



Model Curriculum

QP Name: Designer Mechanical

QP Code: CSC/Q0405

Version: 2.0

NSQF Level: 5

Model Curriculum Version: 1.0

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Training Parameters

Sector	Capital Goods
Sub-Sector	Machine Tools, Dies, Moulds and Press Tools, Plastics Manufacturing Machinery, Textile Manufacturing Machinery, Process Plant Machinery, Electrical and Power Machinery, Light Engineering Goods
Occupation	Design
Country	India
NSQF Level	5
Aligned to NCO/ISCO/ISIC Code	NCO-2015/NIL
Minimum Educational Qualification and Experience	<p>B. Tech/B.E. (Mechanical)</p> <p>OR</p> <p>3 Year Diploma - Mechanical (After 10th) in the relevant field with 2 years of experience in the relevant field</p> <p>OR</p> <p>10th + ITI (2 years) in the relevant field with 2 years of relevant experience in the relevant field</p> <p>OR</p> <p>12th Class Pass with 4 years of experience in the relevant field</p> <p>OR</p> <p>Certified in NSQF-L4 Draughtsman - Mechanical with 2 years of experience in the relevant field</p>
Pre-Requisite License or Training	NA
Minimum Job Entry Age	18 Years
Last Reviewed On	NA
Next Review Date	NA
NSQC Approval Date	NA
QP Version	2.0
Model Curriculum Creation Date	NA
Model Curriculum Valid Up to Date	NA

Model Curriculum Version	1.0
Minimum Duration of the Course	540 Hours
Maximum Duration of the Course	540 Hours

Program Overview

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

Training Outcomes

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

- Explain the importance of following the health and safety practices at work.
- Demonstrate ways to coordinate with co-workers to achieve work efficiency
- Describe the process of determining the client’s requirement and create a design brief.
- Demonstrate the process of creating and modifying 2D mechanical engineering drawings using the CAD system.
- Demonstrate the process of creating and modifying 3D mechanical engineering models using the CAD system.
- Demonstrate the process of developing prototypes as per the design brief and carry out testing and production.

Compulsory Modules

The table lists the modules and their duration corresponding to the Compulsory NOS of the QP.

NOS and Module Details	Theory Duration	Practical Duration	On-the-Job Training Duration (Mandatory)	On-the-Job Training Duration (Recommended)	Total Duration
Bridge Module	04:00	00:00	0:00	00:00	04:00
Module 1: Introduction to the role of a Designer Mechanical	04:00	0:00	0:00	00:00	04:00
CSC/N1335 Follow the health and safety practices at work NOS Version- 2.0 NSQF Level- 3	20:00	60:00	0:00	00:00	80:00
Module 2: Health and safety practices	20:00	60:00	0:00	00:00	80:00
CSC/N1336 Coordinate with co-workers to achieve work efficiency NOS Version-2.0 NSQF Level- 3	20:00	60:00	0:00	00:00	80:00
Module 3: Process of coordinating with co-workers to achieve work efficiency	20:00	60:00	0:00	00:00	80:00

CSC/N0405 Determine the client's requirement and create a design brief NOS Version- 2.0 NSQF Level- 5	36:00	60:00	0:00	00:00	96:00
Module 4: Process of determining the client's requirement and create a design brief	36:00	60:00	0:00	00:00	96:00
CSC/N0402 Create and modify 2D mechanical engineering drawings using the CAD system NOS Version- 2.0 NSQF Level- 4	36:00	60:00	0:00	00:00	96:00
Module 5: Process of creating and modifying 2D mechanical engineering drawings using the CAD system	36:00	60:00	0:00	00:00	96:00
CSC/N0408 Create and modify 3D mechanical engineering models using the CAD system NOS Version- 2.0 NSQF Level- 5	32:00	60:00	0:00	00:00	92:00
Module 6: Process of creating and modifying 3D mechanical engineering models using the CAD system	32:00	60:00	0:00	00:00	92:00
CSC/N0407: Develop prototypes as per the design brief and carry out testing and production NOS Version- 2.0 NSQF Level- 5	32:00	60:00	0:00	00:00	92:00
Module 7: Process of developing prototypes as per the design brief and carry out testing and production	32:00	60:00	0:00	00:00	92:00
Total Duration	180:00	360:00	0:00	00:00	540:00

Module Details

Module 1: Introduction to the role of a Designer Mechanical

Bridge Module

Terminal Outcomes:

- Discuss the job role of a Designer Mechanical.

Duration: 04:00	Duration: 0:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> • Describe the size and scope of the capital good industry and its sub-sectors. • Discuss the role and responsibilities of a Designer Mechanical. • Identify various employment opportunities for a Designer Mechanical. 	
Classroom Aids	
Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop, Video Films	
Tools, Equipment and Other Requirements	
NA	

Module 2: Health and safety Practices

Mapped to CSC/N1335 v2.0

Terminal Outcomes:

- Demonstrate ways to maintain personal health and safety.
- Describe the process of assisting in hazard management.
- Explain how to check the first aid box, firefighting and safety equipment.
- Describe the process of assisting in waste management.
- Explain the importance of following the fire safety guidelines.
- Explain the importance of following the emergency and first-aid procedures.
- Demonstrate the process of carrying out relevant documentation and review.

Duration: 20:00	Duration: 60:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> • Explain the recommended practices to be followed to ensure protection from infections and transmission to others, such as the use of hand sanitizer and face mask. • Explain the importance and process of checking the work conditions, assessing the potential health and safety risks, and take appropriate measures to mitigate them. • Explain the importance and process of selecting and using the appropriate PPE relevant to the task and work conditions. • Explain the recommended techniques to be followed while lifting and moving heavy objects to avoid injury. • Explain the importance of following the manufacturer’s instructions and workplace safety guidelines while working on heavy machinery, tools and equipment. • Explain the importance and process of identifying existing and potential hazards at work. • Describe the process of assessing the potential risks and injuries associated with the various hazards. • Explain how to prevent or minimise different types of hazards. 	<ul style="list-style-type: none"> • Demonstrate the use of appropriate Personal Protective Equipment (PPE) relevant to the task and work conditions. • Demonstrate how to handle hazardous materials safely. • Demonstrate the process of testing the firefighting and various safety equipment to ensure they are in usable condition. • Demonstrate the process of recycling and disposing different types of waste appropriately. • Demonstrate how to use the appropriate type of fire extinguisher to extinguish different types of fires safely. • Demonstrate how to administer appropriate first aid to the injured personnel. • Demonstrate the process of performing Cardiopulmonary Resuscitation (CPR) on a potential victim of cardiac arrest. • Demonstrate the process of carrying out appropriate documentation following a health and safety incident at work, including all the required information.

- Explain how to handle and store hazardous materials safely.
- Explain the importance of ensuring the first aid box is updated with the relevant first aid supplies.
- Describe the process of checking and testing the firefighting and various safety equipment to ensure they are in a usable condition.
- Explain the criteria for segregating waste into appropriate categories.
- Describe the appropriate methods for recycling the recyclable waste.
- Describe the process of disposing of the non-recyclable waste safely and the applicable regulations.
- Explain the use of different types of fire extinguishers to extinguish different types of fires.
- State the recommended practices to be followed for a safe rescue during a fire emergency.
- Explain how to request assistance from the fire department to extinguish a serious fire.
- Explain the appropriate practices to be followed during workplace emergencies to ensure safety and minimise loss to organisational property.
- State the common health and safety hazards present in a work environment, associated risks, and how to mitigate them.
- State the safe working practices to be followed while working at various hazardous sites and using electrical equipment.
- Explain the importance of ensuring easy access to firefighting and safety equipment.
- Explain the appropriate preventative and remedial actions to be taken in the case of exposure to toxic materials, such as poisonous

chemicals and gases.

- Explain various causes of fire in different work environments and the recommended precautions to be taken to prevent fire accidents.
- Describe different methods of extinguishing fire.
- List different materials used for extinguishing fire.
- Explain the applicable rescue techniques to be followed during a fire emergency.
- Explain the importance of placing safety signs and instructions at strategic locations in a workplace and following them.
- Explain different types of first aid treatment to be provided for different types of injuries.
- State the potential injuries associated with incorrect manual handling.
- Explain how to move an injured person safely.
- State various hazards associated with the use of various machinery, tools, implements, equipment and materials.
- Explain the importance of ensuring no obstruction and free access to fire exits.
- Explain how to free a person from electrocution safely.
- Explain how to administer appropriate first aid to an injured person.
- Explain how to perform Cardiopulmonary Resuscitation (CPR).
- Explain the importance of coordinating with the emergency services to request urgent medical assistance for persons requiring professional medical attention or hospitalisation.
- State the appropriate documentation

<p>to be carried out following a health and safety incident at work, and the relevant information to be included.</p> <ul style="list-style-type: none"> • Explain the importance and process of reviewing the health and safety conditions at work regularly or following an incident. • Explain the importance and process of implementing appropriate changes to improve the health and safety conditions at work. 	
<p>Classroom Aids</p>	
<p>Computer, Projection Equipment, PowerPoint Presentation and Software, Facilitator’s Guide, Participant’s Handbook.</p>	
<p>Tools, Equipment and Other Requirements</p>	
<p>Personal Protective Equipment, Cleaning Equipment and Materials, Sanitizer, Soap, Mask</p>	

Module 3: Process of coordinating with co-workers to achieve work efficiency

Mapped to NOS CSC/N1336 v2.0

Terminal Outcomes:

- Demonstrate ways to Work and communicate effectively with co-workers.
- Discuss ways to promote diversity and inclusion at the workplace.

Duration: 20:00	Duration: 60:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> • Explain the importance and process of effective communication in the workplace. • Explain the barriers to effective communication and how to overcome them. • Explain the importance of teamwork in an organisation’s and individual’s success. • Explain the importance of active listening in the work environment. • State the appropriate techniques to be followed for active listening. • Explain the importance of tone and pitch ineffective communication. • Explain the importance of avoiding casual expletives and unpleasant terms while communicating professional circles. • Explain the importance of maintaining discipline and ethical behaviour at work. • State the common reasons for interpersonal conflict and how to resolve them. • Explain the importance of developing effective working relationships for professional success. • Describe the process of expressing and addressing grievances appropriately and effectively. • Explain the importance and process of planning daily tasks to ensure their timely completion and efficient use of 	<ul style="list-style-type: none"> • Demonstrate the process of preparing the relevant documents and reports as per the supervisor’s instructions, providing appropriate information clearly and systematically. • Demonstrate how to mentor and assist subordinates in the execution of their work responsibilities. • Demonstrate the process of using various resources efficiently to ensure maximum utilisation and minimum wastage. • Demonstrate how to communicate clearly and politely to ensure effective communication with co-workers. • Demonstrate appropriate verbal and non-verbal communication that is respectful of genders and disability.

<p>time.</p> <ul style="list-style-type: none"> • Explain the importance of adhering to the limits of authority at work. • Explain the importance of following the applicable quality standards and timescales at work. • Explain the importance of coordinating with co-workers to achieve the work objectives efficiently. • Explain the relevant documentation requirements. • Explain the importance of providing appropriate information clearly and systematically in work documents. • State the escalation matrix to be followed to deal with out of authority tasks and concerns. • Explain the importance and process of mentoring and assisting subordinates in the execution of their work responsibilities. • Explain how to identify possible disruptions to work prevent them. • Explain how to use various resources efficiently to ensure maximum utilisation and minimum wastage. • Explain the recommended practices to be followed at work to avoid and resolve conflicts at work. • Explain the importance and process of efficient and timely dissemination of information to the authorised personnel. • Explain the procedure to report inappropriate behaviour e.g., harassment. 	
<p>Classroom Aids:</p>	
<p>Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop</p>	
<p>Tools, Equipment and Other Requirements</p>	
<p>NA</p>	

Module 4: Process of determining the client’s requirement and create a design brief

Mapped to CSC/N0405 v2.0

Terminal Outcomes:

- Describe the process of preparing for creating the design brief.
- Describe the process of preparing the design brief.

Duration: 36:00	Duration: 60:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> • Explain the use of relevant information systems for recording design information. • Explain different types of design briefs and the purpose of creating one. • Explain how to determine the specifications of the product to be designed and the valid sources of information for that. • Explain different types of design features to be incorporated in a design brief. • List various factors with an impact on the feasibility of achieving a client's requirements and the process of assessing the feasibility. • Explain the information and level of detail to be included in a design brief. • Explain the importance of identifying design constraints. • Explain how to prepare a brief confirming the requirements of the customer. • Explain the importance of recording the desired size and quality of the machined components. • List the relevant stakeholders to be consulted on the various aspects of a design brief. • Explain the importance of taking client’s feedback on the design brief. • Explain various design brief constraints such as technology, 	<ul style="list-style-type: none"> • Demonstrate how to record all the relevant information such as raw material specifications and desired size and quality, using the appropriate information system. • Demonstrate the process of performing relevant calculations such as tolerance, dimensions, and thermal and structural analysis regarding the proposed design brief. • Show how to prepare technical drawings, sketches and designs using input from engineers and relevant experts. • Demonstrate the process of creating mechanical designs using Computer-Aided Design (CAD), Computer-Aided Manufacturing (CAM), and 3D CAD programs, ensuring compliance with the client requirements, company procedure, and applicable regulations. • Show how to create separate assembly view or isometric view. • Demonstrate the process of performing assembly and motion analysis for the moving parts of the assembly. • Demonstrate the process of creating the design brief using the relevant software, ensuring it captures all the client’s requirements. • Demonstrate how to record the qualities required in the finished components, such as hardness, grinding, blackening, chrome plating,

<p>environmental/sustainability, legal, logistical, financial, safety, ease of maintenance, etc.</p> <ul style="list-style-type: none"> • Describe the applicable procedures to be followed while disseminating information. • Explain how to resolve various problems encountered during the design process. • Explain the importance and process of preparing a contingency plan. • Explain how to prioritise and schedule design activities. • Explain how to determine the requirement of resources for the designing process. • State the relevant organisational and regulatory guidelines and processes. • Explain how to perform relevant calculations and maintain data. • Describe the process of determining the feasibility and functionality of a design. • Explain the importance of taking health, safety and environmental aspects into consideration while preparing the design brief. 	<p>paint colour, etc.</p> <ul style="list-style-type: none"> • Demonstrate how to record the geometrical accuracies on the desired portion of the component. • Demonstrate the process of carrying out appropriate documentation concerning the design process, maintaining version control.
<p>Classroom Aids</p>	
<p>Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop</p>	
<p>Tools, Equipment and Other Requirements</p>	
<p>NA</p>	

Module 5: Process of creating and modifying 2D mechanical engineering drawings using the CAD system

Mapped to CSC/N0402 v2.0

Terminal Outcomes:

- Describe the process of preparing for 2D mechanical engineering drawings.
- Demonstrate the process of performing the set-up activities.
- Demonstrate the process of creating or modifying 2D mechanical engineering drawings.
- Explain the importance of using resources optimally.

Duration: 36:00	Duration: 60:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> • Explain the use of relevant information systems for retrieving and storing drawing data. • List the relevant customizable system variables in a CAD software. • Explain the needs and process for customizing identified system variables. • Describe the applicable drafting standards and procedures. • Explain the needs and process for customizing menus and system defaults. • Explain the needs and process for developing macros. • State the appropriate projection for the drawing purpose. • List the relevant reasons for including auxiliary views in drawings. • Describe the procedures for producing components, layout and assembly drawings. • List relevant drawing specifications and common symbols used in drawings. • List the relevant sources and methods for obtaining any required technical information relevant to the drawing. • Explain the common practices that make systems vulnerable to cyber- 	<ul style="list-style-type: none"> • Demonstrate how to customize system variables, menus and drawing defaults to produce the drawing to the appropriate scale. • Show how to develop macros as per the approved procedures. • Demonstrate the process of setting up and checking that all relevant devices are connected and operating. • Demonstrate the process of setting the drawing datum at a convenient point along with drawing parameters such as layers, line types, colour, text styles according to the drawing to be produced. • Show how to analyse and produce mechanical drawings, using first angle orthographic projections, isometric/oblique projections, third angle orthographic projections, sectional views. • Show how to create separate assembly view or isometric view. • Demonstrate the process of performing assembly and motion analysis for the moving parts of the assembly. • Demonstrate how to create a drawing template using the appropriate drawing tool according to the required standards, including all the necessary details. • Demonstrate how to record the

attacks, viruses and damage.

- Explain how to protect a computer from cyber-attacks and viruses.
- Describe the appropriate procedure to be followed to deal with virus attacks on a computer.
- Explain how to set up and use a computer system and the relevant peripherals light pen, digitizer and tablet, printer or plotter, scanner, etc.
- Explain how to various computer drawing software.
- Explain the importance of using CAD software as per the instructions in the user manual.
- State the relevant principles of engineering and manufacturing operations that are applied in manufacturing processes such as casting and forging; fabrication; machining methods; joining processes; assembly and installation, etc.
- List different types of drawings that may be produced using a CAD software.
- Describe the process of selecting standard components in the designing process.
- Explain the functionality of different components, their interrelation with other components and assemblies.
- Explain how to set up the viewing screen to show multiple views of the drawing.
- State the relevant standards and conventions used for drawings.
- Explain how to set up the drawing template parameters.
- Explain the application and use of various drawing tools.
- Explain how to access and use a wide range of standard components and symbol libraries from the CAD

qualities required in the finished components such as hardness, grinding, blackening, chrome plating, paint colour, etc.

- Demonstrate how to use various menus available in the CAD system along with relevant codes and references.
- Demonstrate the process of drawing temporary fasteners and rivets, components details, assembly drawings, piping layouts, gears and machine foundation, etc.
- Show how to create all required views such as section and detailed views to avoid any issues during machining.
- Show how to label the drawings as per approved procedures.
- Demonstrate the process of creating detailed views using various scales to as per the requirement.
- Demonstrate how to check for the intersection of components with each other in the assembly mode.
- Demonstrate the process of carrying out load testing and simulation before finalising the drawing.
- Demonstrate how to save the drawing to an appropriate storage medium such as a hard drive or USB pen drive, while creating a backup to protect against accidental loss.
- Prepare a sample bill of materials as per organisational guidelines after determining the required component, material specifications, and appropriate quantities.
- Demonstrate how to optimise the usage of electricity and other resources in various tasks and processes.

equipment.

- Explain the need for document control.
- Explain the importance and process of saving and storing drawings.
- Explain the importance and process of creating backup copies, and save them safely.
- Explain how to produce hard copies of drawings, and the advantages and disadvantages of printers and plotters.
- Explain the technical information relevant to the drawing to be created such as drawing brief, overall dimensions, etc.
- Explain the applicable design features such as interface, tolerance, etc.
- Explain the use of relevant computer peripherals such as light pen, digitizer/tablet, scanner, printer, plotter, etc.
- Explain different types of drawings such as detail drawings, sub-assembly drawings, general arrangement drawings, installation drawings, etc.
- Describe the applicable standards and procedures such as organizational guidelines and procedures, relevant directives or codes of practice, CAD software standards/protocols, national and international standards and directives, etc.
- State the applicable health, safety and environmental concerns.
- Explain the relevant engineering activities such as processing of materials, fabrication, finishing, assembly, joining, commissioning/decommissioning, equipment installation, etc.
- Explain the operational activities such as movement of materials, preparation of workplace layouts and work-flow diagrams.

- Explain various functions of drawing template in the CAD software such as layers of drawings, scale, paper size, colour setup, detailed view, etc.
- Explain the relevant activities done during preparing drawings in the CAD software such as hatching and shading on drawings, adding dimensions and text to drawings, producing layers of drawings, etc.
- State the relevant symbols and abbreviations.
- Explain the benefits and methods of resource optimisation.
- Explain how to create assembly and isometric views.
- Explain how to perform assembly and motion analysis for moving parts of the assembly.
- Explain the importance of mentioning the desired qualities required in the finished component, such as hardness, grinding, blackening, chrome plating, paint colour, etc.
- Explain the importance of checking all possible views before releasing the drawing to avoid issues during machining.
- Explain the importance of describing geometrical accuracies, such as runout surface finishing circularity, cylindricity, perpendicularity, on the desired portion of the component.
- Explain the importance of considering the standard sizes of raw material available in the market, during designing to avoid wastage of resources.
- Explain how to check for the intersection of components with each other in the assembly mode.
- Explain how to perform load testing and simulation before finalising the drawing.
- Explain the benefits and methods of

resource optimisation.	
Classroom Aids	
Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop	
Tools, Equipment and Other Requirements	
CAD/CAM Software's (Auto CAD, PRO-E, CATIA, NX, SOLIDWORKS, INVENTOR Etc), Measuring Tools, Drawing Tools, Grinders, GD&T, etc.	

Module 6: Process of creating and modifying 3D mechanical engineering models using the CAD system

Mapped to CSC/N0408 v2.0

Terminal Outcomes:

- Describe the process of preparing for performing 3D mechanical engineering modelling.
- Demonstrate the process of creating and editing 3D mechanical engineering models.

Duration: 32:00	Duration: 60:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> • Describe the applicable organisational procedures for storing drawing data using the relevant information systems. • Describe the relevant sources and methods for obtaining any required technical information relevant to the model being produced, such as drawing briefs, specification sheets, etc. • Explain the importance of determining and incorporating technical information in the drawings, such as limits and fits, contraction allowances, bearing selection, surface finish, etc. • Explain the use of various accessories, such as a mouse, light pen, digitizer and tablet, printer or plotter, and scanner. • Explain how to use different types of computer modelling software. • Explain how to use the help file to aid efficient operation of the relevant drawing system. • List different types of drawings that may be produced by using a 3D modelling software. • Explain how to set up the viewing screen to show multiple views of the component such as isometric front and side elevations, to help with creating drawing creation. • Explain the application of modelling tools. 	<ul style="list-style-type: none"> • Demonstrate how to set the drawing datum at an appropriate point to create a modelling template with title, file number, material, date. • Demonstrate the process of creating and modifying entities in 3D space as per job requirement. • Demonstrate the process of creating 3D views by manipulating drawing planes and inserting 3D geometric shapes. • Demonstrate the process of creating swept, extruded and revolved solids in 3D space. • Show how to construct sectioned models with cutting planes and cross hatching. • Show how to use pre-drawn library files and primitives to produce a 3D model. • Demonstrate how to extract mass and area properties from solid models. • Demonstrate the use of the relevant features of a solid modelling software package such as extrude cut, wireframe, fillet, solid views and others to construct models. • Show how to prepare drawings for solid modelling. • Show how to use pan, isometric and zoom CAD operations to highlight design areas in the modelling environment. • Demonstrate the use of hatching and

<ul style="list-style-type: none"> • Explain how to access, identify and use a wide range of standard components and symbol libraries from the CAD equipment. • Explain the applications of different 3D modelling programs such as surface modelling, solid modelling, wireframe modelling. • Explain how to produce models with sufficient information to allow them to be successfully exported to the relevant manufacturing system. • Explain the importance of ensuring that completed models are approved, labelled and stored on a suitable storage medium. • Explain the importance and process of selecting an appropriate coordinate system according to the job requirement. • Explain how to set the orientation of a model with respect to the coordinate system. • State the appropriate number of views required to establish the model. • Describe the process of creating and modifying various entities in 3D space. • Explain the applications of ruled and revolved surfaces and the process of creating them in 3D space. • Describe the process of modifying existing 3D models. • Explain how to save drawing files in a 3D software and various formats for saving them. • List the physical properties of shapes created in 3D space that can be extracted. • Explain how to use the exploded view in assembly drawings to show the relationship between different components and how they fit together. • Describe the process of creating own 	<p>shading, angular surfaces, curved surfaces, circles or ellipses, surface texture, etc.</p> <ul style="list-style-type: none"> • Demonstrate the process of producing 3D drawings incorporating section views with all the required necessary annotation. • Demonstrate the process of constructing models for export to different manufacturing systems, such as Direct Numerically Controlled (DNC), Computer Numerically Controlled (CNC), etc. • Show how to use the appropriate codes and references that follow the required conventions.
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<p>toolbox in a 3D software.</p> <ul style="list-style-type: none"> • Describe the process of creating intelligent models using parametric modelling in the relevant 3D software. • Explain how to produce composite models with composite regions and solids. • Explain how to produce sectioned models with cutting planes and cross-hatching. • Explain how to save 3D models in various file formats for retrieval into other CAD application software. • Explain various solid modelling features such as extrude, extrude cut, mirror, revolve, wireframe, radius/chamfer, hide, rib, rectangular pattern, fillet, circular pattern, shell, etc. • Explain the use of development view, motion analysis, animation, defining material property, exploded views. • Explain how to extract physical properties from a 3D model according to the job requirement, including volume, mass and centre of gravity. • Explain how to create a dynamic simulation of physical models • the process of creating and analysing the digital prototype of a physical model to predict its actual performance. 	
<p>Classroom Aids</p>	
<p>Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop</p>	
<p>Tools, Equipment and Other Requirements</p>	
<p>Computer System with Latest Configuration, CADD Software</p>	

Module 7: Process of developing prototypes as per the design brief and carry out testing and production

Mapped to CSC/N0407 v2.0

Terminal Outcomes:

- Demonstrate the process of developing and testing prototypes.
- Explain the importance of finalising prototypes and overseeing production.

Duration: 32:00	Duration: 60:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> • Explain the relevant activities to be carried out during the development of a prototype. • Explain the concepts and benefits of Industry 4.0 and Industrial Internet of Things (IIoT). • Describe the process of testing prototypes, seeking feedback from stakeholders and making necessary amendments. • Explain the importance of carrying out relevant documentation during the prototype development and testing process. • Describe the process of finalising a prototype and starting production. • Explain the importance of coordinating with the engineering and production teams to ensure the final product meets the applicable specifications and serves the purpose it was designed for. • Describe the applicable organisational procedures for using the relevant information systems for storing design and configuration data. • State the engineering and manufacturing principles and concepts relevant to the production of fit for purpose prototypes. • List various materials and their properties. • List different types of materials used for developing prototypes such as 	<ul style="list-style-type: none"> • Demonstrate the process of performing computer simulations and experiments to virtually test and refine the designs. • Show how to measure the level of function of prototypes to assess their performance against the relevant performance criteria. • Demonstrate the use of various industry 4.0 manufacturing technologies. • Show how to prepare and present relevant progress reports. • Demonstrate the process of carrying out further testing to ensure relevant processes and performance of prototypes. • Demonstrate how to prepare technical reports, design specification documents, and operations manuals. • Show how to calculate the cost estimates for final product designs, and prepare relevant reports incorporating costs of labour, material, delivery and overhead.

metals, plastic, ceramics, etc.

- Explain basic metallurgy and heat treatment.
- Explain thermal properties and thermal stress analysis-heat treatment process.
- Explain the structural engineering/analytics and finite element analysis.
- Explain various manufacturing and fabrication technologies; welding principles.
- Explain how to perform various design calculations such as pressure, force, capacity, etc.
- State the applicable trigonometry and geometry principles.
- Explain the acceptable dimensional and geometric tolerances.
- Describe design formats and methods for achieving different types of designs in prototypes.
- State potential risks to the process of designing prototypes and how to minimise them.
- Describe the process of making amendments to the design to develop prototypes as per the feedback of relevant stakeholders.
- Explain the importance of establishing and recording responsibilities for the production process.
- Explain the need for effective document and data control and the implications of not following them.
- State the applicable patent, copyright and intellectual processes and relevant issues.
- List the principles of dynamics and kinematics that must be observed to ensure the designed product works as expected.
- Explain the importance of ensuring compliance with the applicable

<p>design regulations, standards and codes of practice such as health, safety and environmental regulations.</p> <ul style="list-style-type: none"> • Explain the importance of protecting the designs following the applicable copyright regulations. • List various factors with an impact on the designing process such as product specifications and required functions, finance, manufacturing, installation and commissioning; the life cycle of the product, etc. • Describe the applicable design evaluation methods such as market research; software simulation; analysis of the design documentation; prototype assessment, pilot trial, small-scale production, etc. 	
<p>Classroom Aids</p>	
<p>Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop</p>	
<p>Tools, Equipment and Other Requirements</p>	
<p>Computer System with Latest Configuration, CADD Software</p>	

Annexure

Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training Experience		Remarks
		Years	Specialization	Years	Specialization	
Diploma /Degree	Diploma /Degree in Mechanical Engineering	4	Designer Mechanical	0		Practical skills and knowledge required in the relevant field

Trainer Certification	
Domain Certification	Platform Certification
Certified for Job Role: “Designer Mechanical” mapped to QP: “CSC/Q0405, v1.0”. Minimum accepted score is 80%	Recommended that the Trainer is certified for the Job Role: “Trainer”, mapped to the Qualification Pack: “MEP/Q0102”. Minimum accepted as per respective SSC guidelines is 80%.

Assessor Requirements

Assessor Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training/Assessment Experience		Remarks
		Years	Specialization	Years	Specialization	
Diploma /Degree	Diploma /Degree in Mechanical Engineering	4	Designer Mechanical	0		Practical skills and knowledge required in the relevant field

Assessor Certification	
Domain Certification	Platform Certification
Certified for Job Role: “ Designer Mechanical ” mapped to QP: “CSC/Q0405, v1.0”. Minimum accepted score is 80%	Certified for the Job Role: “Assessor”, mapped to the Qualification Pack: “MEP/Q2701, v1.0”, with a minimum score of 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
- The assessment agency deploys the ToA certified Assessor for executing the assessment
- SSC monitors the assessment process & records

2. Testing Environment

To ensure a conducive environment for conducting a test, the trainer will:

- 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 10 a.m. and 5 p.m. respectively
- Ensure there are 2 Assessors if the batch size is more than 30.
- 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 are 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 NOS and PC
- Question papers are prepared considering that levels 1 to 3 are for the unskilled & semi-skilled individuals, and levels 4 and above are for the skilled, supervisor & higher management
- The assessor must be ToA certified and the trainer must be ToT Certified
- The 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:

To verify the details submitted by the training centre, the assessor will undertake:

- A surprise visit to the assessment location
- A random audit of the batch
- A random audit of any candidate

6. Method for assessment documentation, archiving, and access

To protect the assessment papers and information, the assessor will ensure:

- 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 on the Hard drive

References

Glossary

Term	Description
Declarative knowledge	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.
Key Learning	The 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).
OJT (M)	On-the-job training (Mandatory); trainees are mandated to complete specified hours of training on-site
OJT (R)	On-the-job training (Recommended); trainees are recommended the specified hours of training on-site
Procedural Knowledge	Procedural knowledge addresses how to do something, or how to perform a
Training Outcome	Training outcome is a statement of what a learner will know, understand and be able to do upon the completion of the training .
Terminal Outcome	The 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

Term	Description
NOS	National Skills Qualification Committee
NSQF	National Skills Qualification Framework
OJT	On-the-Job Training
OMR	Optical Mark Recognition
PC	Performance Criteria
PwD	Persons with Disabilities
QP	Qualification Pack
SDMS	Skill Development & Management System
SIP	Skill India Portal
SSC	Sector Skill Council
TC	Trainer Certificate
ToA	Training of Assessors
ToT	Training of Trainers
TP	Training Provider