids:</b></p>	
<p>Whiteboard, marker pen, projector</p>	
<p><b>Tools, Equipment and Other Requirements</b></p>	
<p>Drawing Instruments:</p> <ul style="list-style-type: none"> <li>• Drafting Board or Table: A large, flat surface with a parallel straightedge used as a base for drawing.</li> <li>• T-Square: A T-shaped ruler used to draw horizontal lines and align other tools.</li> </ul>	

- Triangles: 30-60-90 and 45-45-90 triangles for drawing angles and lines accurately.
  - Compass: Used to draw circles and arcs of different sizes.
  - Protractors: Measure and draw angles accurately.
  - Curves and French Curves: Templates with various curves for drawing complex shapes.
- Pencils and Pens:**
- Mechanical Pencils: Used for precise lines and dimensions.
  - Technical Drawing Pens: Specialized pens with different nib sizes for varying line thicknesses.
- Templates and Stencils:**
- Lettering Stencils: Used for consistent and neat lettering on the drawing.
  - Symbols and Shape Templates: Templates with standard symbols and shapes for accurate representation.
- Scale Rulers:**
- Architectural Scale Ruler: Used to convert measurements from the drawing to real-world dimensions.
  - Engineering Scale Ruler: Provides various scales for different types of drawings.
- Erasing Tools and Accessories:**
- Erasing Shields: Thin metal or plastic sheets used to protect areas while erasing.
  - Eraser: Used to remove pencil marks and mistakes.
- Coloring Tools:**
- Colored Pencils or Markers: Used to highlight or differentiate specific parts of the drawing.
- Drawing Paper and Tracing Paper:**
- Drawing Paper: High-quality paper suitable for pencil and ink drawings.
  - Tracing Paper: Transparent paper used for copying and tracing.

## Subject: 4 Engine Assembly

### Mapped to ASC/N3622 ,v1.0

#### Core-Elective-1

#### Terminal Outcomes:

- The terminal outcomes of "Engine Assembly" involve achieving a comprehensive understanding of the processes, principles, and skills related to assembling internal combustion engines. This typically covers the various components, techniques, and procedures involved in building functional engines used in vehicles, machinery, and other applications.

<b>Duration: &lt;18:00&gt;</b>	<b>Duration: &lt;36:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Internal Combustion Engine Basics: Understand the fundamental principles of internal combustion engines, including the four-stroke cycle, combustion processes, and engine classifications.</li> <li>• Engine Components and Functions: Gain knowledge of the different</li> </ul>	<ul style="list-style-type: none"> <li>• Component Identification: Develop the ability to identify and differentiate various engine components, including cylinders, pistons, valves, camshafts, and crankshafts.</li> <li>• Fastener Handling and Torque Application: Gain proficiency in handling and applying correct torque to</li> </ul>

<p>components within an engine, such as cylinders, pistons, crankshafts, camshafts, valves, and their functions within the engine's operation.</p> <ul style="list-style-type: none"> <li>• <b>Engineering Drawings and Diagrams:</b> Develop the ability to interpret engineering drawings, diagrams, and schematics to understand the arrangement and relationships of engine components.</li> <li>• <b>Fasteners and Torque:</b> Understand the types of fasteners used in engine assembly, their torque specifications, and the importance of proper torque application.</li> <li>• <b>Assembly Sequencing:</b> Understand the logical sequence for assembling engine components to ensure efficient and error-free assembly.</li> </ul>	<p>fasteners, such as bolts and nuts, using torque wrenches and other tools.</p> <ul style="list-style-type: none"> <li>• <b>Seal and Gasket Installation:</b> Learn how to properly install seals and gaskets to prevent leaks and ensure the integrity of engine components.</li> <li>• <b>Component Alignment and Timing:</b> Practice aligning and timing critical components such as camshafts, crankshafts, and valves to ensure proper engine operation.</li> <li>• <b>Cylinder Head Assembly:</b> Develop expertise in assembling cylinder heads, including valve installation, valve lash adjustment, and proper seating.</li> <li>• <b>Piston and Connecting Rod Installation:</b> Acquire skills in installing pistons, connecting rods, piston rings, and ensuring proper orientation and fitment.</li> <li>• <b>Safe Work Practices:</b> Cultivate a strong understanding of safety protocols, personal protective equipment (PPE) usage, and hazard identification specific to engine assembly.</li> <li>• <b>Precision Measurement:</b> Develop proficiency in using measurement tools like micrometers, calipers, and gauges to ensure accurate component fitment.</li> <li>• <b>Ergonomics and Workspace Organization:</b> Understand the importance of ergonomics and proper workspace organization for efficient and safe assembly.</li> <li>•</li> </ul>
<p><b>Classroom Aids:</b></p>	
<p>Whiteboard, marker pen, projector</p>	
<p><b>Tools, Equipment and Other Requirements</b></p>	
<ul style="list-style-type: none"> <li>• <b>Engine Stand:</b> A fixture that holds the engine securely, allowing easy access to all sides for assembly and disassembly.</li> <li>• <b>Torque Wrenches:</b> Used to apply specific torque to fasteners, ensuring proper tightness without over-tightening or under-tightening.</li> <li>• <b>Socket and Ratchet Sets:</b> Essential for removing and tightening various fasteners, including bolts and nuts.</li> <li>• <b>Engine Hoist or Crane:</b> Used to lift and position heavy engine blocks and assemblies during installation.</li> <li>• <b>Engine Lifting Plate:</b> Attached to the cylinder heads or engine block to provide lifting points for the engine crane.</li> <li>• <b>Piston Ring Compressor:</b> Used to compress piston rings for easier insertion into the cylinder bore.</li> <li>• <b>Connecting Rod Alignment Tool:</b> Ensures proper alignment of connecting rod bearings</li> </ul>	

during assembly.

- Engine Gasket Kits: Complete sets of gaskets and seals required for sealing the engine components.
- Camshaft Bearing Installation Tool: Used to install camshaft bearings accurately.
- Engine Bearings: Main bearings and rod bearings for supporting rotating components.
- Engine Lube: Assembly lubricants and engine oil for lubricating components during assembly.
- Crankshaft Turning Tool: Facilitates turning the crankshaft during assembly to access different bearing surfaces.
- Feeler Gauges: Used to measure clearances between components, such as valve clearances.

## Subject: 5 Vehicle Assembly

### Mapped to ASC/N3623 ,v1.0

#### Core-Elective-2

#### Terminal Outcomes:

- Terminal outcomes of "Vehicle Assembly" encompass the overall knowledge, skills, and competencies that students are expected to achieve by the end of the course. These outcomes reflect the comprehensive understanding of vehicle assembly processes and principles.
- Comprehensive Vehicle Knowledge: Demonstrate a comprehensive understanding of the components, systems, and subassemblies that make up a vehicle, including chassis, powertrain, electrical systems, suspension, steering, braking, and safety features.
- Component Integration: Effectively integrate various vehicle components, subassemblies, and systems to create a functional and safe vehicle while adhering to engineering specifications.

<b>Duration: &lt;18:00&gt;</b>	<b>Duration: &lt;36:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Vehicle Components and Systems: Gain comprehensive knowledge of the various components and systems that make up a vehicle, including chassis, powertrain, suspension, steering, braking, electrical systems, and more.</li> <li>• Vehicle Architecture and Layout: Understand different vehicle architectures, layouts, and body styles, and how they influence component placement and overall design.</li> <li>• Quality Control and Standards: Understand quality control practices, standards, and specifications in vehicle assembly to ensure compliance with industry regulations and safety requirements.</li> <li>• Vehicle Safety and Regulations: Develop an understanding of safety regulations, crash testing, and safety systems integration to ensure compliance with safety standards.</li> <li>• Environmental Considerations: Learn about environmental regulations, sustainability practices, and waste management in vehicle manufacturing and assembly.</li> </ul>	<ul style="list-style-type: none"> <li>• Component Familiarity: Develop a comprehensive understanding of the different components that make up a vehicle, including the chassis, engine, transmission, suspension, electrical systems, and more.</li> <li>• Fastener Handling and Torque Application: Gain proficiency in handling and applying correct torque to fasteners, such as bolts, nuts, and screws, using torque wrenches and other tools.</li> <li>• Subassembly Integration: Learn how to integrate subassemblies such as engines, transmissions, and suspension components into the vehicle structure.</li> <li>• Alignment and Positioning: Acquire skills in aligning components accurately to ensure proper fitment and functionality within the vehicle.</li> <li>• Wiring and Electrical Systems: Develop expertise in routing and connecting wiring harnesses, electrical components, and systems such as lighting, sensors, and entertainment systems.</li> <li>• Fluid Systems Integration: Understand</li> </ul>

<ul style="list-style-type: none"> <li>• <b>Vehicle Dynamics and Handling:</b> Understand vehicle dynamics principles, including weight distribution, center of gravity, and suspension characteristics that affect handling and ride quality.</li> </ul>	<p>how to integrate fluid systems such as fuel, brake, cooling, and lubrication systems into the vehicle assembly.</p> <ul style="list-style-type: none"> <li>• <b>Interior and Exterior Trim:</b> Practice installing interior components like seats, dashboard panels, and exterior components like bumpers, lights, and trim.</li> <li>• <b>Suspension and Steering Assembly:</b> Learn how to assemble and align suspension and steering components to ensure proper handling and ride quality.</li> <li>• <b>Brake System Integration:</b> Gain skills in assembling and connecting brake components, including calipers, rotors, pads, and brake lines.</li> <li>• <b>Exhaust System Integration:</b> Develop knowledge of integrating exhaust components, such as exhaust pipes, mufflers, and catalytic converters.</li> <li>• <b>Wheel and Tire Installation:</b> Acquire skills in mounting and balancing wheels and tires to ensure proper alignment, balance, and safety.</li> </ul>
<p><b>Classroom Aids:</b></p>	
<p>Whiteboard, marker pen, projector</p>	
<p><b>Tools, Equipment and Other Requirements</b></p>	
<ul style="list-style-type: none"> <li>• <b>Assembly Line Conveyors:</b> Transport components and vehicles along the assembly line, facilitating efficient movement and assembly.</li> <li>• <b>Torque Wrenches:</b> Used to apply specific torque to fasteners, ensuring proper tightness without over-tightening or under-tightening.</li> <li>• <b>Air Tools:</b> Pneumatic tools such as impact wrenches, drills, and grinders for faster and consistent fastener tightening and other tasks.</li> <li>• <b>Hoists and Lifts:</b> Hydraulic lifts and hoists for raising vehicles to different heights, allowing easier access to components.</li> <li>• <b>Fixture Tables:</b> Precision tables with adjustable fixtures to hold and align components during assembly.</li> <li>• <b>Screwdriver Sets:</b> Electric or pneumatic screwdrivers for consistent and efficient fastener installation.</li> <li>• <b>Pliers and Cutters:</b> Various types for gripping, bending, and cutting wires, hoses, and other components.</li> <li>• <b>Electrical Testers and Multimeters:</b> Used to test electrical connections, circuits, and components.</li> <li>• <b>Wiring Harness Tools:</b> Tools for routing and securing wiring harnesses and connectors.</li> <li>• <b>Wire Crimping Tools:</b> Used to crimp connectors onto wires for secure electrical connections.</li> <li>• <b>Lubrication and Fluid Dispensing Equipment:</b> Dispensers for oils, lubricants, and fluids needed during assembly.</li> <li>• <b>Bolt and Nut Bin Systems:</b> Organize and store fasteners for easy access and efficient</li> </ul>	

assembly.

- Exhaust System Tools: Clamps, hangers, and tools for attaching exhaust components.
- Brake System Tools: Tools for bleeding and testing brake systems, including brake caliper tools.
- Suspension and Steering Tools: Tools for installing suspension components and aligning wheels.
- Engine and Transmission Lifts: Specialty lifts for installing engines and transmissions into vehicles.
- Wheel and Tire Mounting Equipment: Mounting machines and balancers for installing tires and wheels.
- Alignment Equipment: Tools and equipment for aligning wheels and steering components.
- Diagnostic Tools: Scanners and diagnostic equipment for identifying and troubleshooting vehicle issues.



## Subject: 6 Industrial Safety

### Mapped to ASC/N9833 ,v1.0

#### Terminal Outcomes:

- Terminal outcomes of "Industrial Safety" encompass the overall knowledge, skills, and competencies that students are expected to achieve by the end of the course. These outcomes reflect a comprehensive understanding of safety principles, practices, regulations, and their application in industrial settings
- Safety Principles and Concepts: Demonstrate a thorough understanding of fundamental safety principles, concepts, and theories that apply to various industrial environments.
- Hazard Identification and Risk Assessment: Proficiently identify potential workplace hazards, assess risks, and develop strategies to mitigate and manage these risks effectively.
- Personal Protective Equipment (PPE): Expertly select and use appropriate PPE for various workplace hazards, ensuring worker protection and compliance.
- Safe Work Practices: Implement and advocate for safe work practices, ergonomic considerations, and proper body mechanics to prevent injuries.

Duration: <18:00>	Duration: <36:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>• Safety Principles and Theories: Develop a strong foundation in safety principles, theories, and models that underlie the identification, assessment, and management of workplace hazards.</li> <li>• Hazard Recognition and Assessment: Understand techniques for recognizing various types of workplace hazards, including physical, chemical, biological, ergonomic, and psychosocial hazards.</li> <li>• Safety Culture and Behaviour: Understand the importance of fostering a strong safety culture within organizations and the role of human behaviour in safety practices.</li> <li>• Personal Protective Equipment (PPE): Understand the types, selection criteria, and proper usage of PPE to ensure worker protection from various hazards.</li> </ul>	<ul style="list-style-type: none"> <li>• Hazard Identification and Assessment: Develop the ability to identify potential workplace hazards through site inspections, risk assessments, and observation of work processes.</li> <li>• Risk Mitigation Strategies: Learn how to implement practical strategies to mitigate risks, such as engineering controls, administrative controls, and personal protective equipment (PPE).</li> <li>• Safety Inspections and Audits: Gain hands-on experience in conducting safety inspections and audits, identifying safety deficiencies, and recommending corrective actions.</li> <li>• Emergency Response Simulations: Participate in emergency response simulations to practice crisis management, evacuation procedures, and coordination during simulated emergencies.</li> <li>• PPE Selection and Usage: Develop skills in selecting and using appropriate personal protective equipment (PPE) for various workplace hazards and tasks.</li> <li>• First Aid and CPR Training: Acquire practical skills in administering basic first aid and cardiopulmonary</li> </ul>

	<p>resuscitation (CPR) in simulated scenarios.</p> <ul style="list-style-type: none"> <li>• Fire Extinguisher Training: Participate in fire extinguisher training to understand the proper use of fire extinguishers and simulate fire emergency scenarios.</li> </ul>
<p><b>Classroom Aids:</b></p>	
<p>Whiteboard, marker pen, projector</p>	
<p><b>Tools, Equipment and Other Requirements</b></p>	
<ul style="list-style-type: none"> <li>• Personal Protective Equipment (PPE):</li> <li>• Hard Hats: Protect the head from falling objects and impact.</li> <li>• Safety Glasses and Goggles: Protect the eyes from debris, chemicals, and projectiles.</li> <li>• Hearing Protection: Earplugs or earmuffs to protect against loud noise.</li> <li>• Respirators and Masks: Protect against harmful dust, fumes, and airborne contaminants.</li> <li>• Gloves: Different types for hand protection when handling hazardous materials or sharp objects.</li> <li>• Safety Footwear: Steel-toed boots or shoes to protect the feet from heavy objects and impacts.</li> <li>• Protective Clothing: Coveralls, aprons, and other specialized clothing to protect against chemicals, heat, and other hazards.</li> <li>• Fall Protection Equipment:</li> <li>• Safety Harnesses: Prevent falls from heights by securing workers to a fixed anchor point.</li> <li>• Lanyards and Lifelines: Attach to safety harnesses to prevent workers from falling.</li> <li>• Anchorage Points: Secure points for attaching fall protection equipment.</li> <li>• Fire Safety Equipment:</li> <li>• Fire Extinguishers: Portable devices to extinguish small fires.</li> <li>• Fire Blankets: Used to smother fires and protect against flames and heat.</li> <li>• Emergency Exit Signs and Lighting: Ensure safe evacuation during emergencies.</li> </ul>	

## Semester-2

### Subject: 1 Machining Skills-Drilling, Milling & Turning Mapped to ASC/N3546 ,v1.0

#### Terminal Outcomes:

- Terminal outcomes of "Machining Skills - Milling and Turning" encompass the overall knowledge, skills, and competencies that students are expected to achieve by the end of the course. These outcomes reflect a comprehensive understanding of machining principles, techniques, and practical application in milling and turning processes.
- Milling Machine Operation: Demonstrate proficiency in setting up and operating milling machines, including selecting cutting tools, work piece clamping, and tool path programming.
- Turning Lathe Operation: Exhibit the ability to set up and operate turning lathes, including work piece chucking, tool selection, and tool path programming.
- Machining Tools and Techniques: Gain comprehensive knowledge of various cutting tools, tool materials, feeds, speeds, and cutting parameters for milling and turning processes.

<b>Duration: &lt;24:00&gt;</b>	<b>Duration: &lt;48:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Machining Fundamentals: Develop a strong foundation in the fundamentals of machining, including terminology, processes, and the role of machining in manufacturing.</li> <li>• Metal Cutting Theory: Understand the mechanics of metal cutting, including chip formation, cutting forces, and tool wear, and their implications on machining operations.</li> <li>• Cutting Tools and Tool Materials: Gain knowledge of different types of cutting tools, tool geometry, tool materials, and their selection based on workpiece material and machining requirements.</li> <li>• Cutting Parameters: Learn about cutting speed, feed rate, and depth of cut as critical parameters that affect tool life, surface finish, and material removal rates.</li> <li>• Cutting Fluids and Lubrication: Understand the importance of cutting fluids in cooling, lubricating, and improving tool life and workpiece surface finish.</li> </ul>	<ul style="list-style-type: none"> <li>• Machine Setup and Operation: Develop proficiency in setting up and operating machining equipment, including selecting tools, workpiece positioning, and machine calibration.</li> <li>• Cutting Tool Handling and Setup: Acquire skills in handling cutting tools, tool inserts, and toolholders, and setting them up accurately for machining operations.</li> <li>• Workpiece Clamping and Fixturing: Learn how to securely clamp and fixture workpieces in machines to ensure stability during machining processes.</li> <li>• Tool Selection and Tool Changes: Develop the ability to select appropriate cutting tools for specific operations and perform tool changes effectively.</li> <li>• Toolpath Programming and CNC</li> </ul>

<ul style="list-style-type: none"> <li>• <b>Tool Wear and Failure Modes:</b> Learn about the causes of tool wear, different wear patterns, and strategies to mitigate premature tool failure.</li> <li>• <b>Surface Finish and Tolerances:</b> Gain insights into factors influencing surface finish, roughness measurements, and achieving desired dimensional tolerances.</li> </ul>	<p><b>Operation:</b> Gain practical experience in programming toolpaths for CNC machines, executing machining operations, and monitoring the process.</p> <ul style="list-style-type: none"> <li>• <b>Precision Measurement and Inspection:</b> Learn to use precision measuring instruments, such as calipers, micrometers, and dial indicators, to measure workpiece dimensions accurately.</li> <li>• <b>Surface Finish and Quality Control:</b> Acquire skills in achieving desired surface finishes and dimensional tolerances, and perform quality checks to ensure machining accuracy.</li> <li>• <b>Chip Control and Machining Dynamics:</b> Understand chip formation and control techniques to optimize material removal rates and prevent chip-related issues.</li> <li>• <b>Cutting Parameters Adjustment:</b> Develop the ability to adjust cutting parameters, such as cutting speed, feed rate, and depth of cut, for optimal machining performance.</li> <li>• <b>Tool Wear Monitoring and Replacement:</b> Learn to monitor tool wear during machining, recognize signs of wear, and replace tools when necessary.</li> <li>• <b>Facing, Contouring, and Profiling:</b> Practice facing, contouring, and profiling operations to achieve specific workpiece geometries and surface finishes.</li> <li>• <b>Drilling and Tapping Operations:</b> Acquire skills in drilling holes to precise depths, diameters, and thread tapping for threaded holes.</li> </ul>
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**Classroom Aids:**

Whiteboard, marker pen, projector

**Tools, Equipment and Other Requirements**

### **Drilling:**

- Drill Press: A machine used to drill holes accurately and efficiently.
- Drill Bits: Cutting tools designed for creating holes in various materials.
- Center Drills: Used for creating a starting point for accurate drilling.
- Countersink Tools: Used to create a recess for countersunk screws.
- Reamers: Used to enlarge and refine holes to precise dimensions.
- Tap and Die Sets: Used for threading holes and creating internal and external threads.
- Coolant Systems: Keep the drill bit cool and lubricated during the drilling process.
- Clamps and Vises: Secure workpieces in place for accurate drilling.

### **Milling:**

- Vertical Milling Machine: Used to perform milling operations vertically.
- Horizontal Milling Machine: Used for milling operations horizontally.
- Milling Cutters: Various types of cutters for different milling operations.
- End Mills: Cutting tools used for making precise cuts on the ends of workpieces.
- Face Mills: Used for machining large flat areas on workpieces.
- Fly Cutters: Single-point tools used for shallow cuts on the surface.
- Digital Readout (DRO): Provides precise measurements of milling machine movements.
- Milling Vises and Clamps: Hold workpieces securely during milling operations.
- Rotary Tables: Used for indexing and machining circular features.
- Coolant Systems: Keep the cutting tool and workpiece cool during milling.
- Machinist Squares and Angle Plates: Ensure accurate alignment and positioning.

### **Turning:**

- Lathe Machine: Used to perform turning operations on cylindrical workpieces.
- Chucks: Hold and secure workpieces on the lathe spindle.
- Turning Tools: Cutting tools used to remove material from the workpiece.
- Boring Bars: Used for enlarging holes and creating internal features.
- Parting Tools: Used to cut off workpieces from the main stock.
- Live Centers and Dead Centers: Support the workpiece during turning.
- Digital Readout (DRO): Provides precise measurements of lathe movements.
- Coolant Systems: Keep the cutting tool and workpiece cool during turning.
- Steady Rests and Follow Rests: Support long or flexible workpieces during turning.

## Subject: 2 Machining Skills-CNC Milling

### Mapped to ASC/N3547 ,v1.0

#### Terminal Outcomes:

- Terminal outcomes of “Machining Skills - CNC Milling” encompass the overall knowledge, skills, and competencies that students are expected to achieve by the end of the course. These outcomes reflect a comprehensive understanding of CNC milling processes, programming, and practical application.
- CNC Mill Setup and Operation: Demonstrate proficiency in setting up and operating CNC milling machines, including loading tools, work piece clamping, and machine calibration.
- Tool Selection and Programming: Gain comprehensive knowledge of tool selection, cutting parameters, and CNC programming techniques for various milling operations.

<b>Duration: &lt;24:00&gt;</b>	<b>Duration: &lt;48:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• CNC Milling Fundamentals: Develop a strong foundation in the principles and concepts of CNC milling, including terminology, machine components, and the role of CNC milling in manufacturing.</li> <li>• CNC Machine Architecture: Understand the components of CNC milling machines, their functions, and how they contribute to accurate and precise machining.</li> <li>• Tooling and Tool Management: Gain knowledge of various cutting tools, tool holders, tool selection criteria, and their use in CNC milling operations.</li> <li>• Cutting Parameters and Strategies: Learn about cutting speed, feed rate, depth of cut, and tool path strategies for different CNC milling operations.</li> </ul>	<ul style="list-style-type: none"> <li>• CNC Machine Setup and Calibration: Develop proficiency in setting up CNC milling machines, including tool loading, work piece clamping, and machine calibration.</li> <li>• Tool Selection and Tool holder Setup: Acquire skills in selecting appropriate cutting tools, inserting them into tool holders, and securing them for machining operations.</li> <li>• CAD/CAM Software Familiarity: Gain hands-on experience with computer-aided design (CAD) and computer-aided manufacturing (CAM) software for generating CNC milling tool paths.</li> <li>• CNC Programming and Code Interpretation: Learn to write CNC programs using G-codes and M-codes, as well as interpret existing CNC code for machining operations.</li> <li>• Tool path Generation and Simulation: Practice generating tool paths using CAD/CAM software, simulating machining operations, and verifying programs for collisions and accuracy.</li> <li>• Work piece Fixture and Alignment: Develop the ability to securely fixture work pieces in CNC milling machines, ensuring proper alignment for precise machining.</li> <li>• Safety Protocols and Machine Maintenance: Adhere to safety</li> </ul>

	<p>protocols, wear appropriate personal protective equipment (PPE), and perform basic machine maintenance.</p>
<p><b>Classroom Aids:</b></p>	
<p>Whiteboard, marker pen, projector</p>	
<p><b>Tools, Equipment and Other Requirements</b></p>	
<ul style="list-style-type: none"> <li>• <b>CNC Milling Machine:</b> Computer-controlled machine tool that uses rotating cutting tools to remove material from a work piece.</li> <li>• <b>Tool Holders:</b> Devices that secure cutting tools in the spindle of the CNC milling machine.</li> </ul> <p><b>Cutting Tools:</b></p> <ul style="list-style-type: none"> <li>• <b>End Mills:</b> Various types for different milling operations, such as ball end mills, flat end mills, and more.</li> <li>• <b>Face Mills:</b> For machining large flat surfaces.</li> <li>• <b>Drill Mills:</b> Combination tools for drilling and milling.</li> <li>• <b>Specialty Tools:</b> Such as chamfer mills, thread mills, and reamers.</li> <li>• <b>Tool Changer:</b> Automatic or semi-automatic mechanism that changes cutting tools during the machining process.</li> </ul> <p><b>Work holding Devices:</b></p> <ul style="list-style-type: none"> <li>• <b>Vice:</b> Holds workpieces securely on the CNC milling table.</li> <li>• <b>Clamps and Fixtures:</b> Secure workpieces during machining to prevent movement.</li> </ul> <p><b>CNC Controller:</b> Computer or controller unit that interprets the G-code instructions and controls the CNC milling machine's movements.</p> <ul style="list-style-type: none"> <li>• <b>CAD/CAM Software:</b> Computer-aided design (CAD) and computer-aided manufacturing (CAM) software used to create and program toolpaths for CNC milling.</li> <li>•</li> </ul>	

## Subject: 3 Machining Skills-CNC Turning

### Mapped to ASC/N3548 ,v1.0

#### Terminal Outcomes:

- Terminal outcomes of "Machining Skills - CNC Turning" encompass the overall knowledge, skills, and competencies that students are expected to achieve by the end of the course. These outcomes reflect a comprehensive understanding of CNC turning processes, programming, and practical application.
- CNC Turning Setup and Operation: Demonstrate proficiency in setting up and operating CNC turning machines, including loading tools, work piece clamping, and machine calibration.
- Tool Selection and Programming: Gain comprehensive knowledge of tool selection, cutting parameters, and CNC programming techniques for various turning operations.

Duration: <24:00>	Duration: <48:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>• CNC Turning Fundamentals: Develop a strong foundation in the principles and concepts of CNC turning, including terminology, machine components, and the role of CNC turning in manufacturing.</li> <li>• CNC Machine Architecture: Understand the components of CNC turning machines, their functions, and how they contribute to accurate and precise machining.</li> <li>• Tooling and Tool Management: Gain knowledge of various cutting tools, tool holders, tool selection criteria, and their use in CNC turning operations.</li> <li>• Cutting Parameters and Strategies: Learn about cutting speed, feed rate, depth of cut, and tool path strategies for different CNC turning operations.</li> </ul>	<ul style="list-style-type: none"> <li>• CNC Machine Setup and Calibration: Develop proficiency in setting up and operating CNC turning machines, including tool loading, work piece clamping, and machine calibration.</li> <li>• Tool Selection and Tool holder Setup: Acquire skills in selecting appropriate cutting tools, inserting them into tool holders, and securing them for turning operations.</li> <li>• CAD/CAM Software Familiarity: Gain hands-on experience with computer-aided design (CAD) and computer-aided manufacturing (CAM) software for generating CNC turning tool paths.</li> <li>• CNC Programming and Code Interpretation: Learn to write CNC programs using G-codes and M-codes, as well as interpret existing CNC code for turning operations.</li> <li>• Tool path Generation and Simulation: Practice generating tool paths using CAD/CAM software, simulating machining operations, and verifying programs for collisions and accuracy.</li> <li>• Work piece Fixture and Alignment:</li> </ul>



	<p>Develop the ability to securely fixture work pieces in CNC turning machines, ensuring proper alignment for precise machining.</p> <ul style="list-style-type: none"> <li>•</li> </ul>
<p><b>Classroom Aids:</b></p>	
<p>Whiteboard, marker pen, projector</p>	
<p><b>Tools, Equipment and Other Requirements</b></p>	
<ul style="list-style-type: none"> <li>• CNC Lathe Machine: Computer-controlled machine tool designed for CNC turning operations.</li> <li>• Chuck: A device that holds and secures the work piece while it rotates during machining.</li> <li>• Tool Holders: Hold cutting tools in position and allow them to move along different axes.</li> <li>• Cutting Tools:</li> <li>• Turning Inserts: Cutting tips that attach to the tool holders and remove material from the work piece.</li> <li>• Boring Bars: Used for enlarging holes and creating internal features.</li> <li>• Grooving Tools: Used for cutting grooves and slots.</li> <li>• Tool Pre-setter: Measures and sets the length and dimensions of cutting tools accurately.</li> <li>• Bar Feeder: Automatic mechanism for feeding long bar stock into the lathe for continuous machining.</li> <li>• Tailstock: Supports the other end of the work piece during machining and provides stability.</li> <li>• CNC Controller: Computer or controller unit that interprets the G-code instructions and controls the CNC lathe's movements.</li> <li>• CAD/CAM Software: Computer-aided design (CAD) and computer-aided manufacturing (CAM) software for creating and programming tool paths for CNC turning.</li> </ul>	

## Subject: 4 Exports & Packaging

### Mapped to ASC/N6112 ,v1.0

#### Core-Elective-1

#### Terminal Outcomes:

- Terminal outcomes of “Exports & Packaging” encompass the overall knowledge, skills, and competencies that students are expected to achieve by the end of the course. These outcomes reflect a comprehensive understanding of the processes involved in exporting goods and the principles of packaging.
- Export Logistics and Supply Chain: Understand the logistics and supply chain management aspects of exporting, including transportation modes, freight forwarding, and inventory management.
- Packaging Design Principles: Understand the principles of effective packaging design, including protection, aesthetics, branding, and sustainable packaging practices.
- Packaging Materials and Techniques: Gain knowledge of different packaging materials, techniques, and their suitability for various products and modes of transportation.
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Duration: <18:00>	Duration: <36:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>• International Trade Concepts: Develop a grasp of fundamental concepts in international trade, including export-import dynamics, trade barriers, and trade agreements.</li> <li>• Export Documentation: Understand various types of export documentation, such as invoices, packing lists, certificates of origin, and bills of lading, and their significance in international transactions.</li> <li>• Export Regulations and Compliance: Gain insights into export regulations, trade restrictions, export controls, and compliance with international trade laws.</li> <li>• Export Logistics and Supply Chain: Gain knowledge of the logistics and supply chain management aspects of exporting, including transportation modes, freight forwarding, and distribution.</li> <li>• Export Risk Management: Explore methods for managing risks associated with international trade, including currency fluctuations, political instability, and transportation issues.</li> <li>• Packaging Functions and Objectives:</li> </ul>	<ul style="list-style-type: none"> <li>• Export Documentation Preparation: Develop the ability to prepare and complete various export documents accurately, such as invoices, packing lists, certificates of origin, and customs declarations.</li> <li>• Market Research and Analysis: Acquire skills in conducting market research to identify potential export markets, assess market demand, and analyse competition.</li> <li>• Export Pricing Strategies: Practice developing competitive export pricing strategies based on cost calculations, market conditions, and customer preferences.</li> <li>• Packaging Design and Prototyping: Develop skills in designing packaging solutions that ensure product protection, aesthetics, and user-friendliness.</li> <li>• Packaging Material Selection: Gain hands-on experience in selecting appropriate packaging materials based on product requirements and transportation considerations.</li> <li>• Packaging Labeling and Compliance: Practice creating accurate and</li> </ul>

<p>Develop an understanding of the key functions of packaging, including protection, containment, communication, and convenience.</p> <ul style="list-style-type: none"> <li>• Packaging Design Principles: Gain insights into the principles of effective packaging design, including aesthetics, usability, and visual communication.</li> <li>• Packaging Regulations and Standards: Understand packaging regulations, labelling requirements, and compliance with international standards and regulations.</li> <li>• Packaging and Branding: Explore the role of packaging in branding, product differentiation, and consumer perception.</li> <li>• Packaging Cost Considerations: Develop knowledge of factors influencing packaging costs, including material choices, manufacturing processes, and transportation expenses.</li> <li>•</li> </ul>	<p>compliant packaging labels, including required information and regulatory requirements.</p> <ul style="list-style-type: none"> <li>• Packaging Testing and Quality Control: Acquire skills in conducting packaging tests to ensure durability, product fit, and compliance with standards.</li> <li>• Sustainable Packaging Practices: Explore practical approaches to designing eco-friendly packaging solutions that minimize environmental impact.</li> <li>• Packaging Machinery and Automation: Gain exposure to packaging machinery and automation technologies used in real-world packaging processes.</li> <li>•</li> </ul>
<p><b>Classroom Aids:</b></p>	
<p>Whiteboard, marker pen, projector</p>	
<p><b>Tools, Equipment and Other Requirements</b></p>	
<p>Packaging Materials:</p> <ul style="list-style-type: none"> <li>• Cardboard Boxes: Used for various-sized goods and products.</li> <li>• Wooden Crates: Provide sturdy protection for heavy or fragile items.</li> <li>• Pallets: Used for stacking and transporting goods efficiently.</li> <li>• Bubble Wrap: Provides cushioning and protection against impact.</li> <li>• Foam Packaging: Used to secure delicate items and prevent movement.</li> <li>• Stretch Film: Wraps around pallets to secure items in place.</li> <li>• Corrugated Sheets: Used for layering and separating items within packaging.</li> <li>• Tape: Packaging tape for sealing boxes and securing packaging materials.</li> </ul> <p>Labelling and Documentation:</p> <ul style="list-style-type: none"> <li>• Shipping Labels: Indicate shipping details, handling instructions, and barcodes.</li> <li>• Customs Labels: Include information required for customs clearance.</li> <li>• Packing List: Lists the contents and quantities of the shipment.</li> <li>• Commercial Invoice: Document for customs and billing purposes.</li> <li>• Bill of Lading: Records shipment details and serves as a receipt.</li> </ul> <p>Handling and Securing:</p> <ul style="list-style-type: none"> <li>• Strapping Tools: Used to secure boxes and bundles with strapping.</li> <li>• Dunnage Bags: Inflatable bags used to fill gaps in containers and prevent movement.</li> <li>• Corner Protectors: Prevent sharp edges from damaging packaging.</li> <li>• Tie-Down Straps: Secure items to pallets or within containers.</li> </ul> <p>Wrapping and Protection:</p> <ul style="list-style-type: none"> <li>• Shrink Wrap Machine: Applies heat to shrink wrap around products.</li> <li>• Heat Guns: Used to shrink wrap and provide a secure seal.</li> <li>• VCI (Vapor Corrosion Inhibitor) Packaging: Protects against corrosion during shipping and storage.</li> </ul>	

#### Handling and Moving Equipment:

- Forklifts: Used to lift and move heavy pallets and crates.
- Pallet Jacks: Manual or electric equipment for moving pallets.
- Hand Trucks and Dollies: Used to transport boxes and packages.
- Lifting Straps and Slings: Assist in lifting and moving heavy items safely.

## Subject: 5 Forklift Driving

*Mapped to ASC/N6113 ,v1.0*

### Core-Elective-2

#### Terminal Outcomes:

- Terminal outcomes of "Forklift Driving" encompass the overall knowledge, skills, and competencies that participants are expected to achieve by the end of the training. These outcomes reflect a comprehensive understanding of forklift operation, safety practices, and practical skills.
- Safe Forklift Operation: Demonstrate the ability to safely operate a forklift, including starting, stopping, steering, and manoeuvring the vehicle in various environments.
- Forklift Types and Components: Understand different types of forklifts, their components, and their specific applications.
- Load Handling and Placement: Develop proficiency in lifting, moving, and placing loads using a forklift while maintaining stability and balance.

<b>Duration: &lt;18:00&gt;</b>	<b>Duration: &lt;36:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Forklift Types and Components: Develop a clear understanding of different types of forklifts, their components, and how each type is used in various industrial settings.</li> <li>• Forklift Mechanics and Operation: Understand the mechanical components and operating principles of a forklift, including steering, braking, lifting, and tilting mechanisms.</li> <li>• Load Center and Stability: Gain insights into load center concepts and how they affect the stability and balance of a forklift when carrying loads.</li> <li>• Weight Distribution and Capacity: Learn about weight distribution, load capacities, and how to calculate safe load weights for different forklift configurations.</li> <li>• Forklift Controls and Instrumentation: Familiarize yourself with the controls, gauges, and indicators on a forklift dashboard and understand their</li> </ul>	<ul style="list-style-type: none"> <li>• Forklift Familiarization: Become familiar with the controls, instruments, and features of different types of forklifts.</li> <li>• Pre-Operation Inspection: Develop the ability to conduct a thorough pre-operation inspection of a forklift, checking for any defects or malfunctions.</li> <li>• Starting and Stopping: Practice starting and stopping a forklift smoothly and safely, understanding the importance of control and stability.</li> <li>• Steering and Maneuvering: Acquire skills in steering a forklift, making turns, and navigating through different types of pathways and spaces.</li> <li>• Load Handling Techniques: Learn practical techniques for picking up, moving, and placing loads using a forklift, while maintaining load stability.</li> <li>• Load Weight Assessment: Develop the ability to estimate and assess the weight of different loads, ensuring safe</li> </ul>

<p>functions during operation.</p> <ul style="list-style-type: none"> <li>• <b>Safety Regulations and Guidelines:</b> Understand local and international safety regulations, guidelines, and standards that govern forklift operation to ensure compliance and safe practices.</li> <li>• <b>Safe Operating Procedures:</b> Develop knowledge of safe operating procedures, including starting, stopping, steering, manoeuvring, and parking a forklift.</li> </ul>	<ul style="list-style-type: none"> <li>• lifting and transport.</li> <li>• <b>Loading and Unloading:</b> Practice loading and unloading materials from shelves, pallets, and other storage areas with accuracy and precision.</li> </ul>
<p><b>Classroom Aids:</b></p>	
<p>Whiteboard, marker pen, projector</p>	
<p><b>Tools, Equipment and Other Requirements</b></p>	
<p><b>Personal Protective Equipment (PPE):</b></p> <ul style="list-style-type: none"> <li>• <b>Helmet:</b> Protects the head from falling objects or impacts.</li> <li>• <b>Safety Shoes:</b> Provide foot protection against heavy objects and potential hazards.</li> <li>• <b>High Visibility Vest:</b> Improves visibility to other workers and vehicles.</li> </ul> <p><b>Forklift Equipment and Attachments:</b></p> <ul style="list-style-type: none"> <li>• <b>Forklift Trucks:</b> The main equipment used for lifting, moving, and transporting loads.</li> </ul> <p><b>Forklift Attachments:</b></p> <ul style="list-style-type: none"> <li>• <b>Forks:</b> Standard attachments for lifting pallets and loads.</li> <li>• <b>Clamps:</b> Used for handling barrels, drums, and other cylindrical objects.</li> <li>• <b>Rotators:</b> Rotate loads for better positioning and dumping.</li> <li>• <b>Sideshifters:</b> Shift forks laterally for precise load placement.</li> <li>• <b>Extensions:</b> Extend the length of forks for larger loads.</li> <li>• <b>Load Backrests:</b> Prevent loads from shifting backward.</li> </ul> <p><b>Controls and Instruments:</b></p> <ul style="list-style-type: none"> <li>• <b>Steering Wheel:</b> Controls the direction of the forklift.</li> <li>• <b>Accelerator and Brake Pedals:</b> Control speed and stopping.</li> <li>• <b>Hydraulic Controls:</b> Operate lifting and tilting functions.</li> <li>• <b>Horn:</b> Used to signal other workers and alert pedestrians.</li> <li>• <b>Dashboard:</b> Displays speed, direction, and operating information.</li> </ul>	

## Subject: 6 Applied Mathematics

### Mapped to ASC/N9835 ,v1.0

#### Terminal Outcomes:

- Terminal outcomes of "Applied Mathematics" encompass the overall knowledge, skills, and competencies that students are expected to achieve by the end of the course. These outcomes reflect a comprehensive understanding of mathematical concepts and their practical applications.
- Problem-Solving Skills: Develop proficient problem-solving skills by applying mathematical concepts to solve real-world problems across various disciplines.
- Mathematical Concepts Mastery: Attain a deep understanding of fundamental mathematical concepts, including algebra, calculus, geometry, and statistics.
- Mathematical Modelling: Acquire the ability to create mathematical models to represent and analyze real-world phenomena and situations.
- Data Analysis and Interpretation: Develop skills to analyze and interpret data using statistical techniques, graphs, and visualization tools.
- Engineering Applications: Apply mathematical principles to engineering problems, such as mechanics, thermodynamics, electrical circuits, and fluid dynamics.

<b>Duration: &lt;18:00&gt;</b>	<b>Duration: &lt;36:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• <b>Mathematical Concepts:</b> Gain a thorough understanding of core mathematical concepts, including algebra, calculus, geometry, and linear algebra.</li> <li>• <b>Mathematical Modelling:</b> Learn how to create mathematical models that represent real-world phenomena, systems, and relationships.</li> <li>• <b>Functions and Equations:</b> Understand the properties and behaviour of functions and equations, including polynomial, exponential, logarithmic, and trigonometric functions.</li> <li>• <b>Differential and Integral Calculus:</b> Develop proficiency in differential and integral calculus, including concepts of limits, derivatives, and integrals.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Data Analysis and Interpretation:</b> Acquire skills to collect, organize, and analyze data using statistical methods and tools.</li> <li>• <b>Mathematical Modelling:</b> Develop the ability to create mathematical models that represent real-world situations and phenomena accurately.</li> <li>• <b>Problem-Solving Strategies:</b> Apply mathematical techniques to solve practical problems in fields such as engineering, physics, economics, and more.</li> <li>• <b>Optimization Techniques:</b> Learn to optimize scenarios by applying mathematical methods to find optimal solutions in complex situations.</li> <li>• <b>Numerical Computations:</b> Gain practical experience in using numerical methods to solve mathematical problems that may not have analytical solutions.</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	
<ul style="list-style-type: none"> <li>• Math Reference Books and Textbooks:</li> </ul>	

- Resources that provide explanations, examples, and techniques for applying mathematical concepts.
- Online Calculators and Solvers:
- Web-based tools that perform specific mathematical calculations or solve equations.
- Mathematical Databases and Tables:
- References for mathematical constants, formulas, and tables.



## Subject 7: Introduction to Employability Skills (120 Hours)

### Mapped to DGT/VSQ/N0104

#### Terminal Outcomes:

- Discuss about Employability Skills in meeting the job requirements

<b>Duration: &lt;48:00&gt;</b>	<b>Duration: &lt;72:00&gt;</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Outline the importance of Employability Skills for the current job market and future of work</li> <li>• Self-Awareness and Personal Branding: Understand the importance of self-awareness, self-assessment, and personal branding in showcasing skills, strengths, and values to potential employers.</li> <li>• Communication Skills: Develop a strong foundation in effective verbal and written communication, including interpersonal communication, public speaking, and professional correspondence.</li> <li>• Teamwork and Collaboration: Understand the dynamics of effective teamwork, collaborative problem-solving, and building positive working relationships with colleagues.</li> <li>• Critical Thinking and Problem-Solving: Learn how to analyze complex situations, evaluate options, and make informed decisions using critical thinking and problem-solving techniques.</li> </ul>	<ul style="list-style-type: none"> <li>• Effective Communication: Develop the ability to communicate clearly and confidently through written, verbal, and nonverbal means, adapting communication style to different contexts and audiences.</li> <li>• Professional Email and Correspondence: Acquire skills in writing professional emails, memos, and reports that convey information accurately and professionally.</li> <li>• Active Listening: Practice active listening techniques to understand and respond effectively to colleagues, clients, and supervisors.</li> <li>• Teamwork and Collaboration: Learn how to work collaboratively within diverse teams, contribute ideas, and respect others' viewpoints.</li> <li>• Time Management and Organization: Develop skills to prioritize tasks, set goals, and manage time effectively to meet deadlines and deliver results.</li> <li>• Problem-Solving and Critical Thinking: Enhance problem-solving skills by identifying issues, analyzing situations, and generating innovative solutions.</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	
<b>Online Learning Platforms:</b>	
Websites like Coursera, LinkedIn Learning, and Udemy offer courses on communication, teamwork, time management, leadership, and other employability skills.	
<b>Career Development Workshops and Seminars:</b>	
Attend workshops and seminars organized by universities, career centers, and professional organizations to enhance skills and gain insights into job-seeking strategies.	
<b>Online Skill Assessments:</b>	

Platforms like Indeed Assessments or Skillshare provide assessments that evaluate your skill levels and offer targeted skill improvement recommendations.

**Networking Tools:**

LinkedIn and other professional networking platforms help you connect with professionals in your field, expand your network, and learn from others' experiences.

**Communication Tools:**

Video conferencing tools like Zoom and Microsoft Teams enhance remote communication skills and virtual collaboration.

**Presentation Software:**

Tools like Microsoft PowerPoint or Google Slides help in creating and delivering effective presentations.

# Annexure

## Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training Experience		Remarks
		Years	Specialization	Years	Specialization	
B.E/B.Tech	Mechanical/Automobile/ Electrical/ Electronics	4	Mechanical/ Automobile/ Electronics/ Instrumentation	1	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
B.E/B.Tech	Mechanical/Automobile/ Electrical/ Electronics	5	Mechanical/ Automobile/ Electronics/ Instrumentation	0	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
Diploma	Mechanical/Automobile/ Electrical/ Electronics	3	Mechanical/ Automobile/ Electronics	1	Mechanical/ Automobile/ Electronics	NA
Diploma	Mechanical/Automobile/ Electrical/ Electronics	4	Mechanical/ Automobile/ Electronics	0	Mechanical/ Automobile/ Electronics	NA
M.E/M.Tech	Mechanical/Automobile/ Electrical/ Electronics	2	Mechanical/Automobile/ Electrical/ Electronics	1	Mechanical/Automobile/ Electrical/ Electronics	NA
M.E/M.Tech	Mechanical/Automobile/ Electrical/ Electronics	3	Mechanical/Automobile/ Electrical/ Electronics	0	Mechanical/Automobile/ Electrical/ Electronics	NA

Trainer Certification	
Domain Certification	Platform Certification
“Machining and Assembly Technician, version 1.0”. Minimum accepted score is 80%.	“Recommended that the trainer is certified for the job role “Trainer (VET and Skills)”, Mapped to Qualification Pack: MEP/Q2601, V2.0” Minimum accepted score is 80%

## Assessor Requirements

Assessor Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training Experience		Remarks
		Years	Specialization	Years	Specialization	
B.E/B.Tech	Mechanical/Automobile/ Electrical/ Electronics	5	Mechanical/ Automobile/ Electronics/ Instrumentation	1	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
B.E/B.Tech	Mechanical/Automobile/ Electrical/ Electronics	6	Mechanical/ Automobile/ Electronics/ Instrumentation	0	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
Diploma	Mechanical/Automobile/ Electrical/ Electronics	4	Mechanical/ Automobile/ Electronics	1	Mechanical/ Automobile/ Electronics	NA
Diploma	Mechanical/Automobile/ Electrical/ Electronics	5	Mechanical/ Automobile/ Electronics	0	Mechanical/ Automobile/ Electronics	NA
M.E/M.Tech	Mechanical/Automobile/ Electrical/ Electronics	3	Mechanical/Automobile/ Electrical/ Electronics	1	Mechanical/Automobile/ Electrical/ Electronics	NA
M.E/M.Tech	Mechanical/Automobile/ Electrical/ Electronics	4	Mechanical/Automobile/ Electrical/ Electronics	0	Mechanical/Automobile/ Electrical/ Electronics	NA

Assessor Certification	
Domain Certification	Platform Certification
“Machining and Assembly Technician, version 1.0”. Minimum accepted score is 80%.	“Recommended that the Assessor is certified for the job role “Assessor (VET and Skills)”, Mapped to Qualification Pack: MEP/Q2701, V2.0” Minimum accepted score is 80%.

## Assessment Strategy

1. Assessment System Overview:
  - Batches assigned to the assessment agencies for conducting the assessment on SDMS/SIP or email
  - Assessment agencies send the assessment confirmation to VTP/TC looping SSC
  - Assessment agency deploys the ToA certified Assessor for executing the assessment
  - SSC monitors the assessment process & records
2. Testing Environment:
  - Confirm that the centre is available at the same address as mentioned on SDMS or SIP
  - Check the duration of the training.
  - Check the Assessment Start and End time to be as 10 a.m. and 5 p.m.
  - If the batch size is more than 30, then there should be 2 Assessors.
  - Check that the allotted time to the candidates to complete Theory & Practical Assessment is correct.
  - Check the mode of assessment—Online (TAB/Computer) or Offline (OMR/PP).
  - Confirm the number of TABs on the ground is correct to execute the Assessment smoothly.
  - Check the availability of the Lab Equipment for the particular Job Role.
3. Assessment Quality Assurance levels / Framework:
  - Question papers created by the Subject Matter Experts (SME)
  - Question papers created by the SME verified by the other subject Matter Experts
  - Questions are mapped with Semester-wise Curriculum.
  - Question papers are prepared considering that level 1 to 3 are for the unskilled & semi-skilled individuals, and level 4 and above are for the skilled, supervisor & higher management
  - Assessor must be ToA certified & trainer must be ToT Certified
  - Assessment agency must follow the assessment guidelines to conduct the assessment
4. Types of evidence or evidence-gathering protocol:
  - Time-stamped & geotagged reporting of the assessor from assessment location
  - Centre photographs with signboards and scheme specific branding
  - Biometric or manual attendance sheet (stamped by TP) of the trainees during the training period
  - Time-stamped & geotagged assessment (Theory + Viva + Practical) photographs & videos
5. Method of verification or validation:
  - Surprise visit to the assessment location
  - Random audit of the batch
  - Random audit of any candidate
6. Method for assessment documentation, archiving, and access
  - Hard copies of the documents are stored
  - Soft copies of the documents & photographs of the assessment are uploaded / accessed from Cloud Storage

- Soft copies of the documents & photographs of the assessment are stored in the Hard Drives

## References

## Glossary

Term	Description
<b>Declarative Knowledge</b>	Declarative knowledge refers to facts, concepts and principles that need to be known and/or understood in order to accomplish a task or to solve a problem.
<b>Key Learning Outcome</b>	Key learning outcome is the statement of what a learner needs to know, understand and be able to do in order to achieve the terminal outcomes. A set of key learning outcomes will make up the training outcomes. Training outcome is specified in terms of knowledge, understanding (theory) and skills (practical application).
<b>OJT</b>	On-the-job training (Mandatory); trainees are mandated to complete specified hours of training on site
<b>Procedural Knowledge</b>	Procedural knowledge addresses how to do something, or how to perform a task. It is the ability to work, or produce a tangible work output by applying cognitive, affective or psychomotor skills.
<b>Training Outcome</b>	Training outcome is a statement of what a learner will know, understand and be able to do upon the completion of the training.
<b>Terminal Outcome</b>	Terminal outcome is a statement of what a learner will know, understand and be able to do upon the completion of a module. A set of terminal outcomes help to achieve the training outcome.

## Acronyms and Abbreviations

<b>NOS</b>	National Occupational Standard(s)
<b>NSQF</b>	National Skills Qualifications Framework
<b>QP</b>	Qualifications Pack
<b>TVET</b>	Technical and Vocational Education and Training
<b>SOP</b>	Standard Operating Procedure
<b>WI</b>	Work Instructions
<b>PPE</b>	Personal Protective equipment