QUALIFICATIONS PACK - OCCUPATIONAL STANDARDS FOR CAPITAL GOODS INDUSTRY

Contents

What are Occupational Standards(OS)?

- OS describe what individuals need to do, know and understand in order to carry out a particular job role or function
- OS are performance standards that individuals must achieve when carrying out functions in the workplace, together with specifications of the underpinning knowledge and understanding

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Introduction

Qualifications Pack: Designer - Mechanical

SECTOR: CAPITAL GOODS

SUB-SECTOR:

1. Machine Tools
2. Dies, Moulds and Press Tools
3. Plastics Manufacturing Machinery
4. Textile Manufacturing Machinery
5. Process Plant Machinery
6. Electrical and Power Machinery
7. Light Engineering Goods

OCCUPATION: Design

REFERENCE ID: CSC/ Q 0405

ALIGNED TO: NCO-2004/NIL

Designer - Mechanical: Identifying customer's requirements, creating a design brief, planning desgn activities, creating and evaluating design options, creating details design and models using 2D and 3D softwares for design.

Brief Job Description: It involves understanding the customer's requirement with respect to the mechanical engineering equipment and establish a design brief, further allocate responsibilities and resources to each activity, and ensure that the complete designing process is completed within agreed deadlines and complying with all relevant regulations, identifying design options, evaluation of design options and their presentation in suitable formats, creating detailed design and models using 2D and 3D softwares for design and obtaining design validations from production and maintenance considerations.

Personal Attributes: Basic communication, numerical and computational abilities. Openness to learning, ability to plan and organize own work and identify and solve problems in the course of working. Understanding the need to take initiative and manage self and work to improve efficiency and effectiveness.

Job Details

Qualifications Pack Code	**CSC/ Q 0405**		
Job Role	**Designer - Mechanical**		
Credits(NSQF)	**TBD**	**Version number**	**1.0**
Sector	**CAPITAL GOODS**	**Drafted on**	**14/04/14**
Sub-sector	1. Machine Tools 2. Dies, Moulds And Press Tools 3. Plastics Manufacturing Machinery 4. Textile Manufacturing Machinery 5. Process Plant Machinery 6. Electrical and Power Machinery 7. Light Engineering Goods	**Last reviewed on**	**18/03/15**
Occupation	**DESIGN**	**Next review date**	**30/08/16**
NSQC Clearance on	**18/0**6/2015		

Job Role	Designer - Mechanical
Role Description	Identifying customer's requirements, creating a design brief, planning design activities, creating and evaluating desgn options, creating details design using 2D and 3D softwares for design.
NSQF level	5
Minimum Educational Qualifications	Diploma - Mechanical Engineering, Degree preferred
Maximum Educational Qualifications	N.A.
Training (Suggested but not mandatory)	Computer Aided Design System Training, 2D and 3D
Minimum Job Entry Age	18 Years Old
Experience	Minimum 1 year apprenticeship
Applicable National Occupational Standards (NOS)	**Compulsory:** 1. CSC/ N 0405 (Identify customer's requirement and create an engineering design brief) 2. CSC/ N 0406 (Develop plan for engineering design process) 3. CSC/ N 0407 (Create and evaluate mechanical engineering design options) 4. CSC/ N 0402 (Make or modify 2D mechanical engineering drawings using CAD system) 5. CSC/ N 0408 (Make or modify 3D mechanical engineering models using CAD system) 6. CSC/ N 1335 (Use basic health and safety practices at the workplace) 7. CSC/ N 1336 (Work effectively with others) **Optional:** N.A.
Performance Criteria	As described in the relevant OS units

Definitions

Keywords /Terms	Description
Core Skills/Generic Skills	Core Skills or Generic Skills are a group of skills that are key to learning and working in today's world. These skills are typically needed in any work environment. In the context of the NOS, these include communication related skills that are applicable to most job roles.
Function	Function is an activity necessary for achieving the key purpose of the sector, occupation, or area of work, which can be carried out by a person or a group of persons. Functions are identified through functional analysis and form the basis of NOS.
Job role	Job role defines a unique set of functions that together form a unique employment opportunity in an organization.
Knowledge and Understanding	Knowledge and Understanding are statements which together specify the technical, generic, professional and organizational specific knowledge that an individual needs in order to perform to the required standard.
National Occupational Standards (NOS)	NOS are Occupational Standards which apply uniquely in the Indian context
Occupation	Occupation is a set of job roles, which perform similar/related set of functions in an industry.
Organisational Context	Organisational Context includes the way the organization is structured and how it operates, including the extent of operative knowledge managers have of their relevant areas of responsibility.
Performance Criteria	Performance Criteria are statements that together specify the standard of performance required when carrying out a task.
Qualifications Pack(QP)	Qualifications Pack comprises the set of NOS, together with the educational, training and other criteria required to perform a job role. A Qualifications Pack is assigned a unique qualification pack code.
Qualifications Pack Code	Qualifications Pack Code is a unique reference code that identifies a qualifications pack.
Scope	Scope is the set of statements specifying the range of variables that an individual may have to deal with in carrying out the function which have a critical impact on the quality of performance required.
Sector	Sector is a conglomeration of different business operations having similar businesses and interests. It may also be defined as a distinct subset of the economy whose components share similar characteristics and interests.
Sub-Sector	Sub-sector is derived from a further breakdown based on the characteristics and interests of its components.
Sub-functions	Sub-functions are sub-activities essential to fulfil the achieving the objectives of the function.
Technical Knowledge	Technical Knowledge is the specific knowledge needed to accomplish specific designated responsibilities.
Unit Code	Unit Code is a unique identifier for a NOS unit, which can be denoted with an 'N'
Unit Title	Unit Title gives a clear overall statement about what the incumbent should be able to do.
Vertical	Vertical may exist within a sub-sector representing different domain areas or the client industries served by the industry.

Acronyms

Keywords /Terms	Description
CNC	Computer Numerically Controlled
CAD	Computer Aided Design
2D	2 Dimensional
3D	3 Dimensional
CO2	Carbon dioxide
CPR	Cardiac Pulmonary Resuscitation
ISO	International Organization for Standardization
PPE	Personal Protective Equipment
CD	Compact Disc
DVD	Digital Video Disc or Digital Versatile Disc

CSC/ N 0405: Identify customer's requirement and create an engineering design brief

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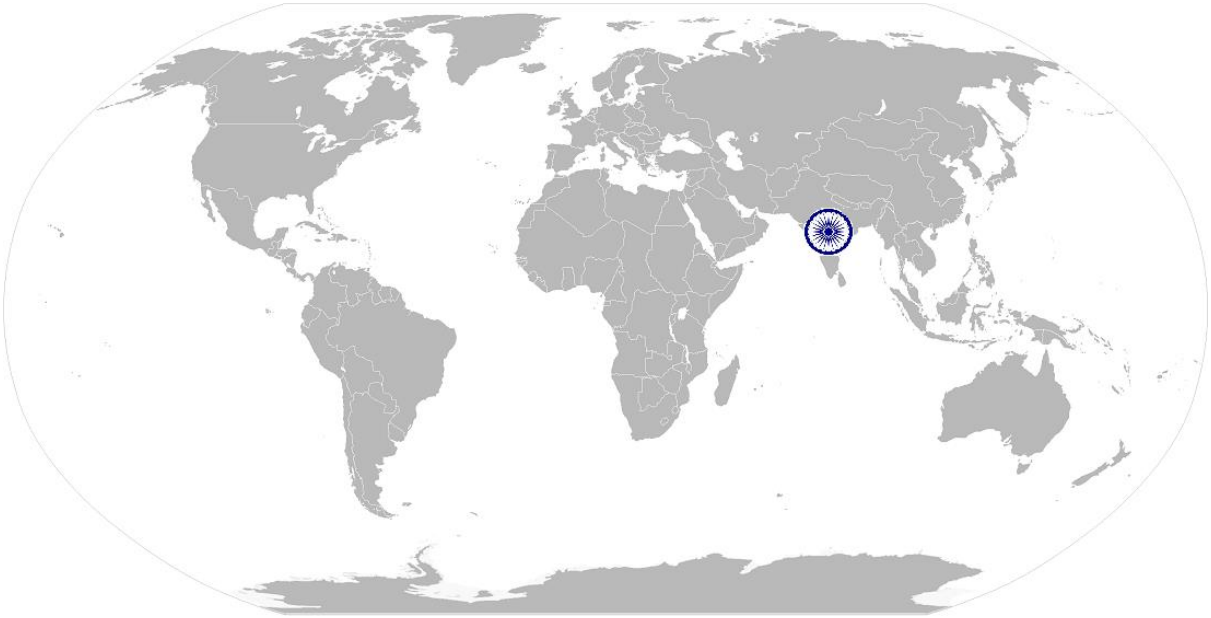
National Occupational Standard



Overview

This unit covers creating and establishing of engineering brief and design specifications, as per customer's requirement and approved procedures.

CSC/ N 0405: Identify customer's requirement and create an engineering design brief

National Occupational Standard

Unit Code	CSC/ N 0405
Unit Title (Task)	Identify customer's requirement and create an engineering design brief
Description	This unit is about identifying the engineering design requirements of the customer and creating an engineering design brief, as per approved procedures and using cost optimization techniques. The candidate will be expected to work unsupervised, on their own or as part of a team and may also be expected to lead or instruct a team, taking responsibility for own actions as well as the actions of the team and for the quality and accuracy of the work produced.
Scope	This unit/task covers the following: • Working safely • Identify and interpret engineering design requirements of customer • Identify, interpret and communicate manufacturing machinery design requirements of customer

Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Working safely	The user/individual on the job should be able to: PC1. work safely at all times, complying with health and safety, environmental and other relevant regulations and guidelines PC2. check that all safety mechanisms are in place and that the equipment is set correctly for the required operations PC3. adhere to procedures or systems in place for health and safety, including personal protective equipment and other relevant safety regulations and procedures to contribute to a safe work environment PC4. wear the appropriate protective clothing and equipment, and keep the work area clean and tidy PC5. follow safe practice/approved setting up procedures at all times
Identify and interpret engineering design requirements of customer	The user/individual on the job should be able to: PC6. gather accurate information on the requirements of the customer from various sources **Sources:** purchase order, quotation documents submitted to customer, customer interaction(self or others), sales representative/application engineer/proposal engineer, existing designs, research, suppliers, process and manufacturing technologies PC7. confirm the customer's objectives for the engineering products or processes PC8. identify any unique or specific features that need particular consideration PC9. determine the feasibility of achieving the customer's requirements PC10. confirm the requirements and other relevant issues with the customer PC11. record all relevant information in the appropriate information systems for future use

CSC/ N 0405: Identify customer's requirement and create an engineering design brief

Identify, interpret and communicate manufacturing machinery design requirements of customer	PC12. confirm the operational and functional requirements and quality criteria of the design PC13. obtain clarification from relevant people any aspect of the requirement that is not clear PC14. identify clearly any design constraints **Design brief constraints**: customer acceptability, departmental constraints, available technologies, environmental/sustainability, delivery schedule, legal, logistical, financial, international/national standards or directives, safety, capacity, capability, copyright, commercial/branding, ease of maintenance PC15. create the design brief in a draft form and discuss any changes required with the relevant people **Design brief details:** confirmation of objectives, draft design concepts, supporting calculations and data, overall functionality, feasibility of achieving requirements, any special features, detail of specific issues for consideration (such as product safety, health and safety, impending regulation changes, emerging technologies), design process, product life cycle requirements, support required PC16. ensure that the design brief captures all the requirements of the customer PC17. ensure that the design brief and specification meets relevant regulations, directives and guidelines **Regulations, directives and guidelines**: organizational guidelines and codes of practice; recognized compliance agency/body's standards; equipment manufacturer's operating specification/range; customer standards and requirements; national or International standards or directives; health, safety and environmental requirements PC18. save the design brief and communicate it to the relevant people, as per organizational process **Communicate via any of the following**: a verbal report, electronic mail, presentation, computer generated report, specific company document
Knowledge and Understanding (K)	
A. Organizational Context (Knowledge of the company / organization and its processes)	The user/individual on the job needs to know and understand: KA1. legislation, standards, policies, and procedures followed in the company relevant to own employment and performance conditions KA2. relevant health and safety requirements applicable in the work place KA3. importance of working in clean and safe environment KA4. own job role and responsibilities and sources for information pertaining to employment terms, entitlements, job role and responsibilities KA5. reporting structure, inter-dependent functions, lines and procedures in the work area KA6. relevant people and their responsibilities within the work area KA7. escalation matrix and procedures for reporting work and employment related issues KA8. documentation and related procedures applicable in the context of employment and work KA9. importance and purpose of documentation in context of employment and work KA10. company systems for recording design information

CSC/ N 0405: Identify customer's requirement and create an engineering design brief

	KA11. importance of using the company information systems KA12. limits of learner's own authority, and to whom should they report if they have problems that they cannot resolve
B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. purpose of a design brief and it's importance KB2. how to obtain details of the specification of the product or process to be designed KB3. various sources for information for the design brief KB4. when can a customer be consulted on a design brief KB5. how to obtain and interpret legislative and regulatory documentation KB6. types of design features that should be considered unique or specific KB7. factors that affect the feasibility of achieving a customer's requirements KB8. how to assess the feasibility of achieving the customer's requirements KB9. information and level of detail to be included in a design brief KB10. how to prepare a brief confirming the requirements of the customer KB11. Importance of identifying design constraints KB12. different types of design briefs KB13. who should be informed and consulted on the various aspects of a design brief and specification KB14. regulations, directives and guidelines that are relevant KB15. how to obtain information on regulations, directives and guidelines
Skills (S) [Optional]	
A. Core Skills/ Generic Skills	**Communication**
	The user/ individual on the job needs to know and understand how to: SA1. read and interpret information correctly from various job specification documents, manuals, health and safety instructions, memos, etc. applicable to the job in English and/or local language SA2. fill up appropriate technical forms, process charts, activity logs as per organizational format in English and/or local language SA3. convey and share technical information clearly using appropriate language SA4. check and clarify task-related information SA5. liaise with appropriate authorities using correct protocol SA6. communicate with people in respectful form and manner in line with organizational protocol SA7. listen to questions and concerns of the customer and provide resolution in a respectful manner as per organizational guidelines SA8. use basic office applications like spread sheet, word processor, presentations SA9. use ERP software and other organizational software specific to quality function SA10. use email to communicate within the organization as per organization guidelines SA11. be well dressed and groomed SA12. put forward ones point of view in a convincing manner
	Numerical and computational skills
	The user/individual on the job needs to know and understand how to: SA13. undertake numerical operations, geometry and calculations/ formulae **Arithmetic**: addition, subtraction, multiplication, division, fractions and decimals, percentages and proportions, simple ratios and averages

CSC/ N 0405: Identify customer's requirement and create an engineering design brief

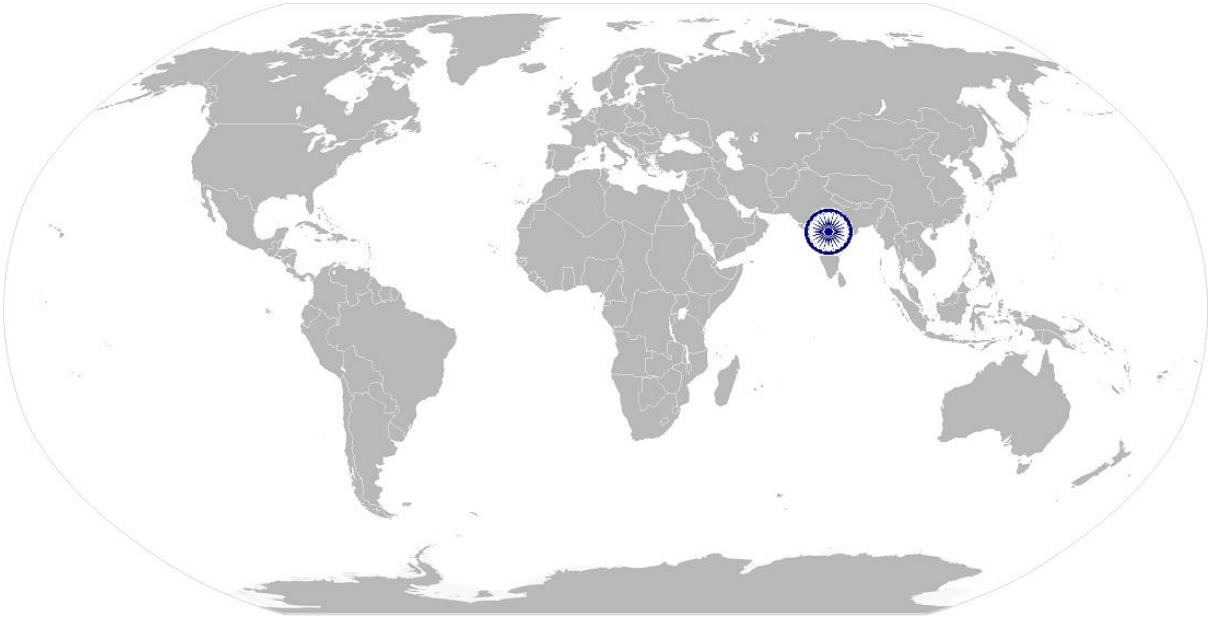
	SA14. use appropriate measuring techniques SA15. express numerical solutions to a degree of accuracy that is appropriate to the value being calculated **Degree of accuracy**: correct to three significant figures, correct to two decimal places, express a decimal fraction in standard form, express tolerance in terms of limits of size SA16. use a calculator to raise a number to a power and determine square roots SA17. use formulae to complete transpositions and solve problems **Transpositions**: involving addition, subtraction, multiplication and division in any combination using a maximum of three terms, for example Ohm's Law, substitution of known values SA18. use algebraic expressions to solve linear equations SA19. plot and interpret straight line graphs
	Learning
	The user/individual on the job needs to know and understand how to: SA20. maintain current knowledge of applicable standards, legislation, codes of practice and product/process developments SA21. participate in on-the-job and other learning, training and development interventions and assessment SA22. clarify task related information with appropriate personnel or technical adviser SA23. seek to improve and modify own work practices
	Computer Basics
	The user/individual on the job needs to know and understand how to: SA24. perform basic operations in a computer like switching it on/off, using the mouse and keyboard, accessing files, opening, closing, creating and deleting folders, etc. SA25. use basic office applications like spread sheet, word processor, presentations SA26. use ERP software and other organizational software specific to quality function SA27. write a small program which consists of all the machine functions SA28. use email to communicate within the organization as per organization guidelines SA29. retrieve and enter data using standard system forms and templates SA30. take printouts of documents
B. Professional Skills	**Problem Solving**
	The user/individual on the job needs to know and understand how to: SB1. identify problems with work planning, procedures, output and behavior and their implications SB2. prioritize and plan for problem solving SB3. communicate problems appropriately to others SB4. identify sources of information and support for problem solving SB5. seek assistance and support from other sources to solve problems SB6. identify effective resolution techniques SB7. select and apply resolution techniques SB8. seek evidence for problem resolution SB9. inspect quality of own or other employee's work

CSC/ N 0405: Identify customer's requirement and create an engineering design brief

	SB10. analyze information according to enterprise and work requirements SB11. use diagnostic skills to identify and determine causes of faults, including interpretation of in-built fault indicators and error codes SB12. take decisions within if within own jurisdiction or take approval for case outside own jurisdiction
	Plan and Organize
	The user/individual on the job needs to know and understand how to: SB13. plan, prioritize and sequence work operations as per job requirements SB14. organize and analyze information relevant to work SB15. apply basic concepts of work productivity including waste reduction, efficient material usage and optimization of time
	Initiative and Enterprise
	The user/individual on the job needs to know and understand how to: SB16. work towards achieving better results for self, others and organization by displaying initiative and enterprise SB17. undertake and express new ideas and initiatives to others SB18. modify work plan to overcome unforeseen difficulties or developments that occur as work progresses SB19. participate in improvement procedures including process, quality and internal/external customer/supplier relationships SB20. achieve more by applying one's competencies in new and different situations and contexts to achieve more SB21. identify potential business opportunities for the company
	Self-Management
	The user/individual on the job needs to know and understand how to: SB22. work taking responsibility for own work outcomes SB23. adhere to work timings, dress code and other organizational policies SB24. work following laid down rules, procedures, instructions and policies SB25. conduct oneself express dissent during conflict situations while exercising restraint SB26. avoid and manage distractions to be disciplined at work SB27. work by time management for achieving better results
	Customer Centricity
	The user/individual on the job needs to know and understand how to: SB28. communicate with customers following organizational protocols and practices generating customer satisfaction and delight SB29. undertake clear and open communication with customers for trust building and clarifying and managing expectations of customers SB30. respond to customer expectation promptly and recognizing and communicating limits of one's authority SB31. deal with customer feedback SB32. handle customer disgruntlement and dissatisfaction
	Teamwork
	The user/individual on the job needs to know and understand how to: SB33. work in a team in order to achieve better results SB34. identify and clarify work roles within a team

CSC/ N 0405: Identify customer's requirement and create an engineering design brief

	SB35. communicate and cooperate with others in the team SB36. seek assistance from fellow team members SB37. co-ordinate across teams and personnel for getting work done



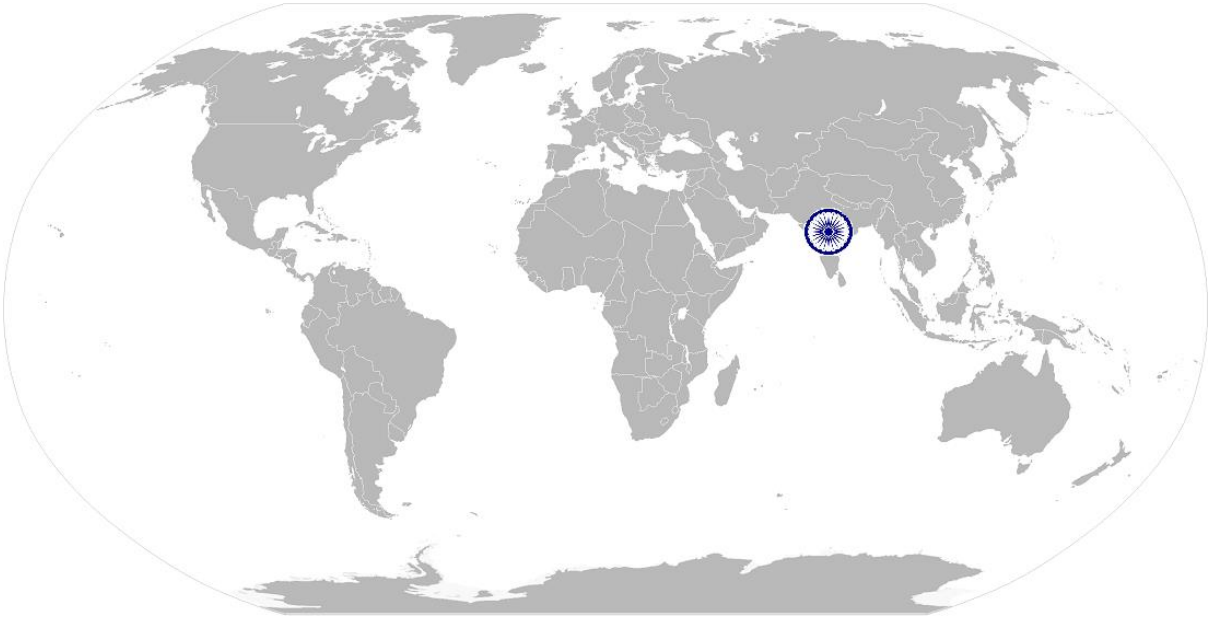
CSC/ N 0405: Identify customer's requirement and create an engineering design brief

NOS Version Control

NOS Code	**CSC / N 0405**		
Credits (NSQF)	**TBD**	**Version number**	**1.0**
Industry	**Capital Goods**	**Drafted on**	**24/04/14**
Industry Sub-sector	1. Machine Tools 2. Dies, Moulds And Press Tools 3. Plastics Manufacturing Machinery 4. Textile Manufacturing Machinery 5. Process Plant Machinery 6. Electrical and Power Machinery 7. Light Engineering Goods	**Last reviewed on**	**18/03/15**
Occupation	**Design**	**Next review date**	**30/08/16**

CSC/ N 0406: Develop plan for engineering design process

National Occupational Standard



Overview

This unit covers planning for engineering design process as per approved processes, for a smooth and timely delivery of the final design.

CSC/ N 0406: Develop plan for engineering design process

National Occupational Standard

Unit Code	CSC / N 0406
Unit Title (Task)	Develop plan for engineering design process
Description	This unit covers planning for engineering design process as per approved processes, for a smooth and timely delivery of the final design. It covers the identification of the design activities that needed to be undertaken, to allocate responsibilities and resources to each activity, and ensure that the complete designing process is completed with agreed deadlines, delivering output that complies with all relevant regulations, directives and guidelines. The candidate will be expected to work unsupervised, on their own or as part of a team and may also be expected to lead or instruct a team, taking responsibility for own actions as well as the actions of the team and for the quality and accuracy of the work produced.
Scope	This unit/task covers the following: • Working safely • Planning for the engineering design process

Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Working safely	The user/individual on the job should be able to: PC1. work safely at all times, complying with health and safety, environmental and other relevant regulations and guidelines PC2. check that all safety mechanisms are in place and that the equipment is set correctly for the required operations PC3. adhere to procedures or systems in place for health and safety, including personal protective equipment and other relevant safety regulations and procedures to contribute to a safe work environment PC4. wear the appropriate protective clothing and equipment, and keep the work area clean and tidy PC5. follow safe practice/approved setting up procedures at all times
Planning for the engineering design process	The user/individual on the job should be able to: PC6. identify the design activities to be undertaken **Design activities**: e.g. confirmation of requirements; production and review of detailed design/s; review of reference materials; development of models (such as software, physical); production and review of high level design/s; obtaining final approval, etc. PC7. identify specifications to be incorporated in the design **Specifications**: manufacturing requirements, aesthetics, materials, technology, characteristics, performance/capability, components/systems, fit, form or function, costs, life cycles, monitoring/servicing/maintenance requirements, timescales PC8. establish the responsibilities for developing specific aspects of the design

CSC/ N 0406:	Develop plan for engineering design process
	process PC9. identify the activities that make up the design process **Activities that make up the design process**: disseminating information, change management, obtaining resources, configuration management, reviewing design/s, resource procurement PC10. establish the responsibility for each activity PC11. identify the resources necessary to undertake the design process agree procedures for disseminating information on the designs PC12. identify any potentially critical problems and include contingency plans for the same PC13. develop a schedule for the design process PC14. agree the schedule with the appropriate people PC15. establish priorities for completion of the design process within deadlines PC16. ensure that the design process complies with all relevant regulations, directives and guidelines **Regulations, directives and guidelines**: organizational guidelines and procedures; recognized compliance agency/body's standards, directives or codes of practice; equipment manufacturer's operating specification/manual; customer's requirements; international and or national standards; health, safety and environmental requirements PC17. obtain approvals of the relevant people for the design plan PC18. establish version control for the document PC19. save and store the design documentation as per organizational guidelines PC20. communicate information to the appropriate people using various company specific media **Media**: verbal report, electronic mail, presentation, computer generated report, specific company document
Knowledge and Understanding (K)	
A. Organizational Context (Knowledge of the company / organization and its processes)	The user/individual on the job needs to know and understand: KA1. legislation, standards, policies, and procedures followed in the company relevant to own employment and performance conditions KA2. relevant health and safety requirements applicable in the work place KA3. importance of working in clean and safe environment KA4. own job role and responsibilities and sources for information pertaining to employment terms, entitlements, job role and responsibilities KA5. reporting structure, inter-dependent functions, lines and procedures in the work area KA6. relevant people and their responsibilities within the work area KA7. escalation matrix and procedures for reporting work and employment related issues KA8. documentation and related procedures applicable in the context of employment and work KA9. importance and purpose of documentation in context of employment and work KA10. the organizational activities required for the design process

CSC/ N 0406: Develop plan for engineering design process

B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. importance of establishing and recording responsibilities KB2. who should have responsibility for developing different parts of a design KB3. various procedures that can be used in the design process KB4. factors that should be taken into account for disseminating information KB5. types of problem that could occur during the design process KB6. why it is important to have contingency plans KB7. what should be included in contingency plans KB8. how to priorities and schedule design activities KB9. how to obtain information on resources KB10. how to determine what resources are necessary KB11. how to determine the availability of resources KB12. organizational and regulatory, directives and guidelines that are relevant KB13. how to obtain information on relevant regulations, directives and guidelines
Skills (S) [Optional]	
A. Core Skills/ Generic Skills	**Communication**
	The user/ individual on the job needs to know and understand how to: SA1. read and interpret information correctly from various job specification documents, manuals, health and safety instructions, memos, etc. applicable to the job in English and/or local language SA2. fill up appropriate technical forms, process charts, activity logs as per organizational format in English and/or local language SA3. convey and share technical information clearly using appropriate language SA4. check and clarify task-related information SA5. liaise with appropriate authorities using correct protocol SA6. communicate with people in respectful form and manner in line with organizational protocol SA7. listen to questions and concerns of the customer and provide resolution in a respectful manner as per organizational guidelines SA8. use basic office applications like spread sheet, word processor, presentations SA9. use ERP software and other organizational software specific to quality function SA10. use email to communicate within the organization as per organization guidelines SA11. be well dressed and groomed SA12. put forward ones point of view in a convincing manner
	Numerical and computational skills
	The user/individual on the job needs to know and understand how to: SA13. undertake numerical operations, geometry and calculations/ formulae **Arithmetic**: addition, subtraction, multiplication, division, fractions and decimals, percentages and proportions, simple ratios and averages SA14. use appropriate measuring techniques SA15. express numerical solutions to a degree of accuracy that is appropriate to the value being calculated **Degree of accuracy**: correct to three significant figures, correct to two decimal places, express a decimal fraction in standard form, express tolerance in terms of limits of size SA16. use a calculator to raise a number to a power and determine square roots

CSC/ N 0406: Develop plan for engineering design process

	SA17. use formulae to complete transpositions and solve problems **Transpositions**: involving addition, subtraction, multiplication and division in any combination using a maximum of three terms, for example Ohm's Law, substitution of known values SA18. use algebraic expressions to solve linear equations SA19. plot and interpret straight line graphs SA20. write a small program which consists of all the machine functions
	Learning
	The user/individual on the job needs to know and understand how to: SA21. maintain current knowledge of applicable standards, legislation, codes of practice and product/process developments SA22. participate in on-the-job and other learning, training and development interventions and assessment SA23. clarify task related information with appropriate personnel or technical adviser SA24. seek to improve and modify own work practices
B. Professional Skills	**Problem Solving**
	The user/individual on the job needs to know and understand how to: SB1. identify problems with work planning, procedures, output and behavior and their implications SB2. prioritize and plan for problem solving SB3. communicate problems appropriately to others SB4. identify sources of information and support for problem solving SB5. seek assistance and support from other sources to solve problems SB6. identify effective resolution techniques SB7. select and apply resolution techniques SB8. seek evidence for problem resolution SB9. inspect quality of own or other employee's work SB10. analyze information according to enterprise and work requirements SB11. use diagnostic skills to identify and determine causes of faults, including interpretation of in-built fault indicators and error codes SB12. take decisions within if within own jurisdiction or take approval for case outside own jurisdiction
	Plan and Organize
	The user/individual on the job needs to know and understand how to: SB13. plan, prioritize and sequence work operations as per job requirements SB14. organize and analyze information relevant to work SB15. basic concepts of work productivity including waste reduction, efficient material usage and optimization of time
	Initiative and Enterprise
	The user/individual on the job needs to know and understand how to: SB16. work towards achieving better results for self, others and organization by displaying initiative and enterprise SB17. undertake and express new ideas and initiatives to others SB18. modify work plan to overcome unforeseen difficulties or developments that occur as work progresses

CSC/ N 0406: Develop plan for engineering design process

	SB19. participate in improvement procedures including process, quality and internal/external customer/supplier relationships SB20. achieve more by applying one's competencies in new and different situations and contexts to achieve more SB21. identify potential business opportunities for the company
	Self-Management
	The user/individual on the job needs to know and understand how to: SB22. work taking responsibility for own work outcomes SB23. adhere to work timings, dress code and other organizational policies SB24. work following laid down rules, procedures, instructions and policies SB25. conduct oneself express dissent during conflict situations while exercising restraint SB26. avoid and manage distractions to be disciplined at work SB27. work by time management for achieving better results
	Customer Centricity
	The user/individual on the job needs to know and understand how to: SB28. communicate with customers following organizational protocols and practices generating customer satisfaction and delight SB29. undertake clear and open communication with customers for trust building and clarifying and managing expectations of customers SB30. respond to customer expectation promptly and recognizing and communicating limits of one's authority SB31. deal with customer feedback SB32. handle customer disgruntlement and dissatisfaction
	Teamwork
	The user/individual on the job needs to know and understand how to: SB33. work in a team in order to achieve better results SB34. identify and clarify work roles within a team SB35. communicate and cooperate with others in the team SB36. seek assistance from fellow team members SB37. co-ordinate across teams and personnel for getting work done

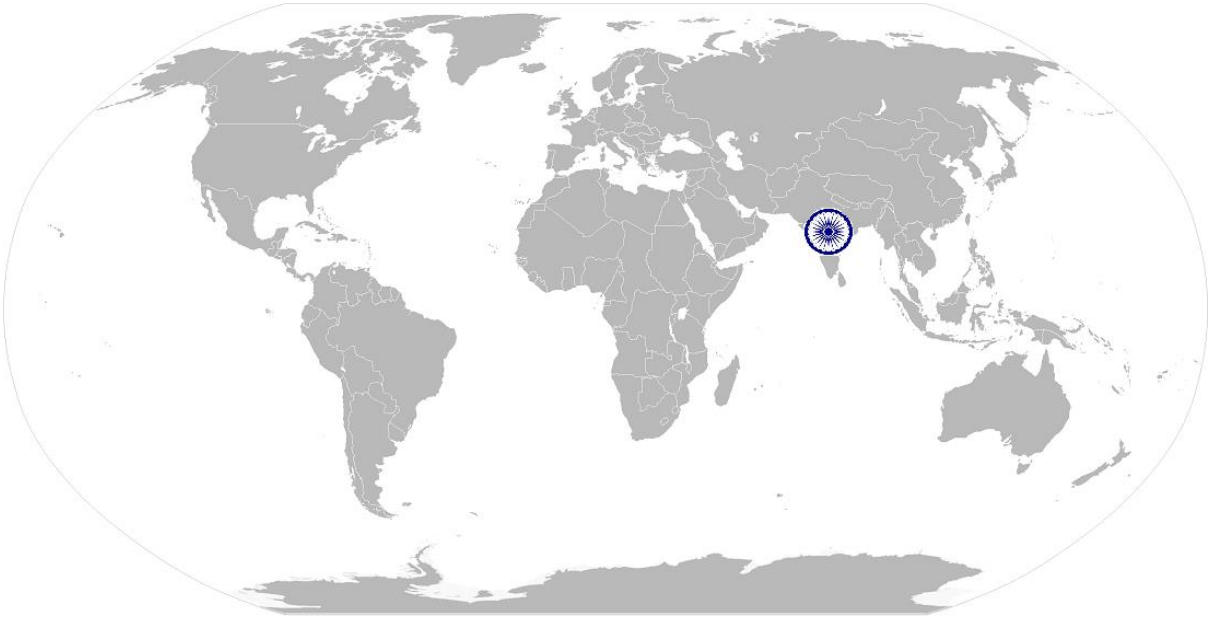
CSC/ N 0406: Develop plan for engineering design process

NOS Version Control

NOS Code	**CSC / N 0406**		
Credits(NSQF)	**TBD**	**Version number**	**1.0**
Industry	**Capital Goods**	**Drafted on**	**24/04/14**
Industry Sub-sector	1. Machine Tools 2. Dies, Moulds And Press Tools 3. Plastics Manufacturing Machinery 4. Textile Manufacturing Machinery 5. Process Plant Machinery 6. Electrical and Power Machinery 7. Light Engineering Goods	**Last reviewed on**	**18/03/15**
Occupation	**Design**	**Next review date**	**30/08/16**

CSC/ N 0407: Create and evaluate mechanical engineering design options

National Occupational Standard



Overview

This unit covers the creation of mechanical engineering design options and their evaluation against a design brief, in accordance with approved procedures.

CSC/ N 0407: Create and evaluate mechanical engineering design options

National Occupational Standard

Unit Code	**CSC/ N 0407**
Unit Title (Task)	**Create and evaluate mechanical engineering design options**
Description	This unit covers the creation of engineering design options and their evaluation against a design brief, in accordance with approved procedures. It covers understanding the design requirements from the design brief, identifying design options, evaluation of design options and their presentation in suitable formats The candidate will be expected to work unsupervised, on their own or as part of a team and may also be expected to lead or instruct a team, taking responsibility for own actions as well as the actions of the team and for the quality and accuracy of the work produced.
Scope	This unit/task covers the following: • Creating and presenting engineering design options • Evaluating engineering design options

Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Creating and presenting engineering design options	The user/individual on the job should be able to: PC1. obtain and review existing information with reference to the specified design requirements **Existing information**: drawing brief; modification request; regulations; calculations, previous drawings/designs, sketches, previous test/trial data, modelling data, standards reference documents, notes from meetings/discussions **Design requirements as per the following**: customer requirements; legal/copyright considerations; design brief; regulatory requirements; design constraints PC2. prepare outline ideas for the designs PC3. obtain agreement from relevant people PC4. carry out the design process, utilizing the appropriate technology PC5. document all facets of the design activity PC6. communicate the outcomes of the design process to the appropriate people via various media used in the organisation **Media**: a verbal report; presentation; computer generated report; specific company document PC7. deliver the designs in the appropriate format PC8. ensure that the design cannot be changed or amended without authorization PC9. confirm and agree understanding of the design requirements PC10. deal with problems relating to the design requirements and agreed solutions PC11. identify design options which will meet requirements and the design specification

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	PC12. create designs that meet the customer's requirements as specified in the design brief for the engineering product or process PC13. apply approved general and sub-sector specific engineering concepts, processes, principles to achieve the design brief **Engineering or manufacturing principles and concepts**: metals, plastic, ceramics materials and their properties; basic metallurgy and heat treatment; thermal properties; thermal stress analysis-heat treatment diagram/process; structural engineering/analytics; finite element analysis; manufacturing technologies; welding principles; fabrication principles; kinematics and dynamics principles; design calculations like pressure, force, capacity etc.; trigonometry, geometry, dimensional and geometric tolerance; general engineering drawing PC14. apply the principles of dynamics and kinematics to ensure that design options will work PC15. ensure that the design options are practical PC16. prepare costing's and timescale and ensure they are acceptable PC17. obtain suitable advice and guidance to assist in the design work PC18. present the designs in suitable formats and with sufficient information to allow the customer to assess them PC19. ensure that the designs comply with all relevant regulations, standards directives or codes of practice **Regulations, standards directives or codes of practice**: organisational guidelines and procedures; recognised compliance agency/body's standards, directives or codes of practice; equipment manufacturer's operating specification/range; customer standards and requirements; national and/or International standards or directives; health, safety and environmental requirements PC20. deal promptly and effectively with problems within your control and seek help and guidance from the relevant people if you have problems that you cannot resolve PC21. ensure that the designs are protected in line with organizational procedures
Evaluating engineering design options	The user/individual on the job should be able to: PC22. obtain clear criteria on which to base the evaluation **Criteria for evaluating designs**: function; financial constraints; manufacturing or installation requirements; installation or commissioning requirements; building redundancy into the design; appropriate materials; technology; aesthetics; performance/capability; reliability; life cycle of product, system or process; compatibility; maintenance and repair; product features; availability of resources; characteristics; corporate branding; components to be used; any interface requirements; future customer support; timescales; diversity/alternatives; safety; environmental/sustainability factors PC23. obtain the necessary information from the available sources PC24. evaluate the design against the established criteria, using appropriate evaluation methods

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	Evaluation methods: market research; software simulation; analysis of the design documentation; simulation; model; prototype assessment; pilot trial; small-scale production PC25. make recommendations on various design options, and communicate the results of the evaluation to the relevant people
Knowledge and Understanding (K)	
A. Organizational Context (Knowledge of the company / organization and its processes)	The user/individual on the job needs to know and understand: KA1. legislation, standards, policies, and procedures followed in the company relevant to own employment and performance conditions KA2. relevant health and safety requirements applicable in the work place KA3. importance of working in clean and safe environment KA4. own job role and responsibilities and sources for information pertaining to employment terms, entitlements, job role and responsibilities KA5. reporting structure, inter-dependent functions, lines and procedures in the work area KA6. relevant people and their responsibilities within the work area KA7. escalation matrix and procedures for reporting work and employment related issues KA8. documentation and related procedures applicable in the context of employment and work KA9. importance and purpose of documentation in context of employment and work KA10. organizational activities required for the design process KA11. organizational procedures and information systems for storing design data and configuration management
B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. national and international standards and conventions that are used for the design KB2. underlying general and sub-sector specific engineering or manufacturing principles and concepts required to produce fit for purpose designs **Engineering or manufacturing principles and concepts**: metals, plastic, ceramics materials and their properties; basic metallurgy and heat treatment; thermal properties; thermal stress analysis-heat treatment diagram/process; structural engineering/analytics; finite element analysis; manufacturing technologies; welding principles; fabrication principles; kinematics and dynamics principles; design calculations like pressure, force, capacity etc.; trigonometry, geometry, dimensional and geometric tolerance; general engineering drawing KB3. functionality of the design including any interrelationships required with other components/products/systems or technologies KB4. working knowledge and understanding of the relative costs likely to be incurred during the development and production of the design KB5. regulations, standards, directives and codes of practice that are relevant, and any implications they have on the design KB6. methods for achieving different types of design KB7. design formats that are most suitable to meet the design team's needs KB8. potential risks to a design, and how can it be protected KB9. importance of establishing and recording responsibilities

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	KB10. how and where to obtain the design brief/specification KB11. procedures used for making changes or amendments to the design KB12. sources of advice and guidance on designs KB13. how to present designs to the customer KB14. need for effective document and data control and the implications if these are not applied KB15. patent, copyright and intellectual property issues
Skills (S) [Optional]	
A. Core Skills/ Generic Skills	**Communication**
	The user/ individual on the job needs to know and understand how to: SA1. read and interpret information correctly from various job specification documents, manuals, health and safety instructions, memos, etc. applicable to the job in English and/or local language SA2. fill up appropriate technical forms, process charts, activity logs as per organizational format in English and/or local language SA3. convey and share technical information clearly using appropriate language SA4. check and clarify task-related information SA5. liaise with appropriate authorities using correct protocol SA6. communicate with people in respectful form and manner in line with organizational protocol SA7. listen to questions and concerns of the customer and provide resolution in a respectful manner as per organizational guidelines SA8. use basic office applications like spread sheet, word processor, presentations SA9. use ERP software and other organizational software specific to quality function SA10. use email to communicate within the organization as per organization guidelines SA11. be well dressed and groomed SA12. put forward ones point of view in a convincing manner
	Numerical and computational skills
	The user/individual on the job needs to know and understand how to: SA13. undertake numerical operations, geometry and calculations/ formulae **Arithmetic**: addition, subtraction, multiplication, division, fractions and decimals, percentages and proportions, simple ratios and averages SA14. use appropriate measuring techniques SA15. express numerical solutions to a degree of accuracy that is appropriate to the value being calculated **Degree of accuracy**: correct to three significant figures, correct to two decimal places, express a decimal fraction in standard form, express tolerance in terms of limits of size SA16. use a calculator to raise a number to a power and determine square roots SA17. use formulae to complete transpositions and solve problems **Transpositions**: involving addition, subtraction, multiplication and division in any combination using a maximum of three terms, for example Ohm's Law, substitution of known values SA18. use algebraic expressions to solve linear equations SA19. plot and interpret straight line graphs SA20. write a small program which consists of all the machine functions

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	Learning
	The user/individual on the job needs to know and understand how to: SA21. maintain current knowledge of applicable standards, legislation, codes of practice and product/process developments SA22. participate in on-the-job and other learning, training and development interventions and assessment SA23. clarify task related information with appropriate personnel or technical adviser SA24. seek to improve and modify own work practices
B. Professional Skills	**Problem Solving**
	The user/individual on the job needs to know and understand how to: SB1. identify problems with work planning, procedures, output and behavior and their implications SB2. prioritize and plan for problem solving SB3. communicate problems appropriately to others SB4. identify sources of information and support for problem solving SB5. seek assistance and support from other sources to solve problems SB6. identify effective resolution techniques SB7. select and apply resolution techniques SB8. seek evidence for problem resolution SB9. inspect quality of own or other employee's work SB10. analyze information according to enterprise and work requirements SB11. use diagnostic skills to identify and determine causes of faults, including interpretation of in-built fault indicators and error codes SB12. take decisions within if within own jurisdiction or take approval for case outside own jurisdiction
	Plan and Organize
	The user/individual on the job needs to know and understand: SB13. plan, prioritize and sequence work operations as per job requirements SB14. organize and analyze information relevant to work SB15. basic concepts of work productivity including waste reduction, efficient material usage and optimization of time
	Initiative and Enterprise
	The user/individual on the job needs to know and understand how to: SB16. work towards achieving better results for self, others and organization by displaying initiative and enterprise SB17. undertake and express new ideas and initiatives to others SB18. modify work plan to overcome unforeseen difficulties or developments that occur as work progresses SB19. participate in improvement procedures including process, quality and internal/external customer/supplier relationships SB20. achieve more by applying one's competencies in new and different situations and contexts to achieve more SB21. identify potential business opportunities for the company
	Self-Management

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	The user/individual on the job needs to know and understand how to: SB22. work taking responsibility for own work outcomes SB23. adhere to work timings, dress code and other organizational policies SB24. work following laid down rules, procedures, instructions and policies SB25. conduct oneself express dissent during conflict situations while exercising restraint SB26. avoid and manage distractions to be disciplined at work SB27. work by time management for achieving better results
	Customer Centricity
	The user/individual on the job needs to know and understand how to: SB28. communicate with customers following organizational protocols and practices generating customer satisfaction and delight SB29. undertake clear and open communication with customers for trust building and clarifying and managing expectations of customers SB30. respond to customer expectation promptly and recognizing and communicating limits of one's authority SB31. deal with customer feedback SB32. handle customer disgruntlement and dissatisfaction
	Teamwork
	The user/individual on the job needs to know and understand how to: SB33. work in a team in order to achieve better results SB34. identify and clarify work roles within a team SB35. communicate and cooperate with others in the team SB36. seek assistance from fellow team members SB37. co-ordinate across teams and personnel for getting work done

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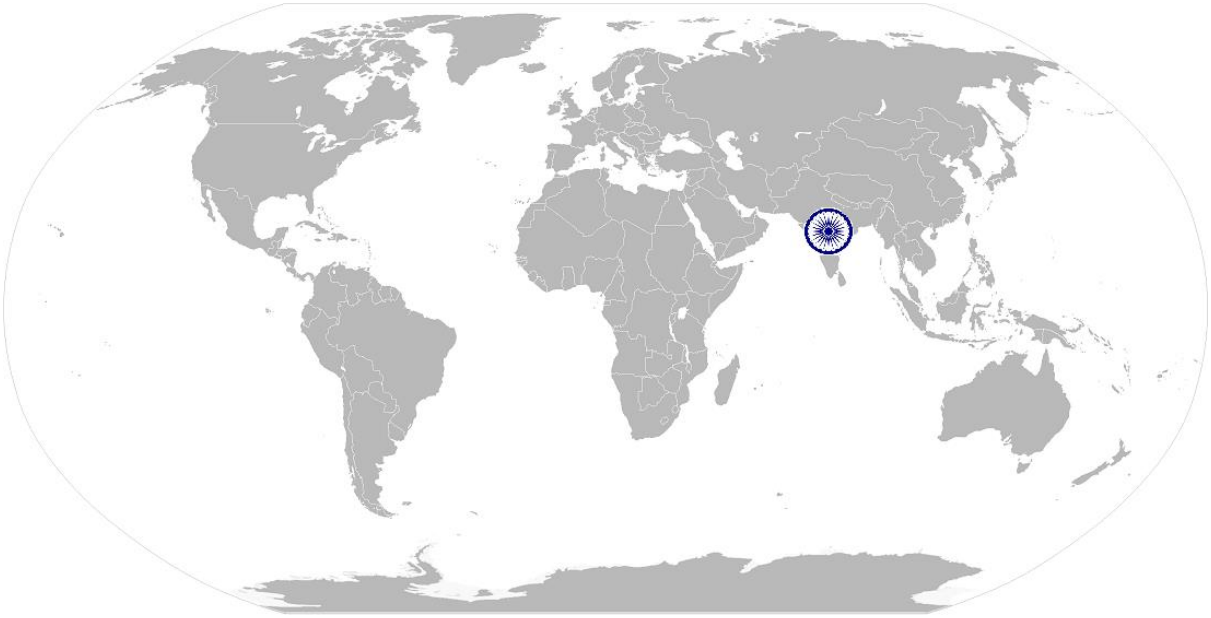
NOS Version Control

NOS Code	**CSC / N 0407**		
Credits(NSQF)	**TBD**	**Version number**	**1.0**
Industry	**Capital Goods**	**Drafted on**	**24/04/14**
Industry Sub-sector	1. Machine Tools 2. Dies, Moulds And Press Tools 3. Plastics Manufacturing Machinery 4. Textile Manufacturing Machinery 5. Process Plant Machinery 6. Electrical and Power Machinery 7. Light Engineering Goods	**Last reviewed on**	**18/03/15**
Occupation	**Design**	**Next review date**	**30/08/16**

National Occupational Standard



Overview

This unit covers the creation and modification of 2D mechanical engineering design using CAD system. It also involves the detail drafting of drawings for manufacturing, assembly, sub-assembly, installation etc.

CSC/ N 0402: Make or modify 2D mechanical engineering drawings using CAD system

National Occupational Standard

Unit Code	**CSC / N 0402**
Unit Title (Task)	**Make or modify 2D mechanical engineering drawings using CAD system**
Description	This unit covers the skills and knowledge needed to set up and operate a computer aided drawing (CAD) system to produce detailed drawings for engineering activities, in accordance with approved procedures. It involves the use of a CAD system linked bills of material, files management and associated customization of installed software including the use of macros, menus and default settings. File formats may include IGES, DXF, HPGL, etc. 2D drawings may be produced from 3D models created using computer aided design system. The candidate will be expected to work unsupervised taking full responsibility for their actions receiving guidance and support from senior management and designers.
Scope	This unit/task covers the following: • Preparing for 2D mechanical engineering drawings • Performing set-up activities • Make or modify 2D mechanical engineering drawings using CAD system

Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Preparing for 2D mechanical engineering drawings	The user/individual on the job should be able to: PC1. use appropriate sources to obtain the technical information relevant to the drawing to be created **Technical information relevant to the drawing to be created**: drawing brief; specifications(overall dimensions, materials, special procedures for manufacturing); drawing change or modification request; regulations; existing drawings/designs, sketches, notes from meetings/discussions; standards reference documents (eg. limits and fits, tapping drill charts, contraction allowances) PC2. identify design features, as appropriate to the drawing being produced **Design features**: function, materials, clearance, operating environment, quality, aesthetics, interfaces, physical space; tolerances PC3. ensure that the data and information received is complete and correct PC4. establish the drawing requirements from the data and information received PC5. report and rectify incorrect and inconsistent information in job specification documents as per organization procedures PC6. access and use the correct drawing software PC7. select drafting equipment appropriate to the drawing method chosen PC8. check that all the equipment is correctly connected and in a safe and usable working condition PC9. power up the equipment and activate the appropriate drawing software
Performing set-up activities	The user/individual on the job should be able to: PC10. customize system variables, menus and drawing defaults to produce the

CSC/ N 0402: Make or modify 2D mechanical engineering drawings using CAD system

	drawing to the appropriate scale PC11. develop macros as per approved procedures PC12. set up and check that all peripheral devices are connected and correctly operating and interface with ERP if required is available **Peripheral devices** could be: keyboard, mouse, light pen, digitizer/tablet, scanner, printer, plotter, etc. PC13. set the drawing datum at a convenient point PC14. set up drawing parameters (eg. layers, line types, color, text styles) to company procedures or to suit the drawing produced
Make or modify 2D mechanical engineering drawings using CAD system	The user/individual on the job should be able to: PC15. interpret and produce mechanical drawings, using first angle orthographic projections, isometric/oblique projections, third angle orthographic projections, sectional views PC16. apply drafting principles to produce various types of drawings that are consistent with applicable standards and procedures for use in various engineering activities **Types of drawings**: detail drawings, sub-assembly drawings, general arrangement drawings, installation drawings, exploded views **Standards and procedures**: organizational guidelines and procedures, recognized compliance agency/body standards, directives or codes of practice, CAD software standards/protocols, national and/or International standards or directives, customer standards and requirements, health, safety and environmental requirements **Engineering Activities**: production activities (such as processing of materials, fabrication, finishing, assembly, joining); installation activities (such as commissioning/decommissioning, site preparation, equipment installation); operational activities (such as movement of materials, workplace layouts, work-flow diagrams), maintenance activities (such as planned preventative maintenance, part/sub-assembly exchange) PC17. create a drawing template to the required standards, which includes all necessary detail (eg.) using various drawing tools **Drawing template details**: layers of drawings, scale, paper size, color setup, line types, dimension system, title, drawing number, date, text styles **Drawing Tools**: straight lines, hatching and shading on drawings, adding dimensions and text to drawings, producing layers of drawings, symbols and abbreviations, hidden detail, curved/contour lines, angled lines, circles or ellipses; parts lists, geometrical and dimensional tolerance, insertion of standard components, elevation, plane view, side view, sectional views, detail views PC18. use appropriate terminologies and techniques to create drawings, in the required formats, that are sufficiently and clearly detailed PC19. use keyboard command and pull down menus available in common CAD systems

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	PC20. use codes and other references that follow the required conventions PC21. draw temporary fasteners and rivets PC22. draw components details and assembly drawings PC23. draw piping layouts, gears and machine foundation or base PC24. draw working drawings of jigs and fixtures PC25. draw detailed drawings of dies, moulds and press tools PC26. dimension and label the drawing as per approved procedures PC27. create detailed views using various scales to meet job requirements PC28. ensure that drawings are checked and approved by the appropriate person PC29. produce hard copies of the finished drawings PC30. check that the drawing is correctly titled and referenced; sawing is correctly titled and referenced PC31. save the drawing to an appropriate storage medium (eg. hard drive, CD/DVD, external storage device) PC32. create a separate backup copy and place it in safe storage PC33. identify component parts list with part name, description of part, material specification or part number, quantities and other details to prepare bill of materials as per organizational guidelines PC34. deal promptly and effectively with problems within control and seek help and guidance from the relevant people if you have problems that they cannot resolve PC35. ensure that changes are completed as required by organizational procedures PC36. shut down the CAD system to a safe condition on completion of the drawing activities
Knowledge and Understanding (K)	
A. Organizational Context (Knowledge of the company / organization and its processes)	The user/individual on the job needs to know and understand: KA1. legislation, standards, policies, and procedures followed in the company relevant to own employment and performance conditions KA2. relevant health and safety requirements applicable in the work place KA3. importance of working in clean and safe environment KA4. own job role and responsibilities and sources for information pertaining to employment terms, entitlements, job role and responsibilities KA5. reporting structure, inter-dependent functions, lines and procedures in the work area KA6. relevant people and their responsibilities within the work area KA7. escalation matrix and procedures for reporting work and employment related issues KA8. documentation and related procedures applicable in the context of employment and work KA9. importance and purpose of documentation in context of employment and work

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B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. organizational procedures and information systems for retrieving and storing drawing data KB2. system variables that can be customized KB3. procedures and need for customizing identified system variables KB4. applicable drafting standards/procedures KB5. procedures and need for customizing menus and system defaults KB6. procedures and need for developing macros KB7. appropriate projection for the drawing purpose KB8. reasons for selecting the chosen projection KB9. reasons for including auxiliary views in drawings KB10. procedures for producing component, layout and/or assembly drawings KB11. drawing specifications KB12. common symbols used in drawings KB13. how and where to obtain the relevant sources and methods for obtaining any required technical information relevant to the drawing KB14. methods and procedures used to minimize the chances of infecting a computer with a virus KB15. procedure to follow in case there are corruptions or virus attacks KB16. practices that make systems vulnerable to corruption and damage KB17. basic set-up and operation of the computer system, and the peripheral devices that are used (eg. light pen, digitizer and tablet, printer or plotter, scanner) KB18. how to access the specific computer drawing software to be used, and the use of software manuals and related documents to aid operation of the relevant drawing system KB19. basic principles of engineering manufacturing operations that are used to produce the drawn item **Basic principles of engineering manufacturing operations**: casting and forging; fabrication; machining methods; joining processes; assembly and installation methods; limitations of the equipment/processes; kinematics principles relevant to manufacturing of machinery KB20. types of drawings that may be produced by the software KB21. selection of standard components KB22. functionality of the component being drawn, and its interrelationship with other components and assemblies KB23. how to set up the viewing screen to show multiple views of the drawing to help with drawing creation KB24. standards and conventions that are used for the drawings KB25. how to set up the drawing template parameters KB26. application and use of drawing tools KB27. how to access, recognize and use a wide range of standard components and symbol libraries from the CAD equipment KB28. need for document control KB29. how to save and store drawings KB30. need to create backup copies, and to file them in a separate and safe location KB31. how to produce hard copies of the drawings, and the advantages and disadvantages of printers and plotters

CSC/ N 0402: Make or modify 2D mechanical engineering drawings using CAD system

Skills (S) [Optional]	
A. Core Skills/ Generic Skills	**Communication**
	The user/ individual on the job needs to know and understand how to: SA1. read and interpret information correctly from various job specification documents, manuals, health and safety instructions, memos, etc. applicable to the job in English and/or local language SA2. fill up appropriate technical forms, process charts, activity logs as per organizational format in English and/or local language SA3. convey and share technical information clearly using appropriate language SA4. check and clarify task-related information SA5. liaise with appropriate authorities using correct protocol SA6. communicate with people in respectful form and manner in line with organizational protocol
	Numerical and computational skills
	The user/individual on the job needs to know and understand how to: SA7. undertake numerical operations, and calculations/ formulae **Numerical computations**: addition, subtraction, multiplication, division, fractions and decimals, percentages and proportions, simple ratios and averages SA8. identify and draw various basic, compound and solid shapes as per dimensions given **Basic shapes**: square, rectangle, triangle, circle **Compound shapes**: involving squares, rectangles, triangles, circles, semi-circles, quadrants of a circle **Solid shapes**: cube, rectangular prism, cylinder SA9. use appropriate units and number systems to express degree of accuracy **Units and number systems representing degree of accuracy**: decimals places, significant figures, fractions as a decimal quantity SA10. interpret and express tolerance in terms of limits on dimensions SA11. calculation of the value of angles in a triangle **Angles in a triangle**: right-angled, isosceles, equilateral
	Learning
	The user/individual on the job needs to know and understand how to: SA12. participate in on-the-job and other learning, training and development interventions and assessments SA13. clarify task related information with appropriate personnel or technical adviser SA14. seek to improve and modify own work practices SA15. maintain current knowledge of application standards, legislation, codes of practice and product/process developments
	Computer Basics
	The user/individual on the job needs to know and understand how to: SA16. perform basic operations in a computer like switching it on/off, using the mouse and keyboard, accessing files, opening, closing, creating and deleting folders, etc.

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	SA17. access and use word-processers and spreadsheets in a computer SA18. retrieve and enter data using standard system forms and templates SA19. receive and send emails using preset email accounts SA20. take printouts of documents
B. Professional Skills	**Problem Solving**
	The user/individual on the job needs to know and understand how to: SB1. identify problems with work planning, procedures, output and behavior and their implications SB2. prioritize and plan for problem solving SB3. communicate problems appropriately to others SB4. identify sources of information and support for problem solving SB5. seek assistance and support from other sources to solve problems SB6. identify effective resolution techniques SB7. select and apply resolution techniques SB8. seek evidence for problem resolution
	Plan and Organize
	The user/individual on the job needs to know and understand how to: SB9. plan, prioritize and sequence work operations as per job requirements SB10. organize and analyze information relevant to work SB11. basic concepts of shop-floor work productivity including waste reduction, efficient material usage and optimization of time
	Initiative and Enterprise
	The user/individual on the job needs to know and understand how to: SB12. undertake and express new ideas and initiatives to others SB13. modify work plan to overcome unforeseen difficulties or developments that occur as work progresses SB14. participate in improvement procedures including process, quality and internal/external customer/supplier relationships SB15. one's competencies in new and different situations and contexts to achieve more
	Self-Management
	The user/individual on the job needs to know and understand how to: SB16. exercise restraint while expressing dissent and during conflict situations SB17. avoid and manage distractions to be disciplined at work SB18. manage own time for achieving better results
	Teamwork
	The user/individual on the job needs to know and understand how to: SB19. work in a team in order to achieve better results SB20. identify and clarify work roles within a team SB21. communicate and cooperate with others in the team for better results SB22. seek assistance from fellow team members
	Critical Thinking
	The user/individual on the job needs to know and understand how to: SB23. apply, analyze, and evaluate the information gathered from observation, experience, reasoning, or communication, as a guide to thought and action

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NOS Version Control

NOS Code	**CSC / N 0402**		
Credits(NSQF)	**TBD**	**Version number**	**1.0**
Industry	**Capital Goods**	**Drafted on**	**14/04/14**
Industry Sub-sector	1. Machine Tools 2. Dies, Moulds And Press Tools 3. Plastics Manufacturing Machinery 4. Textile Manufacturing Machinery 5. Process Plant Machinery 6. Electrical and Power Machinery 7. Light Engineering Goods	**Last reviewed on**	**18/03/15**
Occupation	**Design**	**Next review date**	**30/08/16**

CSC/ N 0408: Make or modify 3D mechanical engineering models using CAD system

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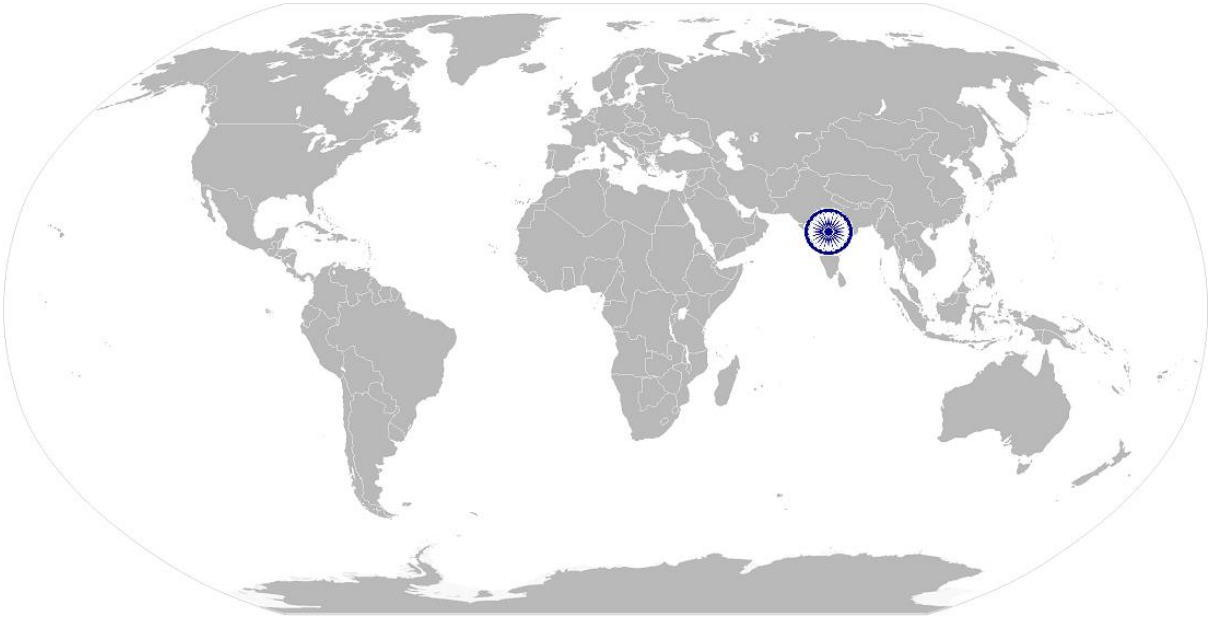
National Occupational Standard



Overview

This unit is about creating or modifying 3D mechanical engineering models using CAD system

CSC/ N 0408: Make or modify 3D mechanical engineering models using CAD system

National Occupational Standard

Unit Code	**CSC/ N 0408**
Unit Title (Task)	**Make or modify 3D mechanical engineering models using CAD system**
Description	This unit is about creating or modifying 3D mechanical engineering models using CAD system. The candidate will be able to extract all necessary information in order to carry out the modelling operations based of 'model' brief or a request for a change/ modification; produce 3D CAM code files, managing files, managing tools and associated customization of installed software including the use of macros, menus and default settings; the creation and manipulation of entities such as arcs and lines and primitives such as spheres, cones, cylinders and boxes using industrial software The candidate will be expected to work unsupervised taking full responsibility for their actions.
Scope	This unit/task covers the following: • Preparing for 3D mechanical engineering modelling using CAD system • Creating and making changes to 3D mechanical engineering models using CAD system

Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Preparing for 3D mechanical engineering modelling using CAD system	The user/individual on the job should be able to: PC1. plan the modelling activities before starting them PC2. use appropriate sources to obtain the required information **Required information**: model brief/request, specifications , change order/modification request, regulations, manuals, sample component, calculations, previous models/designs, sketches, notes from meetings/discussions, standards reference documents (such as limits and fits, tapping drill charts), other available data PC3. access and use the correct modelling software and tools **Modelling software and tools**: solid modelling, wire frame modelling, surface modelling PC4. check that all the equipment is correctly connected and in a safe and usable working condition PC5. power up the equipment and activate the appropriate modelling tools PC6. set up the modelling environment and select a suitable template/folder PC7. set up and check that all peripheral devices are connected and correctly operating (such as keyboard, mouse, light pen, digitizer/tablet, scanner, printer, plotter) PC8. set the drawing datum at a convenient point to create a modelling template with title, file number, material, date PC9. establish coordinate system, orientation and views as per the job

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	requirement
Creating and making changes to 3D mechanical engineering models using CAD system	The user/individual on the job should be able to: PC10. create entities in 3D space as per job requirement. PC11. modify entities in 3D space as per job requirement. PC12. create 3-D views on the screen by manipulating drawing planes and inserting 3-D geometric shapes PC13. creating swept, extruded and revolved solids in 3-D space PC14. produce sectioned models (cutting planes and cross hatching) PC15. use pre-drawn library files and primitives to produce a 3-D model PC16. extracting mass and area properties from solid model PC17. identify and use key features of solid modelling software package to produce models **Key features:** extrude, extrude cut, solid model, mirror, revolve, wire frame, radius/chamfer, hide, rib, rectangular pattern, fillet, cut/remove, circular pattern, shell, development view, motion analysis, animation, defining material property, exploded views PC18. perform drawing for solid modelling PC19. extract physical properties as per job requirement, including volume, mass and centre of gravity PC20. take into account the following factors, as appropriate to the model being produced **Factors**: function, cost, physical space, quality, lifetime of the product, operating environment, manufacturing method, tolerances, interfaces, ergonomics, clearance, safety, materials, aesthetics, apply rendering techniques PC21. use pan, isometric and zoom CAD operations to highlight design areas in the modelling environment PC22. modify parts in the assembly environment using the following features **Features**: constrained parts and assemblies, straight lines, insertion of standard components, hidden detail, dimensions, symbols and abbreviations, hatching and shading, angular surfaces, curved surfaces, parts lists, text, circles or ellipses, material color, surface texture PC23. produce 3-D drawings incorporating section views with all necessary annotation PC24. produce a model for export to the following manufacturing systems **Manufacturing systems**: DNC (Direct Numerically controlled) /CNC(Computer Numerically controlled) machines; 3D printer; other specific system PC25. produce models which comply with organizational guidelines; statutory regulations and codes of practice; CAD software standards; national and international standards PC26. confirm that the model is as per job specifications and contains all relevant information PC27. use appropriate techniques to create models that are sufficiently and clearly detailed

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	PC28. use codes and other references that follow the required conventions PC29. make sure that models are checked and approved by the appropriate person PC30. save the models in the appropriate file type and location PC31. produce hard copies of the finished models, with sufficient detail to allow production PC32. deal promptly and effectively with problems within your control, and seek help and guidance from the relevant people if you have problems that you cannot resolve PC33. shut down the CAD system to a safe condition on completion of the modelling activities
Knowledge and Understanding (K)	
A. Organizational Context (Knowledge of the company / organization and its processes)	The user/individual on the job needs to know and understand: KA1. specific health, safety and environmental requirements that apply to the product or process to be designed KA2. the limits of their own authority, and to whom they should report if they have problems that they cannot resolve KA3. importance of establishing and recording responsibilities KA4. organizational procedures and information systems for storing drawing data KA5. relevant sources and methods for obtaining any required technical information relevant to the model being produced (such as drawing briefs, specification sheets, request for changes or modifications to models; technical information such as limits and fits, contraction allowances, bearing selection, surface finish)
B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. identification of the correct 3D drawing software package from the menu or windows environment; the various techniques that are available to access and use the CAD software (such as mouse, menu or tool bar, light pens, digitizers and tablets, printers or plotters, and scanners) KB2. how to access the specific computer modelling software to be used, and the use of the help file to aid efficient operation of the relevant drawing system KB3. documentation required for particular applications (such as design briefs, specification sheets, request for change orders KB4. types of drawings that may be produced by the modelling software KB5. how to set up the viewing screen to show multiple views of the component to help with drawing creation (to include isometric front and side elevations) KB6. national, international and organizational standards and conventions that are used for the models/drawings KB7. application and use of modelling tools (such as for straight lines, curves and circles; how to add dimensions and text to drawings) KB8. how to access, recognize and use a wide range of standard components and symbol libraries from the CAD equipment KB9. applications of different 3D modelling programs • Surface modelling • solid modelling • wire frame modelling KB10. how to produce models with sufficient information to allow them to be successfully exported to the manufacturing system used

CSC/ N 0408: Make or modify 3D mechanical engineering models using CAD system

	KB11. need for document control (such as ensuring that completed models are approved, labelled and stored on a suitable storage medium) KB12. need to create backup copies, and to file them in a separate and safe location, also filing and storing hard copies for use in production KB13. how to produce hard copies of the drawings, and the advantages and disadvantages of printers and plotters KB14. purpose for which the 3D model is to be developed KB15. appropriate coordinate system for the job KB16. reasons for selecting the chosen coordinate system KB17. orientation of the model with respect to the coordinate system KB18. number of views required to establish the model KB19. procedures for creating entities in 3D space KB20. entities that can be created/manipulated in 3D space KB21. procedures for manipulating entities in 3D space KB22. procedures for creating ruled and revolved surfaces in 3D space KB23. applications of ruled and revolved surfaces KB24. procedures for modifying existing 3D models KB25. procedures for saving drawing files KB26. various formats in which drawing files can be saved KB27. reasons for using different formats when saving drawing files KB28. procedures for extracting data with respect to the physical properties of shapes created in 3D space KB29. physical properties of shapes created in 3D space that can be extracted from the drawing file KB30. erecting of exploded views KB31. creating own toolbox KB32. dynamic simulation of models creating intelligent models using parametric modelling KB33. producing composite models (composite regions and composite solids) KB34. producing sectioned models (cutting planes and cross hatching) KB35. using pre-drawn library files and primitives to produce a 3-D model KB36. extracting mass and area properties from solid model KB37. applying rendering techniques to a 3D model (rendering types and preferences, render lighting techniques, and views and scenes) KB38. using various materials and surface finish options KB39. producing hard copies of 3-D solid models KB40. saving 3-D models in various file formats for retrieval into other CAD application software
Skills (S) [Optional]	
A. Core Skills/ Generic Skills	**Communication**
	The user/ individual on the job needs to know and understand how to: SA1. read and interpret information correctly from various job specification documents, manuals, health and safety instructions, memos, etc. applicable to the job in English and/or local language SA2. fill up appropriate technical forms, process charts, activity logs as per organizational format in English and/or local language SA3. convey and share technical information clearly using appropriate language SA4. check and clarify task-related information

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	SA5. liaise with appropriate authorities using correct protocol SA6. communicate with people in respectful form and manner in line with organizational protocol SA7. listen to questions and concerns of the customer and provide resolution in a respectful manner as per organizational guidelines SA8. use basic office applications like spread sheet, word processor, presentations SA9. use ERP software and other organizational software specific to quality function SA10. use email to communicate within the organization as per organization guidelines SA11. be well dressed and groomed SA12. put forward ones point of view in a convincing manner
	Numerical and computational skills
	The user/individual on the job needs to know and understand how to: SA13. undertake numerical operations, and calculations/ formulae **numerical computations**: addition, subtraction, multiplication, division, fractions and decimals, percentages and proportions, simple ratios and averages SA14. identify and draw various basic, compound and solid shapes as per dimensions given **Basic shapes**: square, rectangle, triangle, circle **Compound shapes**: involving squares, rectangles, triangles, circles, semi-circles, quadrants of a circle **Solid shapes**: cube, rectangular prism, cylinder SA15. use appropriate units and number systems to express degree of accuracy **Units and number systems representing degree of accuracy**: decimals places, significant figures, fractions as a decimal quantity SA16. interpret and express tolerance in terms of limits on dimensions SA17. calculation of the value of angles in a triangle **Angles in a triangle**: right-angled, isosceles, equilateral
	Computer Basics
	The user/individual on the job needs to know and understand how to: SA18. perform basic operations in a computer like switching it on/off, using the mouse and keyboard, accessing files, opening, closing, creating and deleting folders, etc. SA19. access and use word-processers and spreadsheets in a computer SA20. retrieve and enter data using standard system forms and templates SA21. receive and send emails using preset email accounts SA22. take printouts of documents
	Learning

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	The user/individual on the job needs to know and understand how to: SA23. maintain current knowledge of applicable standards, legislation, codes of practice and product/process developments SA24. participate in on-the-job and other learning, training and development interventions and assessment SA25. clarify task related information with appropriate personnel or technical adviser SA26. seek to improve and modify own work practices
B. Professional Skills	**Problem Solving**
	The user/individual on the job needs to know and understand how to: SB1. identify problems with work planning, procedures, output and behavior and their implications SB2. prioritize and plan for problem solving SB3. communicate problems appropriately to others SB4. identify sources of information and support for problem solving SB5. seek assistance and support from other sources to solve problems SB6. identify effective resolution techniques SB7. select and apply resolution techniques SB8. seek evidence for problem resolution SB9. inspect quality of own or other employee's work SB10. analyze information according to enterprise and work requirements SB11. use diagnostic skills to identify and determine causes of faults, including interpretation of in-built fault indicators and error codes SB12. take decisions within if within own jurisdiction or take approval for case outside own jurisdiction
	Plan and Organize
	The user/individual on the job needs to know and understand: SB13. plan, prioritize and sequence work operations as per job requirements SB14. organize and analyze information relevant to work SB15. basic concepts of work productivity including waste reduction, efficient material usage and optimization of time
	Initiative and Enterprise
	The user/individual on the job needs to know and understand how to: SB16. work towards achieving better results for self, others and organization by displaying initiative and enterprise SB17. undertake and express new ideas and initiatives to others SB18. modify work plan to overcome unforeseen difficulties or developments that occur as work progresses SB19. participate in improvement procedures including process, quality and internal/external customer/supplier relationships SB20. achieve more by applying one's competencies in new and different situations and contexts to achieve more SB21. identify potential business opportunities for the company
	Self-Management

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	The user/individual on the job needs to know and understand how to: SB22. work taking responsibility for own work outcomes SB23. adhere to work timings, dress code and other organizational policies SB24. work following laid down rules, procedures, instructions and policies SB25. conduct oneself express dissent during conflict situations while exercising restraint SB26. avoid and manage distractions to be disciplined at work SB27. work by time management for achieving better results
	Customer Centricity
	The user/individual on the job needs to know and understand how to: SB28. communicate with customers following organizational protocols and practices generating customer satisfaction and delight SB29. undertake clear and open communication with customers for trust building and clarifying and managing expectations of customers SB30. respond to customer expectation promptly and recognizing and communicating limits of one's authority SB31. deal with customer feedback SB32. handle customer disgruntlement and dissatisfaction
	Teamwork
	The user/individual on the job needs to know and understand how to: SB33. work in a team in order to achieve better results SB34. identify and clarify work roles within a team SB35. communicate and cooperate with others in the team SB36. seek assistance from fellow team members SB37. co-ordinate across teams and personnel for getting work done

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NOS Version Control

NOS Code	**CSC / N 0408**		
Credits(NSQF)	**TBD**	**Version number**	**1.0**
Industry	**Capital Goods**	**Drafted on**	**24/04/14**
Industry Sub-sector	1. Machine Tools 2. Dies, Moulds And Press Tools 3. Plastics Manufacturing Machinery 4. Textile Manufacturing Machinery 5. Process Plant Machinery 6. Electrical and Power Machinery 7. Light Engineering Goods	**Last reviewed on**	**18/03/15**
Occupation	**Design**	**Next review date**	**30/08/16**

CSC/ N 1335: Use basic health and safety practices at the workplace

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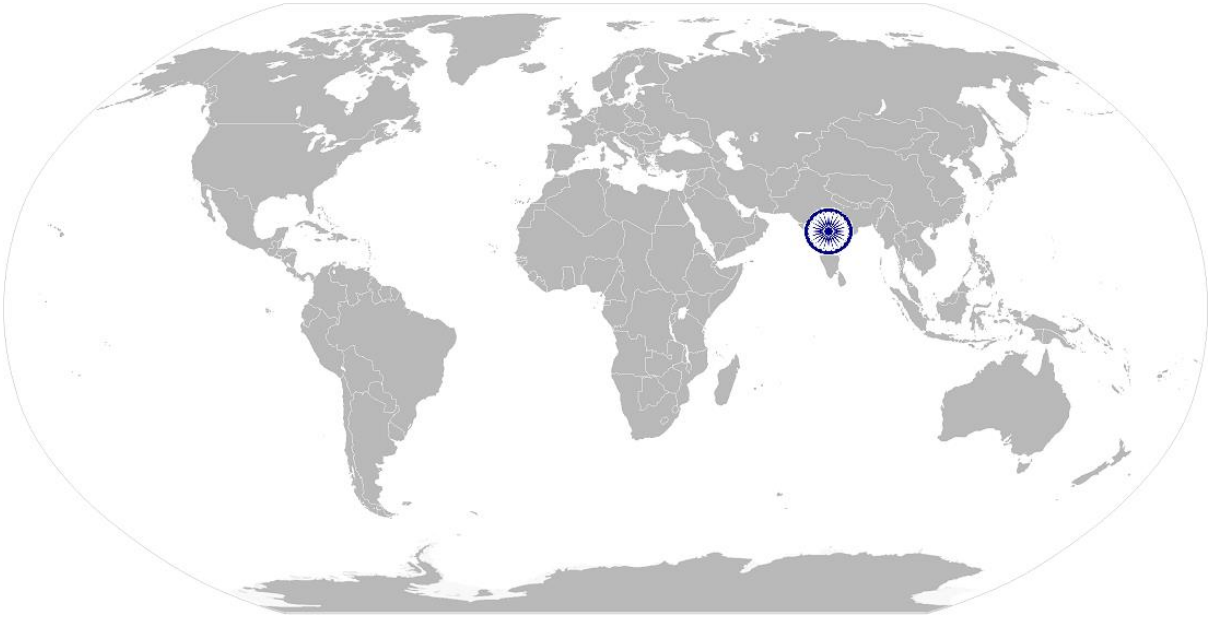
National Occupational Standard



Overview

This unit covers health, safety and security at the workplace. This includes procedures and practices that candidates need to follow to help maintain a healthy, safe and secure work environment.

CSC/ N 1335: Use basic health and safety practices at the workplace

National Occupational Standard

Unit Code	**CSC / N 1335**
Unit Title (Task)	**Use basic health and safety practices at the workplace**
Description	This OS unit is about knowledge and practices relating to health, safety and security that candidates need to use in the workplace. It covers responsibilities towards self, others, assets and the environment. It includes understanding of risks and hazards in the workplace, along with common techniques to minimize risk, deal with accidents, emergencies, etc. It covers knowledge of fire safety, common first aid applications, safe practices and emergency procedures.
Scope	This unit/task covers the following: • Health and safety • Fire safety • Emergencies, rescue and first-aid procedures

Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Health and safety	The user/individual on the job should be able to: PC1. use protective clothing/equipment for specific tasks and work conditions **Protective clothing**: leather or asbestos gloves, flame proof aprons, flame proof overalls buttoned to neck, cuffless (without folds), trousers, reinforced footwear, helmets/hard hats, cap and shoulder covers, ear defenders/plugs, safety boots, knee pads, particle masks, glasses/goggles/visors **Equipment**: hand shields, machine guards, residual current devices, shields, dust sheets, respirator PC2. state the name and location of people responsible for health and safety in the workplace PC3. state the names and location of documents that refer to health and safety in the workplace PC4. identify job-site hazardous work and state possible causes of risk or accident in the workplace **Hazards**: sharp edged and heavy tools; heated metals; oxyfuel and gas cylinders; welding radiation; hazardous surfaces(sharp, slippery, uneven, chipped, broken, etc.); hazardous substances(chemicals, gas, oxy-fuel, fumes, dust, etc.); physical hazards(working at heights, large and heavy objects and machines, sharp and piercing objects, tolls and machines, intense light, load noise, obstructions in corridors, by doors, blind turns, noise, over stacked shelves and packages, etc.) electrical hazards (power supply and points, loose and naked cables and wires, electrical machines and appliances, etc.)

CSC/ N 1335: Use basic health and safety practices at the workplace

	Possible causes of risk and accident: physical actions; reading; listening to and giving instructions; inattention; sickness and incapacity (such as drunkenness); health hazards (such as untreated injuries and contagious illness) PC5. carry out safe working practices while dealing with hazards to ensure the safety of self and others **Safe working practices**: using protective clothing and equipment; putting up and reading safety signs; handle tools in the correct manner and store and maintain them properly; keep work area clear of clutter, spillage and unsafe object lying casually; while working with electricity take all electrical precautions like insulated clothing, adequate equipment insulation, use of control equipment, dry work area, switch off the power supply when not required, etc.; safe lifting and carrying practices; use equipment that is working properly and is well maintained; take due measures for safety while working in confined places, trenches or at heights, etc. including safety harness, fall arrestors, etc. PC6. state methods of accident prevention in the work environment of the job role **Methods of accident prevention**: training in health and safety procedures; using health and safety procedures; use of equipment and working practices (such as safe carrying procedures); safety notices, advice; instruction from colleagues and supervisors PC7. state location of general health and safety equipment in the workplace **General health and safety equipment**: fire extinguishers; first aid equipment; safety instruments and clothing; safety installations(eg fire exits, exhaust fans) PC8. inspect for faults, set up and safely use steps and ladders in general use **Ladder faults**: corrosion of metal components, deterioration, splits and cracks timber components, imbalance, loose rungs, missing/ unfixed nuts or bolts, etc. **Ladders set up**: firm/level base, clip/lash down, leaning at the correct angle, etc. PC9. work safely in and around trenches, elevated places and confined areas PC10. lift heavy objects safely using correct procedures PC11. apply good housekeeping practices at all times **Good housekeeping practices**: clean/tidy work areas, removal/disposal of waste products, protect surfaces PC12. identify common hazard signs displayed in various areas **Various areas**: on chemical containers; equipment; packages; inside buildings; in open areas and public spaces, etc. PC13. retrieve and/or point out documents that refer to health and safety in the workplace

CSC/ N 1335: Use basic health and safety practices at the workplace

	Documents: fire notices, accident reports, safety instructions for equipment and procedures, company notices and documents, legal documents (eg government notices)
Fire safety	The user/individual on the job should be able to: PC14. use the various appropriate fire extinguishers on different types of fires correctly **Types of fires**: Class A: eg. ordinary solid combustibles, such as wood, paper, cloth, plastic, charcoal, etc.; Class B: flammable liquids and gases, such as gasoline, propane, diesel fuel, tar, cooking oil, and similar substances; Class C: eg. electrical equipment such as appliances, wiring, breaker panels, etc. (These categories of fires become Class A, B, and D fires when the electrical equipment that initiated the fire is no longer receiving electricity); Class D: combustible metals such as magnesium, titanium, and sodium (These fires burn at extremely high temperatures and require special suppression agents) PC15. demonstrate rescue techniques applied during fire hazard PC16. demonstrate good housekeeping in order to prevent fire hazards PC17. demonstrate the correct use of a fire extinguisher
Emergencies, rescue and first-aid procedures	The user/individual on the job should be able to: PC18. demonstrate how to free a person from electrocution PC19. administer appropriate first aid to victims where required eg. in case of bleeding, burns, choking, electric shock, poisoning etc. PC20. demonstrate basic techniques of bandaging PC21. respond promptly and appropriately to an accident situation or medical emergency in real or simulated environments PC22. perform and organize loss minimization or rescue activity during an accident in real or simulated environments PC23. administer first aid to victims in case of a heart attack or cardiac arrest due to electric shock, before the arrival of emergency services in real or simulated cases PC24. demonstrate the artificial respiration and the CPR Process PC25. participate in emergency procedures **Emergency procedures**: raising alarm, safe/efficient, evacuation, correct means of escape, correct assembly point, roll call, correct return to work PC26. complete a written accident/incident report or dictate a report to another person, and send report to person responsible **Incident Report includes details of**: name, date/time of incident, date/time of report, location, environment conditions, persons involved, sequence of events, injuries sustained, damage sustained, actions taken, witnesses, supervisor/manager notified PC27. demonstrate correct method to move injured people and others during an emergency
Knowledge and Understanding (K)	

CSC/ N 1335: Use basic health and safety practices at the workplace

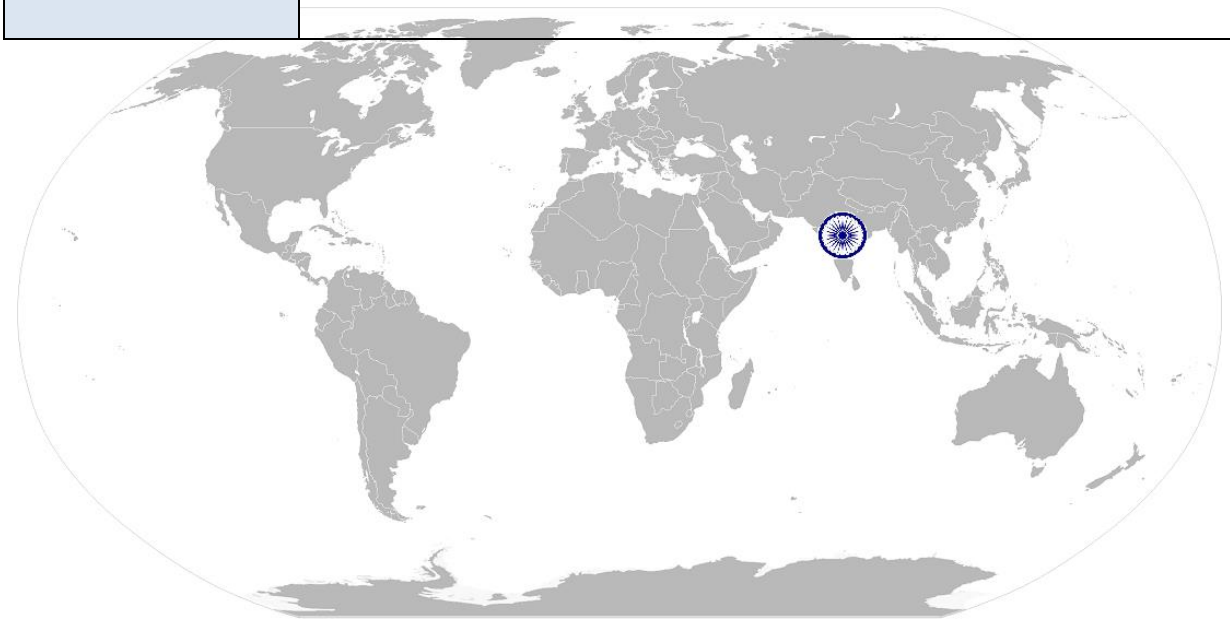
A. Organizational Context (Knowledge of the company / organization and its processes)	The user/individual on the job needs to know and understand: KA1. names (and job titles if applicable), and where to find, all the people responsible for health and safety in a workplace. KA2. names and location of documents that refer to health and safety in the workplace.
B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. meaning of "hazards" and "risks" KB2. health and safety hazards commonly present in the work environment and related precautions KB3. possible causes of risk, hazard or accident in the workplace and why risk and/or accidents are possible KB4. possible causes of risk and accident **Possible causes of risk and accident**: physical actions; reading; listening to and giving instructions; inattention; sickness and incapacity (such as drunkenness); health hazards (such as untreated injuries and contagious illness) KB5. methods of accident prevention **Methods of accident prevention**: training in health and safety procedures; using health and safety procedures; use of equipment and working practices (such as safe carrying procedures); safety notices, advice; instruction from colleagues and supervisors KB6. safe working practices when working with tools and machines KB7. safe working practices while working at various hazardous sites KB8. where to find all the general health and safety equipment in the workplace KB9. various dangers associated with the use of electrical equipment KB10. preventative and remedial actions to be taken in the case of exposure to toxic materials **Exposure:** ingested, contact with skin, inhaled **Preventative action**: ventilation, masks, protective clothing/ equipment); **Remedial action:** immediate first aid, report to supervisor **Toxic materials:** solvents, flux, lead KB11. importance of using protective clothing/equipment while working KB12. precautionary activities to prevent the fire accident KB13. various causes of fire **Causes of fires**: heating of metal; spontaneous ignition; sparking; electrical heating; loose fires (smoking, welding, etc.); chemical fires; etc. KB14. techniques of using the different fire extinguishers KB15. different methods of extinguishing fire KB16. different materials used for extinguishing fire **Materials**: sand, water, foam, CO2, dry powder KB17. rescue techniques applied during a fire hazard KB18. various types of safety signs and what they mean

CSC/ N 1335: Use basic health and safety practices at the workplace

	KB19. appropriate basic first aid treatment relevant to the condition eg. shock, electrical shock, bleeding, breaks to bones, minor burns, resuscitation, poisoning, eye injuries KB20. content of written accident report KB21. potential injuries and ill health associated with incorrect manual handing KB22. safe lifting and carrying practices KB23. personal safety, health and dignity issues relating to the movement of a person by others KB24. potential impact to a person who is moved incorrectly
Skills (S) [Optional]	
A. Core Skills/ Generic Skills	**Reading and Writing Skills**
	The user/individual on the job needs to know and understand how to: SA1. read and comprehend basic content to read labels, charts, signages SA2. read and comprehend basic English to read manuals of operations SA3. read and write an accident/incident report in local language or English
	Oral Communication (Listening and Speaking skills)
	The user/individual on the job needs to know and understand how to: SA4. question coworkers appropriately in order to clarify instructions and other issues SA5. give clear instructions to coworkers, subordinates others
	Decision Making
	The user/individual on the job needs to know and understand how to: SA6. make appropriate decisions pertaining to the concerned area of work with respect to intended work objective, span of authority, responsibility, laid down procedure and guidelines
B. Professional Skills	**Plan and Organize**
	The user/individual on the job needs to know and understand how to: SB1. plan and organize their own work schedule, work area, tools, equipment and materials to maintain decorum and for improved productivity
	Working with others
	The user/individual on the job needs to know and understand how to: SB2. remain congenial while discussing and debating issues with co-workers SB3. follow appropriate protocols for communication based on situation, hierarchy, organizational culture and practice SB4. ask for, provide and receive required assistance where possible to ensure achievement of work related objectives SB5. thank coworkers for any assistance received SB6. offer appropriate respect based on mutuality and respect for fellow worksmanship and authority

CSC/ N 1335: Use basic health and safety practices at the workplace

	Problem Solving
	The user/individual on the job needs to know and understand how to: SB7. think through the problem, evaluate the possible solution(s) and suggest an optimum /best possible solution(s) SB8. identify immediate or temporary solutions to resolve delays SB9. identify sources of support that can be availed of for problem solving for various kind of problems SB10. seek appropriate assistance from other sources to resolve problems SB11. report problems that you cannot resolve to appropriate authority
	Analytical Thinking
	The user/individual on the job needs to know and understand how to: SB12. identify cause and effect relations in their area of work SB13. use cause and effect relations to anticipate potential problems and their solution



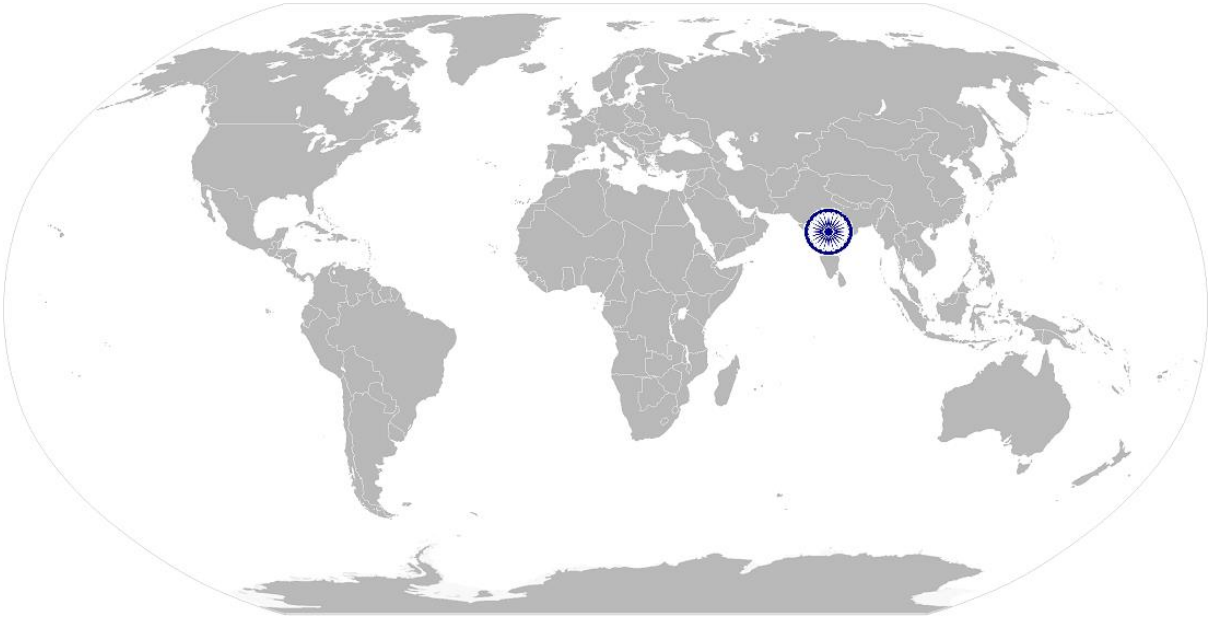
CSC/ N 1335: Use basic health and safety practices at the workplace

NOS Version Control

NOS Code	**CSC / N 1335**		
Credits (NSQF)	**TBD**	**Version number**	**1.0**
Industry	**Capital Goods**	**Drafted on**	**10/04/14**
Industry Sub-sector	1. Machine Tools 2. Dies, Moulds And Press Tools 3. Plastics Manufacturing Machinery 4. Textile Manufacturing Machinery 5. Process Plant Machinery 6. Electrical and Power Generation Machinery 7. Light Engineering Goods	**Last reviewed on**	**18/03/15**
Occupation	**Design**	**Next review date**	**30/08/16**

CSC/ N 1336: Work effectively with others

National Occupational Standard



Overview

This unit covers basic practices that improve effectiveness of working with others in an organizational set-up.

National Occupational Standard

CSC/ N 1336: Work effectively with others

Unit Code	**CSC / N 1336**
Unit Title (Task)	**Work effectively with others**
Description	This unit covers basic etiquette and competencies that a candidate is required to possess and demonstrate in their behavior and interactions with others at the workplace. These cover areas such as communication etiquette, discipline, listening, handling conflict and grievances.
Scope	This unit/task covers the following: • Working with others

Performance Criteria (PC) w.r.t. the Scope

Element	Performance Criteria
Working with others	The user/individual on the job should be able to: PC1. accurately receive information and instructions from the supervisor and fellow workers, getting clarification where required PC2. accurately pass on information to authorized persons who require it and within agreed timescale and confirm its receipt PC3. give information to others clearly, at a pace and in a manner that helps them to understand PC4. display helpful behavior by assisting others in performing tasks in a positive manner, where required and possible PC5. consult with and assist others to maximize effectiveness and efficiency in carrying out tasks PC6. display appropriate communication etiquette while working **Communication etiquette:** do not use abusive language; use appropriate titles and terms of respect; do not eat or chew while talking (vice versa)etc. PC7. display active listening skills while interacting with others at work PC8. use appropriate tone, pitch and language to convey politeness, assertiveness, care and professionalism PC9. demonstrate responsible and disciplined behaviors at the workplace **Disciplined behaviors:** e.g. punctuality; completing tasks as per given time and standards; not gossiping and idling time; eliminating waste, honesty, etc. PC10. escalate grievances and problems to appropriate authority as per procedure to resolve them and avoid conflict

Knowledge and Understanding (K)

A. Organizational Context (Knowledge of the company / organization and its processes)	The user/individual on the job needs to know and understand: KA1. legislation, standards, policies, and procedures followed in the company relevant to own employment and performance conditions KA2. reporting structure, inter-dependent functions, lines and procedures in the work area KA3. relevant people and their responsibilities within the work area KA4. escalation matrix and procedures for reporting work and employment related issues

CSC/ N 1336: Work effectively with others

B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. various categories of people that one is required to communicate and co-ordinate with in the organization KB2. importance of effective communication in the workplace KB3. importance of teamwork in organizational and individual success KB4. various components of effective communication KB5. key elements of active listening KB6. value and importance of active listening and assertive communication KB7. barriers to effective communication KB8. importance of tone and pitch in effective communication KB9. importance of avoiding casual expletives and unpleasant terms while communicating professional circles KB10. how poor communication practices can disturb people, environment and cause problems for the employee, the employer and the customer KB11. importance of ethics for professional success KB12. importance of discipline for professional success KB13. what constitutes disciplined behavior for a working professional KB14. common reasons for interpersonal conflict KB15. importance of developing effective working relationships for professional success KB16. expressing and addressing grievances appropriately and effectively KB17. importance and ways of managing interpersonal conflict effectively
Skills (S) [Optional]	

CSC/ N 1336: **Work effectively with others**

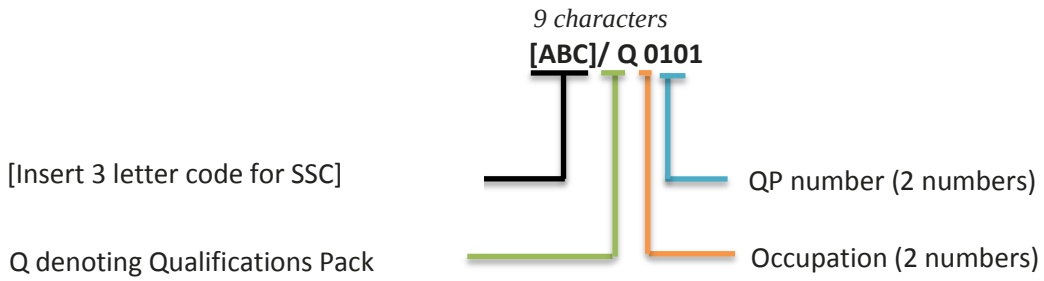
NOS Version Control

NOS Code	CSC / N 1336		
Credits(NSQF)	TBD	Version number	1.0
Industry	Capital Goods	Drafted on	10/04/14
Industry Sub-sector	1. Machine Tools 2. Dies, Moulds And Press Tools 3. Plastics Manufacturing Machinery 4. Textile Manufacturing Machinery 5. Process Plant Machinery 6. Electrical and Power Machinery 7. Light Engineering Goods	Last reviewed on	18/03/15
Occupation	Design	Next review date	30/08/16

Annexure

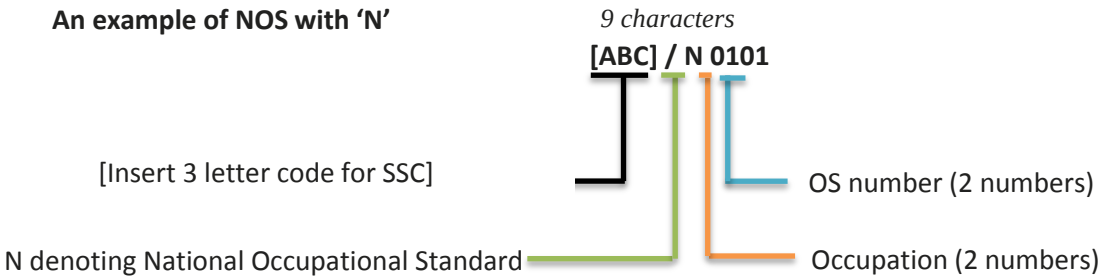
Nomenclature for QP and NOS

Qualifications Pack



Occupational Standard

An example of NOS with 'N'



The following acronyms/codes have been used in the nomenclature above:

Sub-sector	Range of Occupation numbers
Machine Tools	01-13
Dies, Moulds and Press Tools	01-13
Plastic Manufacturing Machinery	01-13
Textile Manufacturing Machinery	01-13
Process Plant Machinery	01-13
Electrical and Power Machinery	01-13
Light Engineering Goods	01-13

Sequence	Description	Example
Three letters	Capital Goods	CSC
Slash	/	/
Next letter	Whether **Q**P or **N**OS	N
Next two numbers	Occupation code	01
Next two numbers	OS number	01

PERFORMANCE CRITERIA

Job Role: Designer-Mechanical

Qualification Pack: CSC/ Q 0405

Sector Skill Council: Capital Goods Sector Skills Council

Guidelines for Assessment:

1. Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC.
2. The assessment for the theory part will be based on knowledge bank of questions created by the SSC.
3. Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training centre (as per assessment criteria below)
4. Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training centre based on this criteria
5. To pass the Qualification Pack , every trainee should score a minimum of 70% in every NOS
6. In case of successfully passing only certain number of NOS's, the trainee is eligible to take subsequent assessment on the balance NOS's to pass the Qualification Pack.

Assessment outcomes	Assessment Criteria	Total Marks	Out of	Theory	Practical Skill
CSC/ N 0405: Identify customer's requirement and create an engineering design brief	PC1. work safely at all times, complying with health and safety, environmental and other relevant regulations and guidelines	100	6	2	4
	PC2. check that all safety mechanisms are in place and that the equipment is set correctly for the required operations		5	2	3
	PC3. adhere to procedures or systems in place for health and safety, including personal protective equipment and other relevant safety regulations and procedures to contribute to a safe work environment		6	2	4
	PC4. wear the appropriate protective clothing and equipment, and keep the work area clean and tidy 2 4		6	2	4
	PC5. follow safe practice/approved setting up procedures at all times 2 3		5	2	3
	PC6. gather accurate information on the requirements of the customer from various sources		5	2	3

	PC7. confirm the customer's objectives for the engineering products or processes		6	2	4
	PC8. identify any unique or specific features that need particular consideration		6	2	4
	PC9. determine the feasibility of achieving the customer's requirements		6	2	4
	PC10. confirm the requirements and other relevant issues with the customer		6	2	4
	PC11. record all relevant information in the appropriate information systems for future use		5	2	3
	PC12. confirm the operational and functional requirements and quality criteria of the design		6	2	4
	PC13. obtain clarification from relevant people any aspect of the requirement that is not clear		5	2	3
	PC14. identify clearly any design constraints		6	2	4
	PC15. create the design brief in a draft form and discuss any changes required with the relevant people		6	2	4
	PC16. ensure that the design brief captures all the requirements of the customer		5	2	3
	4 PC17. ensure that the design brief and specification meets relevant regulations, directives and guidelines		5	2	3
	PC18. save the design brief and communicate it to the relevant people, as per organizational process		5	2	3
		Total	100	36	64
CSC/ N 0406: Develop plan for engineering design process	PC1. work safely at all times, complying with health and safety, environmental and other relevant regulations and guidelines	100	5	2	3
	PC2. check that all safety mechanisms are in place and that the equipment is set correctly for the required operations		4	2	2

	PC3. adhere to procedures or systems in place for health and safety, including personal protective equipment and other relevant safety regulations and procedures to contribute to a safe work environment		5	2	3
	PC4. wear the appropriate protective clothing and equipment, and keep the work area clean and tidy		5	2	3
	PC5. follow safe practice/approved setting up procedures at all times		5	2	3
	PC6. identify the design activities to be undertaken		5	2	3
	PC7. establish the responsibilities for developing specific aspects of the design process		6	2	4
	PC8. identify the activities that make up the design process		6	2	4
	PC9. establish the responsibility for each activity		5	2	3
	PC10. identify the resources necessary to undertake the design process agree procedures for disseminating information on the designs		6	2	4
	PC11. identify any potentially critical problems and include contingency plans for the same		6	2	4
	PC12. develop a schedule for the design process		6	2	4
	PC13. agree the schedule with the appropriate people		5	2	3
	PC14. establish priorities for completion of the design process to within deadlines		6	2	4
	PC15. ensure that the design process complies with all relevant regulations, directives and guidelines		5	2	3
	PC16. obtain approvals of the relevant people for the design plan		5	2	3
	PC17. establish version control for the document		6	2	4
	PC18. Save and store the design documentation as per		5	2	3

	organizational guidelines				
	PC19. communicate information to the appropriate people		4	2	2
		Total	**100**	**28**	**48**
CSC/ N 0407 Create and evaluate mechanical engineering design options	PC1. obtain and review existing information with reference to the specified design requirements	100	3	1	2
	PC2. prepare outline ideas for the designs		4	1	3
	PC3. obtain agreement from relevant people		3	2	1
	PC4. carry out the design process, utilizing the appropriate technology		5	2	3
	2 3 PC5. document all facets of the design activity		4	2	2
	PC6. communicate the outcomes of the design process to the appropriate people		3	1	2
	PC7. deliver the designs in the appropriate format		5	2	3
	PC8. ensure that the design cannot be changed or amended without authorization		3	1	2
	PC9. confirm and agree understanding of the design requirements		4	2	2
	PC10. deal with problems relating to the design requirements and agreed solutions		3	1	2
	PC11. identify design options which will meet requirements and the design specification		4	1	3
	PC12. create designs that meet the customer's requirements as specified in the design brief for the engineering product or process		5	1	4
	PC13. apply approved engineering concepts, processes, principles to achieve the design brief		5	1	4
	PC14. apply the principles of dynamics and kinematics to ensure that design options will work		5	1	4
	PC15. ensure that the design options are practical		4	2	2
	PC16. prepare costing's and timescale and ensure they are acceptable		4	1	3

	PC17. obtain suitable advice and guidance to assist in the design work		4	2	2
	PC18. present the designs in suitable formats and with sufficient information to allow the customer to assess them		4	1	3
	PC19. ensure that the designs comply with all relevant regulations, standards directives or codes of practice		4	1	3
	PC20. deal promptly and effectively with problems within your control and seek help and guidance from the relevant people if you have problems that you cannot resolve		4	2	2
	PC21. ensure that the designs are protected in line with organizational procedures		2	1	1
	PC22. obtain clear criteria on which to base the evaluation		4	1	3
	PC23. obtain the necessary information from the available sources		4	1	3
	PC24. evaluate the design against the established criteria, using appropriate evaluation methods		5	2	3
	PC25. make recommendations on various design options, and communicate the results of the evaluation to the relevant people		5	2	3
		Total	**100**	**35**	**65**
CSC/ N 0402 Make or modify 2D mechanical engineering drawings using CAD system	PC1. use appropriate sources to obtain the technical information relevant to the drawing to be created	100	2	0	2
	PC2. identify design features, as appropriate to the drawing being produced		4	2	2
	PC3. ensure that the data and information received is complete and correct		2	0	2
	PC4. establish the drawing requirements from the data and information received		3	1	2
	PC5. report and rectify incorrect and inconsistent information in job		3	1	2

	specification documents as per organization procedures				
	PC6. access and use the correct drawing software		2	1	1
	PC7. select drafting equipment appropriate to the drawing method chosen		3	1	2
	PC8. check that all the equipment is correctly connected and in a safe and usable working condition		1	0	1
	PC9. power up the equipment and activate the appropriate drawing software		1	0	1
	PC10. customize system variables, menus and drawing defaults to produce the drawing to the appropriate scale		3	1	2
	PC11. develop macros as per approved procedures		4	2	2
	PC12. set up and check that all peripheral devices are connected and correctly operating and interface with ERP if required is available		2	0	2
	PC13. set the drawing datum at a convenient point		2	0	2
	PC14. set up drawing parameters (eg. layers, line types, color, text styles) to company procedures or to suit the drawing produced		3	1	2
	PC15. interpret and produce mechanical drawings, using first angle orthographic projections, isometric/oblique projections, third angle orthographic projections, sectional views		5	2	3
	PC16. apply drafting principles to produce various types of drawings that are consistent with applicable standards and procedures for use in various engineering activities		5	2	3
	PC17. create a drawing template to the required standards, which includes all necessary detail (eg.) using various drawing tools		5	2	3
	PC18. use appropriate terminologies and techniques to		4	2	2

	create drawings, in the required formats, that are sufficiently and clearly detailed				
	PC19. use keyboard command and pull down menus available in common CAD systems		2	1	1
	PC20. use codes and other references that follow the required conventions		3	1	2
	PC21. draw temporary fasteners and rivets		3	1	2
	PC22. draw components details and assembly drawings		4	1	3
	PC23. draw piping layouts, gears and machine foundation or base		4	1	3
	PC24. draw working drawings of jigs and fixtures		4	1	3
	PC25. draw detailed drawings of dies, moulds and press tools		4	1	3
	PC26. dimension and label the drawing as per approved procedures		4	1	3
	PC27. create detailed views using various scales to meet job requirements		3	1	2
	PC28. ensure that drawings are checked and approved by the appropriate person		1	0	1
	PC29. produce hard copies of the finished drawings		1	0	1
	PC30. check that the drawing is correctly titled and referenced; sawing is correctly titled and referenced		2	0	2
	PC31. save the drawing to an appropriate storage medium (eg. hard drive, CD/DVD, external storage device)		1	0	1
	PC32. create a separate backup copy and place it in safe storage		1	0	1
	PC33. identify component parts list with part name, description of part, material specification or part number, quantities and other details to prepare bill of materials as per organizational guidelines		4	2	2
	PC34. deal promptly and effectively with problems within		2	0	2

	control and seek help and guidance from the relevant people if you have problems that they cannot resolve				
	PC35. ensure that changes are completed as required by organizational procedures		2	1	1
	PC36. shut down the CAD system to a safe condition on completion of the drawing activities		1	0	1
		Total	**100**	**30**	**70**
CSC/ N 0408 Make or modify 3D mechanical engineering models using CAD system	PC1. plan the modelling activities before starting them	100	3	1	2
	PC2. use appropriate sources to obtain the required information		3	1	2
	PC3. access and use the correct modelling software		3	1	2
	PC4. check that all the equipment is correctly connected and in a safe and usable working condition		3	1	2
	PC5. power up the equipment and activate the appropriate modelling software		2	1	1
	PC6. set up the modelling environment and select a suitable template/folder		4	1	3
	PC7. set up and check that all peripheral devices are connected and correctly operating (such as keyboard, mouse, light pen, digitizer/tablet, scanner, printer, plotter)		4	1	3
	PC8. set the drawing datum at a convenient point to create a modelling template with title, file number, material, date		4	1	3
	PC9. establish coordinate system, orientation and views as per the job requirement		4	1	3
	PC10. create entities in 3D space as per job requirement		3	1	2
	PC11. modify entities in 3D space as per job requirement		3	1	2
	PC12. create 3-D views on the screen by manipulating drawing planes and inserting 3-D geometric shapes		4	1	3
	PC13. creating swept, extruded		4	1	3

	and revolved solids in 3-D space				
	PC14. produce sectioned models (cutting planes and cross hatching)		4	1	3
	PC15. use pre-drawn library files and primitives to produce a 3-D model		4	1	3
	PC16. extracting mass and area properties from solid model		4	1	3
	PC17. Identify and use key features of solid modelling software package		3	1	2
	PC18. perform drawing for solid modelling		3	1	2
	PC19. extract physical properties as per job requirement, including volume, mass and centre of gravity		3	1	2
	PC20. apply rendering techniques		3	1	2
	PC21. produce 3-D drawings incorporating section views with all necessary annotation		4	1	3
	PC22. complete CAD operations		4	1	3
	PC23. confirm that the model is as per job specifications and contains all relevant information		3	1	2
	PC24. use appropriate techniques to create models that are sufficiently and clearly detailed		3	1	2
	PC25. use codes and other references that follow the required conventions		3	1	2
	PC26. make sure that models are checked and approved by the appropriate person		3	1	2
	PC27. save the models in the appropriate file type and location		3	1	2
	PC28. produce hard copies of the finished models, with sufficient detail to allow production		3	1	2
	PC29. deal promptly and effectively with problems within your control, and seek help and guidance from the relevant people if you have problems that you cannot resolve		3	1	2
	PC30. shut down the CAD system to a safe condition on completion of the modelling activities		3	1	2
		Total	**100**	**30**	**70**

CSC/ N 1335: (Use basic health and safety practices at the workplace)	PC1. use protective clothing/equipment for specific tasks and work conditions	**100**	5	2	3
	PC2. state the name and location of people responsible for health and safety in the workplace		3	1	2
	PC3. state the names and location of documents that refer to health and safety in the workplace		3	1	2
	PC4. identify job-site hazardous work and state possible causes of risk or accident in the workplace		5	2	3
	PC5. carry out safe working practices while dealing with hazards to ensure the safety of self and others state methods of accident prevention in the work environment of the job role		4	2	2
	PC6. state location of general health and safety equipment in the workplace		3	2	1
	PC7. inspect for faults, set up and safely use steps and ladders in general use		5	2	3
	PC8. work safely in and around trenches, elevated places and confined areas		5	2	3
	PC9. lift heavy objects safely using correct procedures		5	2	3
	PC10. apply good housekeeping practices at all times		4	2	2
	PC11. identify common hazard signs displayed in various areas		5	2	3
	PC12. retrieve and/or point out documents that refer to health and safety in the workplace		3	1	2
	PC13. use the various appropriate fire extinguishers on different types of fires correctly		4	1	3
	PC14. demonstrate rescue techniques applied during fire hazard		4	1	3
	PC15. demonstrate good housekeeping in order to prevent fire hazards		3	1	2
	PC16. demonstrate the correct use of a fire extinguisher		4	1	3
	PC17. demonstrate how to free a		4	1	3

	person from electrocution				
	PC18. administer appropriate first aid to victims where required eg. in case of bleeding, burns, choking, electric shock, poisoning etc.		4	1	3
	PC19. demonstrate basic techniques of bandaging		3	1	2
	PC20. respond promptly and appropriately to an accident situation or medical emergency in real or simulated environments		4	1	3
	PC21. perform and organize loss minimization or rescue activity during an accident in real or simulated environments		3	1	2
	PC22. administer first aid to victims in case of a heart attack or cardiac arrest due to electric shock, before the arrival of emergency services in real or simulated cases		3	1	2
	PC23. demonstrate the artificial respiration and the CPR Process		3	1	2
	PC24. participate in emergency procedures		3	2	1
	PC25. complete a written accident/incident report or dictate a report to another person, and send report to person responsible		4	1	3
	PC26. demonstrate correct method to move injured people and others during an emergency		4	1	3
		Total	100	36	64
CSC/ N 1336: (Work effectively with others)	PC1. accurately receive information and instructions from the supervisor and fellow workers, getting clarification where required	**100**	10	3	7
	PC2. accurately pass on information to authorized persons who require it and within agreed timescale and confirm its receipt		10	3	7
	PC3. give information to others clearly, at a pace and in a manner that helps them to understand		10	3	7
	PC4. display helpful behavior by assisting others in performing tasks in a positive manner, where required and possible		10	3	7

	PC5. consult with and assist others to maximize effectiveness and efficiency in carrying out tasks		10	3	7
	PC6. display appropriate communication etiquette while working		10	3	7
	PC7. display active listening skills while interacting with others at work		10	3	7
	PC8. use appropriate tone, pitch and language to convey politeness, assertiveness, care and professionalism		10	3	7
	PC9. demonstrate responsible and disciplined behaviors at the workplace		10	3	7
	PC10. escalate grievances and problems to appropriate authority as per procedure to resolve them and avoid conflict		10	3	7
		Total	100	30	70