

**National Competency Standards for Computer Aided  
Designing (CAD)  
(Level-2,3&4)**



**National Vocational and Technical Training Commission (NAVTTTC)  
Government of Pakistan**

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## INTRODUCTION

Computer Aided Designing (CAD) is one of the popular fields in designing engineering projects and layouts with highest overall job-market demand. CAD designing is very important and very helpful for an individual as well as the employer all over the world. Moreover, an industry recognized credential such as CAD certification helps an individual excel in his/her career in designing —providing benefits to the individual and employer. Competency standards set by TVET provide reliable validation of skills and knowledge and can lead to accelerated professional development, improved productivity and enhanced credibility.

In order to keep pace with current developments and advancements in every walk of life particularly the industrial sector, there is dire need to strengthen and promote productive working relationship between the training provider and the industry so that it results in enhancing the 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 further development of the missing levels, skills set and occupational competencies meeting the demands of the industry. Moreover, these qualifications have been developed in response to the demands of labour market and national priorities with the involvement of industry at key stages in the development process.

The core areas considered in the development of this qualification include competency standards, structure, level, time allocation in credit hours, tools and equipment as per National Vocational Qualification Framework (NVQF) Development Manual 1 using the competency based training and assessment (CBT&A) approach.

## **PURPOSE OF THE QUALIFICATION**

The competency based NVQ has been developed to train the unskilled men of Pakistan on the technical and entrepreneurial skills so that they get employed/ self-employed and inevitably set sustainable impact on their lives by increasing their monthly income.

The purpose of these qualifications is to homogenize the competency standards in line with those applies across the globe for TVET practitioners who serve as key elements in enhancing quality of training and assessment. Also, these qualifications will help in setting and identifying duties and tasks for the usual purpose of earning a livelihood.

The specific objectives of developing these qualifications are as under:

- To set a high profile standard profession for the industry to generate standard outputs
- To validate an individual's skills, knowledge and understanding regarding relevant occupations
- In Competency-Based Training (CBT), these qualifications provide overall course guidelines in relation to teaching and learning and act as key instrument in supporting standardized formal, non-formal and informal training
- Provide flexible pathways and progressions in training and assessment field

## **DATE OF VALIDATION**

These national qualifications have been validated by the Qualifications Validation Committee (QVC) on 7<sup>th</sup> February, 2018 and they will remain in currency until 6<sup>th</sup> February, 2021.

## CODE OF QUALIFICATION

Qualifications	Code
National Vocational Certificate Level-2 in Information Technology (AutoCAD)	0611ICT08
National Vocational Certificate Level-3 in Information Technology (REVIT & SKETCHUP)	0611ICT09
National Vocational Certificate Level-4 in Information Technology (3D Studio MAX)	0611ICT10

## ENTRY REQUIREMENTS

- Minimum qualification for level-2 is Matriculation with some working knowledge of Civil/Electrical/Mechanical technology
- Minimum qualification for level-3 and Level-4 is Matriculation with some hands on practice on level-2.

## QUALIFICATIONS DEVELOPMENT COMMITTEE

The Qualifications Development Committee consisted of following members:

S.No.	Name & Designation	Organization
1.	Aftab Hussain	DACUM Facilitator
2.	Miss Saima Asghar	Interior Designer/Freelance Consultant
3.	Miss Mehwish Aisha Ahsan	CBT Expert/Assessor
4.	Kiran Sabir	AutoCAD Designer and Instructor
5.	Amir Shehzad	Project Designer
6.	Muhammad Abbas Arshad	Site Engineer
7.	Muhammad Faizan	Interior/CAD Designer
8.	Junaid-ur-Rehman	Architect/Interior Designer and Instructor

## QUALIFICATIONS VALIDATION COMMITTEE

The Qualifications Validation Committee consisted of following members:

S.No.	Name & Designation	Organization
1.	Muhammad Ameen	Structure Engineer, Bahria Town Phase-2
2.	Muhammad Iftikhar	Architect, Public Works Development (PWD)
3.	Tanveer Hussain	Civil Engineer, SIYAH KALAM BAGH
4.	Noman Ahmed	Design Engineer, DHC Hydropower Kohistan
5.	Muhammad Abbas Arshad	Site Engineer, Bahria Town

## REGULATIONS FOR THE QUALIFICATION AND SCHEDULE OF UNITS

Not Applicable

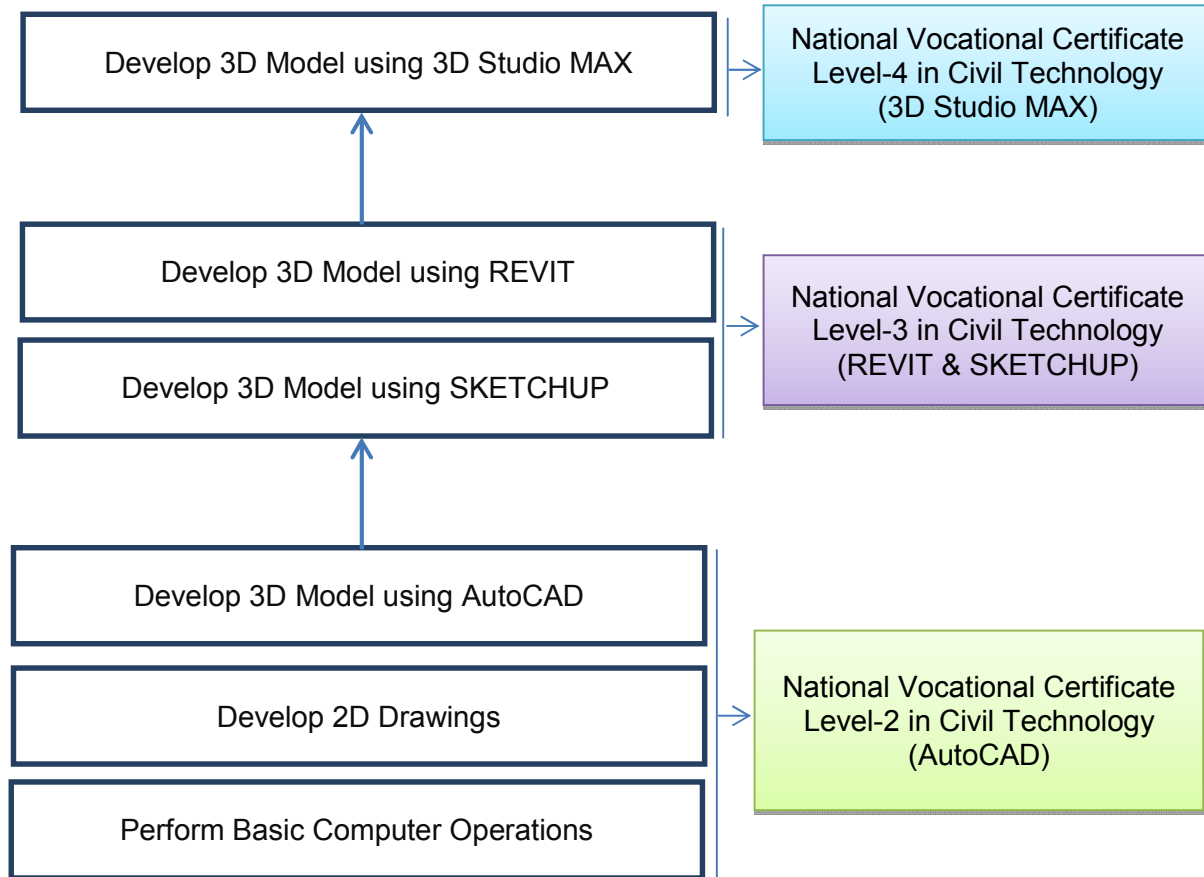
## SUMMARY OF COMPETENCY STANDARDS

Competency Standards	Level	Credits	Category
Perform Basic Computer Operations	2	8	Functional
Develop 2D Drawings	2	30	Technical
Develop 3D Model using AutoCAD	2	20	Technical
Develop 3D Model using SKETCHUP	3	15	Technical
Develop 3D Model using REVIT	3	16	Technical
Develop 3D Model using 3D Studio MAX	4	30	Technical



# PACKAGING OF QUALIFICATIONS

The national vocational qualifications have been packaged as per following:



Code:

## **Perform Basic Computer Operations**

### **Overview**

This competency standard will provide skills and knowledge related to basic computer hardware, software, applications and troubleshooting. You will be able to demonstrate your skills in operating a computer system and computer applications such as MS Word, MS PowerPoint, MS Excel as well as installation and troubleshooting of Operating System and software.

<b>Competency Units</b>	<b>Performance Criteria</b>
1. Configure Computer System	P1. Connect computer components and peripherals as per requirements P2. Install System software and applications software according to the Instruction Manual P3. Troubleshoot Applications to trace and fix faults(if any)to bring it in a running condition P4. Follow health, safety and security procedures to ensure safe working environment
2. Create a Document Using MS Word	P1. Compose a document as per requirements P2. Assign name and location to save a file in word file format P3. Format Word Document according to given requirements P4. Generate hard copy according to job requirements
3. Prepare a Worksheet Using MS Excel	P1. Develop a worksheet as per given data P2. Format the worksheet according to given job requirements P3. Apply Formulas according to given criteria P4. Generate Charts/Graphs according to the given data

<p>4. Prepare a Presentation Using MS PowerPoint</p>	<p>P1. Insert Slides with different Layouts according to requirements of presentation</p> <p>P2. Insert text, tables, images, etc. according to the requirements</p> <p>P3. Apply a set of effects to animate the slide according to requirements</p> <p>P4. Apply Slide Transitions on Slides according to requirement</p> <p>P5. Apply Sound Effects on Objects/text/images according to job requirements</p>
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### **Knowledge & Understanding**

This competency standard will provide knowledge related to:

- **Operating systems**
  - Installation of software applications
  - Open and close files
  - Locate a saved file
  - File management
- **Hardware and Software**
  - Access a CD/DVD-ROM and Data traveler
  - Troubleshoot hardware and software problems
- **Internet and E-mailing**
  - Send an e-mail message
  - Receive an e-mail message
  - Attach a file to an e-mail
  - Basic search in search engine
  - Download and view file from webpage
  - Upload files to cloud location
  - Print web page
- **MS Office**
  - Basic formatting: bold, italic & center
  - Save a file (including naming the file and locating where to save the file)

- Print a file
- Hyperlink and referencing
- Applying Formulas
- Short Keys
- WPM (Words Per Minute)
- Animations and transitions to different slides
- Communication skills

### **Critical Evidence(s) Required**

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

- Install MS Office Application correctly
- Prepare a formatted document using MS Word
- Enter data into the respective columns and rows as per given instructions
- Set page layouts and margins
- Apply any slide transition on entire presentation

Code:

## Develop 2D Drawings

### Overview

This competency standard is designed to provide skills and knowledge to create two dimensional drawings by using various tools and commands. You can create and modify objects and drawings in AutoCAD to meet specific targets according to job requirements.

Competency Units	Performance Criteria
1. Develop 2D Objects	P1. Setup drawing interface for required specifications P2. Setup user interface settings for required specifications P3. Save AutoCAD drawing files in different file formats (DWG, PDF, JPG). P4. Create 2D Objects with given measurements P5. Edit 2D Objects to meet set standards
2. Prepare Final Set of 2D Drawings	P1. Use appropriate command and tools to develop 2D Drawing P2. Develop 2D Drawing with given project specifications and measurements P3. Create title block layout as required P4. Plot drawing on scale according to required size and orientation

### Knowledge & Understanding

This competency standard will provide knowledge related to:

- **Basic Drawing Settings**
  - Unit setting

- Limits setting
- User coordinate system
- Workspace setting
- Object Snap Settings
- **Basic Commands and Concepts**
  - Angles and lines in AutoCAD
  - Differentiate between absolute, relative and polar system
  - DIMSTYLE and MTEXT commands
  - HATCHING concepts in AutoCAD
  - Differentiate between CHAMFER and FILLET command
  - Types of Array
  - OFFSET, CIRCLE and ROTATE short commands
  - Zooming options
  - Tools palettes window
  - Design center
  - Scale and paper sizes
  - Modify dimension style and text size according to paper size
  - Backup file

### **Critical Evidence(s) Required**

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

- Create 2D Drawings including Plan, working plan, section, elevation, legend, schedule, areas & measurements according to specific technologies

Code:

## Develop 3D Model Using AutoCAD

### Overview

This competency standard is designed to provide skills and knowledge to create 3-Dimensional Models by using various tools and commands in AutoCAD 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
1. Develop 3D Objects	P1. Setup & save 3D Drawing Interface for required specifications P2. Setup 3D User Interface settings for required specifications P3. Create 3D Objects with given measurements
2. Manipulate 3D Objects Using 3D Editing Tools	P1. Modify 3D Objects in line with the requirements P2. Make customized 3D Models according to the requirements of the given job P3. Convert 3D Face Objects into Single Mesh Objects
3. Render 3D Model	P1. Apply material to required 3D Model as per given specifications P2. Apply lights to get the requisite scene of required 3D model P3. Assign cameras to execute different views of required 3D Model P4. Render and print the 3D model according to required size and orientation

### Knowledge & Understanding

This competency standard will provide knowledge related to:

- 3D Modeling in AutoCAD
  - 3D solids
  - Surfaces
  - Meshes
  - Wireframe Objects
  - Differentiate between Surface Modeling and Solid Modeling
  - 3D Face and Edges
- Boolean Operation Concepts
  - Subtraction
  - 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:

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



Code:

## Develop 3D Model Using Sketch Up

### Overview

This competency standard is designed to provide drawing and designing tools using Sketch Up. You can use this software to work under real-world time constraints. From broadcasters to designers, architects and engineers; virtually every industry uses Sketch Up to create prototype models and animate 3D objects and environments.

Competency Units	Performance Criteria
1. Develop 3D Objects	P1. Set up template for required specifications P2. Import/create 2D Drawing/Image as per assigned specifications P3. Create 3D Object from 2D Drawing/Image in line with given measurements
2. Modify 3D Objects	P1. Navigate 3D Objects as per required job P2. Modify 3D Objects in line with the requirements
3. Apply Material and Textures on 3D Objects	P1. Create/assign specified materials and textures to 3D Model P2. Modify materials and textures according to the object size P3. Use appropriate tools and commands for applications of materials and textures on 3D objects P4. Edit materials and textures to get realistic outcome
4. Render 3D Model	P1. Install plug-ins to meet specific outcome as per requirement P2. Add scene of 3D Model according to specifications P3. Add lights for illumination to get the requisite scene of 3D Model P4. Assign cameras to execute different views of 3D Model P5. Add shadows and realistic effects to get different rendered views P6. Add Render Components to make scene more realistic P7. Render 3D Model according to required image size or

	resolution& orientation
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## **Knowledge & Understanding**

This competency standard will provide knowledge related to:

- Templates
  - Simple Template
  - Architectural Design
  - Construction Documentation
  - Urban Planning
  - 3D Printing
- Basic Commands and Concepts
  - Axes in SketchUp
  - Short commands: Line, Rectangle and Circle
  - Push/Pull
  - Short command of Pan and Orbit
  - Protractor Tool and Tape Measure Tool
  - Scaling and Stretching
  - Scale and Paper Sizes
- Different Modeling Techniques
- Different Types of Materials and Textures
- Shadow and Fog Views
- Principles of Lighting and Rendering
- Two-Point Perspective

## **Critical Evidence(s) Required**

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

- Render 3D Prototype Model including materials, textures, lights, scene and different camera views

Code:

## Develop 3D Model using Autodesk REVIT

### Overview

This competency standard is developed 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
1. Setup Interface	P1. Create custom user interface as per requirement of specific technology P2. Create and apply Families for given specifications and requirements P3. Use appropriate commands and tools to perform required job
2. Create Building Layout	P1. Create/import drawings to make layout according to the given requirements P2. Use appropriate commands and tools to create building layouts P3. Modify drawings and objects to meet given criteria P4. Create 3D Prototype Model of the drawing according to given measurements
3. Create Construction Document	P1. Create specifications/details 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
4. Render Model	P1. Add scene of 3D Model according to specifications P2. Add lights for illumination to get the requisite scene of 3D model

	<p>P3. Assign cameras to execute different views of 3D Model</p> <p>P4. Render the 3D model according to required image size or resolution &amp; orientation</p>
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## **Knowledge & Understanding**

This competency standard will provide knowledge related to:

- Terms and Concepts
  - Level
  - Snaps and Guides
  - Level Constraint
  - Families
  - Annotation Families
  - Schedules
  - Sheets
  - ViewCube
  - 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 Colours
- 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
- Render 3D Prototype Model

Code:

## Develop 3D Model Using Autodesk 3D Studio Max

### Overview

This competency standard is designed to provide a comprehensive 3ds Max Modeling and Rendering solution to interior designers, architects and engineers (electrical/mechanical/civil). You can cover the interface and proper workflow for setting up 3ds Max projects with cameras, lighting, and rendering. You can handle more complex scenarios and techniques which are found in 3ds Max.

Competency Units	Performance Criteria
1. Create Objects Using Geometry and Shapes	P1. Create/import/link/fetch/merge 2D Drawing to make 3D Objects according to given specifications P2. Use Geometry & Shapes to make 3D Objects according to given specifications
2. Modify Objects	P1. Modify Parameters of 3D Objects according to given specifications P2. Apply modifiers for object manipulation to meet the specific requirements
3. Apply Material and Textures to Objects	P1. Create/assign specified materials and textures to 3D Model P2. Edit materials and textures to get realistic outcome
4. Render 3D Model	P1. Assign/Install Render to meet specific outcome as per requirements P2. Add scene of 3D Model according to specifications P3. Add lights for illumination to get the requisite scene of 3D Model P4. Assign cameras to execute different views of 3D

	Model P5. Render the 3D Model according to required image size or resolution & orientation
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## **Knowledge & Understanding**

This competency standard will provide knowledge related to:

- 3D Prototype Models for presentations
- Principles of Lighting and Rendering
- Modeling Techniques
- Materials, Textures and Colours
- Reflection and Refraction
- 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:

- Render 3D Prototype Model including materials, textures, colours, viewports, lights, scene and different camera views

## LIST OF TOOLS AND EQUIPMENT

Sr.No.	Description
1.	PCs/Laptops
2.	Multimedia Projector
3.	Microsoft Office (Word, PowerPoint and Excel)
4.	AutoCAD
5.	3D Studio Max
6.	SketchUp
7.	REVIT
8.	VRay
9.	IRender
10.	Computer System
11.	Scanner
12.	Printer/Plotter
13.	USB sticks
14.	Internet Connection (Wi-Fi)
15.	White Board
16.	White Board markers/erasers
17.	Printing Papers
18.	Tracing Sheets
19.	Pens/Pencils
20.	Scissors/Cutter
21.	Note Books
22.	Codes of Conduct
23.	NVQF/Policy Documentation
24.	Learning Platforms (online)