

**National Competency Standard level 4 for Computer Aided Design &
Manufacturing
(CAD/CAM Technician)**



National Vocational & Technical Training Commission (NAVTTTC)

ACKNOWLEDGEMENTS

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- *Dr. Muqeen ul Islam*, Director General (Skills, Standards and Curricula) NAVTTTC
- *Mr. Muhammad Naeem Akhtar*, Senior Technical Advisor TSSP-GIZ,
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NAVTTTC team under the leadership of Dr. Muqeen ul Islam initiated development of CBT & A based qualifications of diploma level-5 as a reform project of TVET sector in November 2018 and completed 27 NVQF diplomas of Level-5 in September, 2019. It seems worth highlighting that during this endeavor apart from developing competency standards/curricula in conventional trades new dimensions containing high-tech trades in TVET sector in the context of generation IR 4.0 trades have also been developed which inter alia includes Robotics, Mechatronics, artificial intelligence, industrial automation, instrumentation and process control. Moreover, trades like entrepreneurship, green/environmental skills and variety of soft/digital skill have also been developed to equip the Pakistani youth with skills set as per requirement of the global trends. These skills have been made integral part of all the 27 diplomas.

Nobody has been more important in the pursuit of this project than Dr. Nasir Khan, Executive Director, NAVTTTC, whose patronage and support remain there throughout the development process and lastly to thanks specially to Syed Javeed Hassan, Chairman NAVTTTC and Raja Saad Khan, Deputy Team Lead TSSP-GIZ who made it happened in this challenging time.

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1. Introduction

CAD/CAM is the most popular software with the highest overall job-market demand. CAD designing is very important and very helpful for an individual and employer in all over the globe. More over individual can also get CAD certification which is an industry recognized credential that can help an individual to succeed in his/her design career—providing benefits to both individual and employer. Certification provides reliable validation of skills and knowledge and can lead to accelerated professional development, improved productivity, and enhanced credibility.

In connection of Market job demand to meet the demand of industry there is a need to strength and promote productive working relationship between the training provider and the industry in order to enhance quality of training delivery, enterprise competitiveness and access to decent employment.

That's why existing NVQF for AutoCAD trade have been identified for review and the further development of the missing levels, skills sets and industry demanded occupational competencies. Further this occupation has been developed in response to the demands of labor market and national priorities with the involvement of industry at key stages in the development process.

The main elements in the development of this qualification include; competency standards, structure, level, time allocation in credit hours, Tools and equipment's as per National Vocational Qualification Framework (NVQF) Development Manual 1 using the competency-based training and assessment (CBT&A) approach.

2. Purpose of the Qualification

NVQF qualifications are comprehensible packages of competency standards related to defined occupations. They are developed in response to the demands of labor market and national priorities with the involvement of industry at key stages in the development process.

The purpose of this qualification is to standardized competency standard for level-4 across the globe for VET (Vocational Education and Training) practitioners who will serve as key elements in enhancing quality of training and assessment. Also, to set and identify duties and tasks for the usual purpose of earning a living.

The specific objectives of developing this qualification are as under:

- To set a high profile standard profession for the industry to generate standard outputs.
- To validate an individual skill, knowledge and understanding regarding relevant occupations.
- In a Competency-Based Training (CBT), these qualifications provide overall course guidelines in relation to teaching and learning and act as the key instrument in supporting standardized formal, non-formal and informal training.
- Provide flexible pathways and progressions in training and assessment field.
- Enable the TVET practitioners/instructional staff to perform their duties in efficient manner.
- Establish a standardized and sustainable system of training for TVET practitioners/instructional staff in the country.

3. Summary of competency standards

Sr No	Competency Standards	Occupation	NVQF Level	Category	Estimated Contact Hours			Cr Hr
					Th	Pr	Total	
Level 4								
1.	Develop basic 2D Modeling using Creo Parametric/Solid works	CAD/CAM Technician	4	Technical	24	96	120	12
2.	Develop basic 3D Modeling using Creo Parametric/Solid works		4	Technical	24	96	120	12
3.	Develop Basic CNC code for Lathe Machine		4	Technical	42	168	210	12
4.	Render 3D Model using Plugins in Sketch Up		4	Technical	24	96	120	12
5.	Develop 3D Model in Autodesk REVIT		4	Technical	24	96	120	12
6.	Conduct quantity estimation		4	Technical	24	96	120	12
7.	Develop Preliminary Project Plan		4	Technical	24	96	120	12
8.	Develop Project Plan		4	Technical	24	96	120	12
9.	Develop CPM for a project plan		4	Technical	30	120	150	15
	Total				240	960	1200	120
	Percentage				20%	80%		

4. Date of Validation

The level 5 of National DAE qualification on CAD CAM has been validated by the Qualifications Validation Committee (QVC) members on 27-29th May, 2019 and will remain valid for ten years i.e. **29th May, 2029**

5. Date of Review

The level 5 of National DAE qualification on CAD CAM has been validated by the Qualifications Validation Committee (QVC) members on 27-29th May, 2019 and shall be reviewed after three years i.e. **30TH May, 2022**

6. Codes of Qualifications

The International Standard Classification of Education (ISCED) is a framework for assembling, compiling and analyzing cross-nationally comparable statistics on education and training. ISCED codes for these qualifications are assigned as follows:

ISCED Classification for Computer Aided Design & Manufacturing level 4	
Code	Description
0720 C/C & M 3	National Certificate of Level-4, in “Computer Aided Design & Manufacturing (CAD/CAM Technician)”

7. Members of Qualifications Development Committee

The following members participated in the qualification development of this qualification:

S.No.	Name & Designation	Organization
1.	Sadyia Qureshi	Coordinator
2.	Aftab Hussain	DACUM Facilitator
3.	Ali Raza	DACUM Facilitator
4.	Muhammad Abbas Arshad	Site Engineer
5.	Muhammad Faizan	Interior/CAD Designer
6.	Syed Farhan Hamid Ali	Sr. Instructor Pak Swiss Training Center Karachi
7.	Muhammad Hassan Arshad	Architect Bahria Town
8.	Malik Abdul Basit	Consultant (IT & Overseas employment)
9.	Javed Hayat	Consultant (Survey and Research)

8. Members of Qualification Validation Committee

The following members participated in the validation of this qualification:

Sr.No.	Name & Designation	Organization
1.	Dr. Muhammad Bakhsh DD IT/CS	Pakistan Academy of rural development, Peshawar
2.	Jawaria Qazi Web Admin	PBTE , Lahore
3.	Ali Raza	Principal Quaid-e-Azam College of Engineering & Technology Okara
4.	Aftab Hussain	DACUM Facilitator
5.	Nadeem Zaigham Senior Instructor	P-TEVTA
6.	Muhammad Abbas Arshad Project Engineer	United Engineering Pvt Ltd Jehlum
7.	Muhammad Faizan Architectural Designer	Gleaming Architectural
8.	Navid Ali Lecturer	KP-TEVTA
9.	Amjad Waheed Khan Lecturer	KP-TEVTA
10.	Syed Shadab Ali Shah Assistant Professor	KP-TEVTA
11.	Summar Jan Siddiqui	P-TEVTA
12.	Fayaz A Soomro Deputy Director (Technical Education)	NAVTTTC

9. Entry Requirements

The entry for National Certificate level 4, in Computer Aided Design & Manufacturing is

1. A person having **National Vocational Certificate level 3**, in CAD CAM.

DETAIL OF COMPETENCY STANDARDS

0720C/C &M3 -1. Develop Basic 2D Modelling using CREO parametric/solid work

Overview:

This competency standard is designed to provide knowledge and skill of basic 2D modeling. It emphasizes on creating 2D sketch, modifying sketch.

Competency Unit	Performance Criteria
CU1. Explore Software interface	P1. Setup Interface as per requirement. P2. Select menu as per requirements. P3. Select working directory for given job. P4. Select appropriate module for the given task. P5. Configure the software for part modeling P6. Select datum plans/point/datum axes accordingly. P7. Create and save template as per job requirement
CU2. Create 2D Sketch	P1. Select working plan for the given job P2. Create sketch using lines P3. Create sketch using circles and arcs P4. Create sketch using rectangle P5. Create the sketch as per requirement
CU3. Apply modify commands	P1. Apply offset feature to the given sketch P2. Apply project feature to the given sketch P3. Apply trim to the given sketch P4. Apply chamfer to the given sketch P5. Apply fillet to the given sketch P6. Apply dimension to the given sketch
CU4. Apply Geometric Constraints	P1 Apply parallel constraint to the given sketch entity P2 Apply perpendicular constraint to the given sketch entity P3 Apply equal constraint to the given sketch entity P4 Apply tangent constraint to the given sketch entity P5 Apply collinear constraint to the given sketch entity P6 Apply horizontal constraint to the given sketch entity P7 Apply vertical constraint to the given sketch entity. P8 Apply concentric constraint to the given sketch entity

Knowledge & understanding:

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- Software interface
- Identify sketch environment
- Sketch entities
- Editing entities
- Geometric constraints

Critical Evidence Required:

The candidate needs to Produce 2D sketch as per given requirements

List of Tool & Equipment

S. No	Tools
1.	PCs/Laptop
2.	Solid works/ Cero Parametric
3.	Printer
4.	Paper

0720C/C &M3 -2. Develop Basic 3D Modelling using CREO parametric/solid work

Overview:

This competency standard is designed to provide knowledge and skill of basic 3D modeling. It emphasizes on creating 3D sketch, modifying sketch.

Competency Unit	Performance Criteria
CU1. Create Simple 3D part using Extrude	P1 Create sketch as per requirements P2 Extrude sketch as per given specification P3 Apply extrude cut to remove material from given sketch P4 Apply flip extrude direction as specified P5 Apply material to object as per specification.
CU2. Create 3D part using revolve feature	P1 Create sketch as per given requirements P1 Create axis of rotation P2 Apply revolve feature P3 Manage the angle of rotation P4 Create revolve cut using revolve feature P5 Edit the parameter of revolve feature P6 Apply material to object as per specification.
CU3. Apply features to 3d model	P1 Apply thicken to the 3d model P2 Apply round feature to the 3d model P3 Apply shell feature to the 3d model P4 Apply hole feature to the 3d model P5 Apply draft feature to the 3d model P6 Apply rib feature to the 3d model P7 Apply slice feature to the 3d model
CU4. Edit 3D model	P1 Edit dimension of the given 3d model P2 Edit features of the given 3D model P3 Reorder feature in the given 3D model P4 Edit references of the 3D model P5 Apply pattern tool as per given specifications.

Knowledge & understanding:

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- Software interface
- 3D editing tools
- Features
- Geometric constraints
- Revolve
- Extrude

Critical Evidence Required:

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Produce 3D model using extrude and use edit features to edit the model
- Produce 3D revolve model and edit the model as per given specification.

List of Tool & Equipment

S. No	Tools
1.	PCs/Laptop
2.	Solid works/ Cero Parametric
3.	Printer

0720C/C &M3 -3. Render 3D Model using Plugins in Sketch Up

Overview:

This competency standard is designed to provide skills and knowledge to render models by using various tools and commands in plugin software. You can demonstrate your skills to modify 3D objects and models to ensure job requirements. You can present a rendered 3D Model to present final outcomes.

Competency Units	Performance Criteria
CU1. Render Model using V-Ray	P1. Install V-Ray software to meet the specific outcome as per requirement. P2. Apply textures to the 3D model as specified. P3. Apply light to illuminate model to get the required scene of image. P4. Apply shadow of 3D object according to the movement of light. P5. Apply material to the object as per given requirement. P6. Apply render to the model as per given requirement. P7. Add scene for different camera views to elaborate the model.
CU2. Render Model using Key shot for solid works.	P1. Install Key shot software to meet the specific outcome as per requirement. P2. Apply textures to the 3D model as specified. P3. Apply light to illuminate model to get the required scene of image. P4. Apply shadow of 3D object according to the movement of light. P5. Apply material to the object as per given requirement. P6. Apply render to the model as per given requirement. P7. Add scene for different camera views to elaborate the model.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- **3D Rendering**
 - 3D solids,
 - surfaces,
 - Purpose of rendering.
- **Boolean operation concepts**
 - Addition
 - Intersection
 - Union
- **3D Navigate control**
 - Functions of different camera settings.
 - Importance of scene creation
 - Preset views such as isometric, top, bottom, front, left, etc.

- Perspective projection and parallel projection
- Walk
- Constrained Orbit
- **Material and light control**
 - Planner mapping
 - Texture map
 - Opacity control
 - Render context
 - Render sampling

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Rendered 3D prototype Model including materials, lights, scene and different camera views.

LIST OF TOOLS AND EQUIPMENT

Sr. No.	Description
1.	PCs/Laptops
2.	Multimedia Projector
3.	3ds Max
4.	AutoCAD
5.	Paper
6.	Printer
7.	Sketch up
8.	Lumion
9.	Revit
10.	Solidworks
11.	Keyshot
12.	V-Ray

0720C/C &M3 -4. Develop Basic CNC code for lathe Machine

Overview:

This competency standard is designed to provide skills and knowledge to write basic CNC lathe program to drawing specifications. It details the requirements for performing simple CNC lathe programming such as facing and straight and contour turning, cutting grooves, and drilling, boring, and cutting threads.

Competency Units	Performance Criteria
CU1. Specify job requirements	P1. Interpreted Drawings to produce program according to specifications. P2. Sequence of operation is determined to produce program according to specification requirements of the process. P3. Calculate Cutting speed and feed rate based on cutting tool and material. P4. Process / job / adjustment sheets are filled up with relevant machine, tool and raw material data.
CU2. Write basic CNC lathe Machine program.	P1. Calculate Coordinates for simple tool path or basic machining functions based on part or product to be produced. P2. Develop standard Program for CNC lathe operations, in accordance with standard operating procedures.
CU3. Edit basic CNC lathe Machine programs.	P1 Simulate and edit Program according to standard operating procedures. P2 Save Program according to standard operating procedures. P3 Import Program to the machine according to standard operating procedures.
CU4. Perform Basic CNC Lathe Machine Operations	P1. Mount Work piece in accordance with standard operating procedures. P2. Perform Basic CNC Lathe operations to produce component as programmed. P3. Perform Corrective measures/adjustments according to the requirement (if necessary). P4. USE Personal protective devices are used in accordance with occupational health and safety (OHS) requirements. P5. Check and measure work pieces according to the Job. P6. Mark, Record and Report defective work piece for proper action.

Knowledge & Understanding

This competency standard will provide knowledge related to:

- Drawing interpretation
- Standard drawing scales, symbols and abbreviations

- Orthographic and isometric drawings
- Assembly and detailed drawings
- Interpreting tolerances
- Geometrical Tolerances (form and position)
- Surface condition (surface finish/texture)
- limits and fits
- Machine reference point
- Job reference point
- Shop safety practices
- Safe working habits
- Identification of hazardous areas
- Protective clothing and devices
- Safe handling of tools, equipment and materials
- Housekeeping
- First-aid
- Fire extinguishers
- Measurements
- Linear measuring tools (Vernier, micrometer)
- Angle measuring tools
- Geometrical tolerances checking tools
- Surface finish measuring instrument
- **Material**

Cutting tools used in CNC lathe operations include:

- External and internal cutting tools
- Grooving tools
- Drilling tools
- Tapping tools
- Threading tools
- Parting-off tools

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Determined job requirements
- calculate coordinates
- write basic CNC lathe machine program
- edited basic CNC lathe machine programs
- simulate CNC program
- Performed work piece set-up
- Performed trial cut on work piece
- perform machining operation

List of Tools and Equipment

Sr.No.	Description
1.	Tool pre - setting device (optional)
2.	Dial indicator
3.	Dial test indicator
4.	Gauges (go-no go, pitch, plug, radius, etc.)
5.	Coordinate measuring machine (CMM) (optional)
6.	Bevel protractor
7.	Profile projector
8.	Surface-texture tester
9.	Surface-finish comparator
10.	Steel rule

0720C/C &M3 -5. Develop 3D Model in REVIT

Overview:

This competency standard is designed to provide skills and knowledge to use Autodesk Revit for building information modeling which is widely used by architects, structural engineers, MEP engineers, designers and contractors. This software application allows you to design a building, structure and various related components in 3D, annotate the model with drafting elements.

Competency Units	Performance Criteria
CU1. Setup Interface	P1. Create custom user interface as per requirement of specific trade. P2. Create and apply Families as per given specifications and requirements.
CU2. Create building layout	P1. Create/import drawings to make layout according to the given requirements. P2. Modify drawings and objects to meet given criteria P3. Create 3D prototype model of the drawing according to given measurements.
CU3. Create construction document	P1. Create specification/detail for various parts according to given requirements. P2. Apply specified detail to objects according to given requirements. P3. Annotate the drawings using set parameters as per given details.
CU4. Render model	P1. Add scene of 3D model according to specification P2. Add lights for illumination to get the requisite scene of 3D model. P3. Apply material to the 3D model as per given specification. P4. Apply texture to 3D model as per given specification. P5. Assign cameras to execute different views of 3D Model. P6. Render the 3D model according to required image size or resolution & orientation.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- Terms and Concepts
- Level
- Snaps and Guides
- Level Constraint
- Families
- Annotation Families
- Schedules
- Sheets
- View Cube
- Tiled Views
- Different layouts of software for specific field.
- Commands and tools.
- Pick Tools (Walls, Lines, Edges)

- Chain Option
- Annotation and detailing.
- Massing and site.
- Import/Export.
- Principles of lighting and rendering.
- Materials, textures and colors.
- Cameras and navigation of 3D environment.

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Construction documents.
- Rendered 3D prototype Model.

LIST OF TOOLS AND EQUIPMENT

S. No.	Description
1.	PCs/Laptops
2.	Multimedia Projector
3.	Revit
4.	AutoCAD
5.	Paper
6.	Printer
7.	IRender
8.	VRay
9.	Lumion

0720C/C &M3 -6. Conduct Quantity Estimation

Overview:

This competency standard is designed to provide skills and knowledge related to quantity estimation. You will be able to demonstrate skills in unit conversion, area, volume calculation and conduct quantity estimation to meet specific target according to the job requirement.

Competency Units		Performance Criteria
CU1.	Convert Unit.	P1. Convert unit. P2. Make Unit Coherent.
CU2.	Calculate Area.	P1. Calculate surface area of regular shapes. P2. Convert complex surface area into regular areas. P3. Calculate area of complex surface.
CU3.	Calculate Quantities.	P1. Calculate volume of given object. P2. Calculate execution. P3. Calculate volume of concrete from given drawings. P4. Calculate B/W (Brick Work) as per given drawing. P5. Calculate Plaster as per the given requirement. P6. Calculate material requirement for different projects. P7. Calculate earth work. (Cut and fill) as per the Job requirement. P8. Calculate Material requirement for Infrastructural Development Project.
CU4.	Prepare Bar bending schedule and BOQ	P1. Identify number of steel bars. P2. Calculate length of reinforcement bars P3. Calculate unit weight of reinforcement bar P4. Calculate weight of particular shape of bar P5. Make bar bending schedule from given drawing. P6. Make BOQ (Bill of Quantity) of Project

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- Unit and volume conversion.
- Knowledge about surface area.
- Type and purpose of quantity.
- Volume calculation
- Cut length of steel
- Ratio proportion
- Wet dry ratio
- Bill of quantity
- Knowledge about specification
- Mortar ratio
- **Material**
 - Interaction.
 - Knowledge about material.
 - Load bearing

- Modification of load.
- Calculation of load.

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Make bill of quantity projects.

LIST OF TOOLS AND EQUIPMENT

Sr. No.	Description
1.	MS office
2.	PC
3.	Paper
4.	Printer
5.	Rivit
6.	Eagle point

0720C/C &M3 -7. Develop Preliminary Project Plan

Overview:

This competency standard covers the skills and knowledge required to prepare flow chart for tendering process, prepare tender documents, tender notice and collect proposals.

Competency Unit	Performance Criteria
CU1. Perform Survey of Area	P1. Perform reconnaissance survey of area for project. P2. Perform topographic survey of area for project. P3. Prepare map of area for project.
CU2. Allocate fund & select site of project	P1. Prepare rough cost estimate. P2. Get Administrative approval of project. P3. Mark options on the prepared map. P4. Select most suitable and economic site.
CU3. Design the project features.	P1. Perform Detailed Survey. P2. Prepare structural design of components of project. P3. Prepare geometric design / drawings of project. P4. Prepare working drawings of project.
CU4. Prepare detailed estimate of project- fund allocation.	P1. Work out quantities of items of work. P2. Prepare cost estimate. P3. Get technical sanction from the authority.
CU5. Conduct feasibility study for execution of project.	P1. Draft construction and system feasibility- resources for project. P2. Identify budget allocation and earning from project-economy. P3. Identify social benefits from the project-operational. P4. Estimate quantity of work, time, and available resources for project. P5. Decide the feasibility and prepare feasibility report of project.

Knowledge and understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

- Explain the importance of preliminary planning
- Explain Pre-feasibility study.
- Explain Types of feasibility study.
- Explain Steps involved in feasibility study.
- Explain difference between feasibility report and project report
- Explain the data to be collected and aspects to be considered in feasibility report
- Explain aspects to be considered during preparation of project report

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Prepared flow chart for tendering process

Tools and Equipment's

Sr. No.	Description (Instruments)
1	Calculator
2	Ruler
3	Pencil

0720C/C &M3 -8. Develop Project Plan

Overview:

This competency standard covers the skills and knowledge required to specify the individual activities, determine the sequence of those activities, draw a network diagram, estimate the completion time for each activity, level the resources, apply constraints, identify the critical path (longest path through the network), update the CPM diagram as the project progresses.

Competency Unit	Performance Criteria
CU1. Specify the individual activities.	P1. Collect data from estimate of project. P2. Identify time dependency of activities- Dummy activities. P3. Divide the work into smaller parts. P4. Identify the activities depending on resources. P5. Prepare the list of activities along with normal duration
CU2. Determine the sequence of activities.	P1. Identify the activities project. P2. Find out predecessor and successor of each activity P3. Arrange them in sequence.
CU3. Draw a network diagram.	P1. Represent each activity with arc/ line with an arrow. P2. Draw ellipse/ circles at start and end of activities. P3. Observe the direction of arrows.
CU4. Estimate the completion time for each activity.	P1. Examine the resources for each activity. P2. Estimate the workability of workforce P3. Examine the productivity of machinery. P4. Determine the activities normal duration. P5. Write down time required to complete each activity.

Knowledge and understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of

- State the objectives of scheduling
- Break down the constructions work in to activities
- Explain the procedure of making schedule i.e., sequencing and time computation of each activity
- State the need for material, equipment's and Labour schedule
- Explain methods of procurement of Labour, materials and equipment's
- Plan by bar chart-time and progress chart Gantt Chart
- Prepare bar chart and explain its limitation
- Calculate network time, critical path, free float and total float
- Prepare work progress charts.
- Draw progress network/ charts for a project

- Review of network and crash programming
- Under take Resource Scheduling and levelling.
- Explain characteristics, operations and safety of construction machinery
- Explain cost of owning and operating machinery
- List main factors in selection of machinery
- Describe productivity of different machinery

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Network diagram showing critical path.
- Levelling of resources.
- Updated Network diagram showing critical path.

Tools and Equipment

Sr. No.	Description (Instruments)
1	Calculator
2	Ruler
3	Pencil
4	Drawing lab equipment's

0720C/C &M3 -9. Develop CPM for a Project Plan

Overview:

This competency standard covers the skills and knowledge required to identify the critical path (longest path through the network), update the CPM diagram as the project progresses.

CU1. Identify the critical path (longest path through the network)	P1. Perform forward pass by formula at each project activities. P2. Write early start time and early finish time for each activity. P3. Perform backward pass by formula at each project activities. P4. Write late finish time and late start time for each activity. P5. Level the resources of project. P6. Apply constraints due to resources, time, environment, and season. P7. Calculate float/ slack time for each activity. P8. Decide the critical path of construction project-activities with zero float/ slack time. P9. Calculate the duration of project for completion.
CU2. Expedite/ crash progress of work	P1. Enhance workforce force and machinery for activities. P2. Enhance daily working hours. P3. Assess the impact of each on cost. P4. Calculate critical durations for activities. P5. Calculate time for completion of crash programming.
CU3. Update the CPM diagram as the project progresses.	P1. Record actual time duration during work. P2. Assess the actual cost.

Knowledge and understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of

- State the objectives of scheduling
- Break down the constructions work in to activities
- Explain the procedure of making schedule i.e., sequencing and time computation of each activity
- Explain the advantages of project planning by network analysis (only with critical path method)
- Plan and draw C.P.M. network for a project
- Calculate network time, critical path, free float and total float
- Prepare work progress charts.
- Draw progress network/ charts for a project
- Review of network and crash programming

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Network diagram showing critical path.
- Levelling of resources.
- Updated Network diagram showing critical path.

Tools and Equipment

Sr. No.	Description (Instruments)
1	Calculator
2	Ruler
3	Pencil
4	Drawing lab equipment's

NOTIFICATION

No. F. 5(13)/2018-DD (TE): In pursuance of sub-section (d) of section-6" Functions of the Commission" National Vocational & Technical Training Commission (NAVTTTC) Act-2011, NAVTTTC is pleased to approve and notify following qualifications in twenty (20) trades for Level 1-5 under National Vocational Qualification Framework (NVQF), which have been developed in compatibility with latest global trends in the fields and fulfilling requirements of competency based training and assessment (CBT&A) system. The qualifications have been developed and validated in collaboration with TEVTAs, QABs, industry and other relevant stakeholders: -

S#	National Vocational Qualifications
1.	National Qualification Level-5 diploma in Automobile Technology
2.	National Qualification Level-5 diploma in Civil Technology
3.	National Qualification Level-5 diploma in Construction Technology
4.	National Qualification Level-5 diploma in Information & Commutation Technology (ICT)
5.	National Qualification Level-5 diploma in Garment Manufacturing Technology
6.	National Qualification Level-5 diploma in Electrical Technology
7.	National Qualification Level-5 diploma in Electronics Technology
8.	National Qualification Level-5 diploma in Instrumentation Technology
9.	National Qualification Level-5 diploma in Computer Aided Design & Manufacturing (CAD /CAM)
10.	National Qualification Level-5 diploma in Mechanical Technology
11.	National Qualification Level-5 diploma in Graphics Designing
12.	National Qualification Level-5 diploma in Heating, Ventilation, Air-conditioning & Refrigeration (HVACR) Technology
13.	National Qualification Level-5 diploma in Media Production
14.	National Qualification Level-5 diploma in Hotel Management
15.	National Qualification Level-5 diploma in Professional Chef
16.	National Qualification Level-5 diploma in Tourism Management
17.	National Qualification Level-5 diploma in Hair & Beauty Services
18.	National Qualification Level-5 diploma in Fashion Designing
19.	National Qualification Level-5 diploma in Ceramics Technology
20.	National Qualification Level-5 diploma in Telecom Technology

2. All the TVET related institutions / organizations are required to implement aforementioned qualifications so that a uniform and standardized TVET qualification system is established in Pakistan and efforts are made for international equivalence / recognition of these qualifications.
3. Competency Standards of the above enlisted qualifications can be accessed at NAVTTC's website (www.navttc.org).



(Muqeem Islam)

Director General (Skill Standards & Curricula)

Phone: 051-9215385

Distribution:

1. Federal Secretary, Ministry of Federal Education & Professional Training, Govt of Pakistan
2. Federal Secretary, Ministry of Overseas Pakistanis and Human Resource Development, Govt of Pakistan, Islamabad
3. Federal Secretary, Ministry of Industry and Production, Govt of Pakistan, Islamabad
4. Federal Secretary, Ministry of Textile Industry, Govt of Pakistan, Islamabad
5. Federal Secretary, Ministry of Commerce, Govt of Pakistan, Islamabad
6. Federal Secretary, Ministry of Railway, Govt of Pakistan, Islamabad
7. Federal Secretary, Ministry of Climate Change, Govt of Pakistan, Islamabad
8. Federal Secretary, Ministry of Religious Affairs, Govt of Pakistan, Islamabad
9. Federal Secretary, Ministry of Communication, Govt of Pakistan, Islamabad
10. Federal Secretary, Ministry of Aviation Division, Govt of Pakistan, Islamabad
11. Federal Secretary, Ministry of Science & Technology, Govt of Pakistan, Islamabad
12. Chairperson, Punjab Technical Education and Vocational Training Authority (P-TEVTA), Lahore
13. Managing Director, Khyber Pakhtunkhwa Technical Education and Vocational Training Authority (KP-TEVTA),
14. Managing Director, Sindh Technical Education and Vocational Training Authority (S-TEVTA), Karachi
15. Chairman, Azad Jammu & Kashmir, Technical Education and Vocational Training Authority (AJ&K TEVTA), Muzafarabad
16. Director TVET Cell, Gilgit Baltistan, Gilgit
17. Director General, Punjab Vocational Training Council (PVTC), Punjab

18. Managing Director, Technology Upgradation and Skill Development Company (TUSDEC)
Lahore
19. Project Director, Punjab Skill Development Program (PSDP) Lahore
20. CEO, Punjab Skill Development Fund, Lahore
21. Rector, UNTECH University Islamabad
22. National Deputy Leader, GIZ Islamabad
23. PS to Minister of Federal Education & Professional Training, Govt of Pakistan
24. PS to Special Adviser to the Prime Minister on Youth Affairs, Prime Minister's Office,
Islamabad
25. Chairperson, Federal of Pakistan Chamber of Commerce and Industry (FPCCI), Karachi
26. Conveyor, Sector Skills Council (Textile/ Construction/ Renewable Energy/ Hospitality and
Tourism)
27. Director Technical Education and Vocational Training Authorities (TEVTA), Balochistan
28. Chairman, Pakistan Tourism Development Corporation, Lahore
29. Chairman, PCSIR Headquarters, Islamabad
30. Director General, Pakistan Forest Institute, Peshawar
31. Chairman, Wafaq ul Madaris, Multan
32. Director General, Staff Welfare, Islamabad
33. Director General, NISTE Capital Administration and Development Division, Islamabad
34. Director General, National Training Bureau, Islamabad
35. Chairmen, Provincial Technical Education Boards
36. Chairmen, Provincial Trade Testing Boards
37. Secretary, IBCC, Islamabad: *with the request that National qualifications of Level 5 diploma
in the aforementioned trades may be considered equivalent to Diploma of Associate
Engineer/HSSC after inclusion of compulsory courses in the light of IBCC general
requirement.*

Copy for information to: -

1. DG (P&D)/(A&F)/ (A&C) (S&C) NAVTTC
2. Director General(s), NAVTTC Regional Office(s).
3. Sr. Technical Advisor, TSSP-GIZ
4. Staff Officer to Chairman, NAVTTC
5. PS to Executive Director, NAVTTC Islamabad
6. Concerned File/ Office Copy

