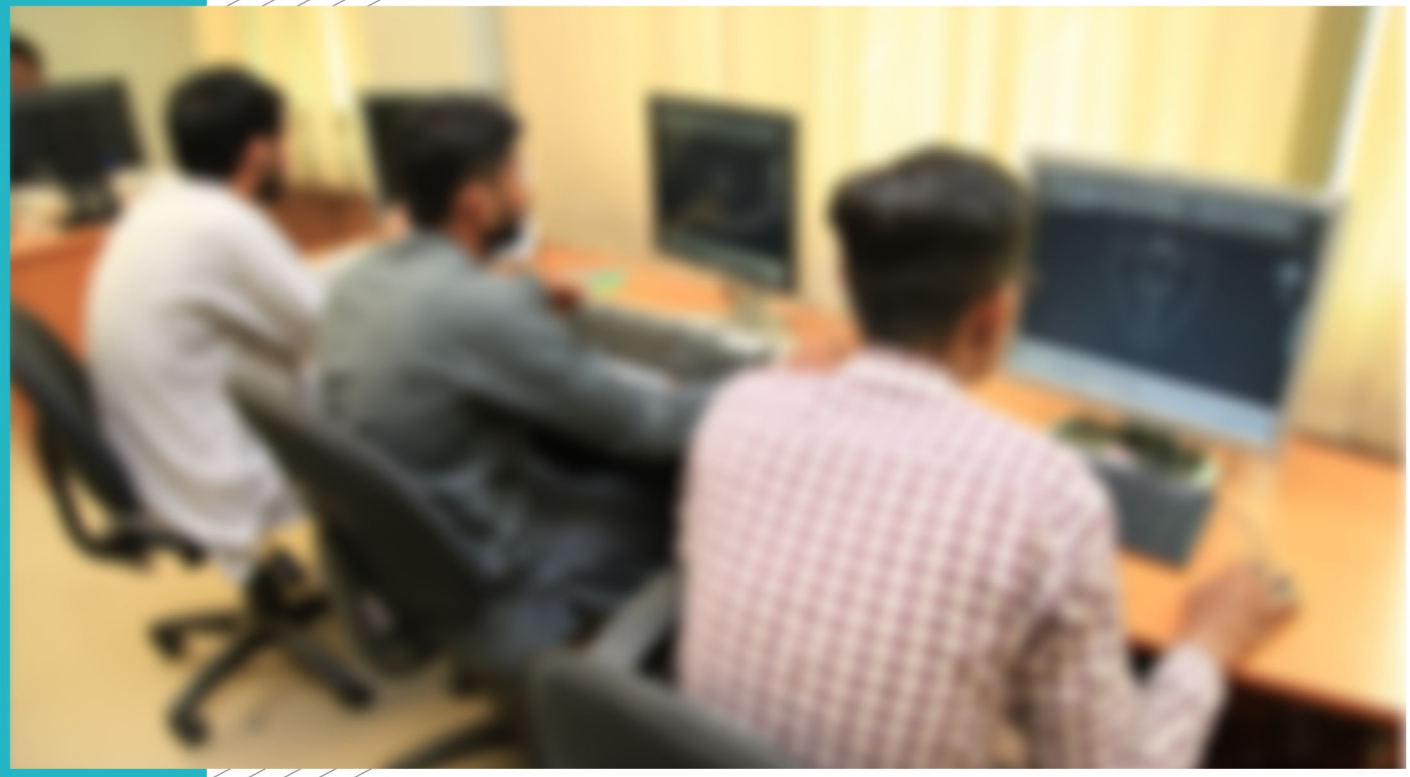
AUTOCAD



CBT Curriculum

National Vocational Certificate Level 3

Version 1 - July 2013

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1. Introduction

The structure of this course

This curriculum comprises of 11 modules. The recommended delivery time is 800 hours. Delivery of the course can therefore be full time (6 hours a business day), 5 days a week, for 6 months (on average 22 business days a month). Training providers are at liberty to develop other models of delivery, including part-time and evening delivery.
The full structure of the course is as follows:

Module	Theory	Practical	Total hours
1: Exhibit Duties and Rights at the Workplace	10	17	27
2: Perform Orientation about AutoCAD 2D Fundamentals	10	52	62
3: Create 3D Interface drawings	13	66	79
4: Draw Coordinates	14	50	64
5: Draw 3D Orbit, Navigations and Model	19	97	116
6: Produce 2D Solids and 3D Faces	09	39	48
7: Insert Surfaces	16	77	93
8: Develop Solids	14	53	67
9: Modify Solid Faces	07	26	33
10: Navigate Sections and merge Flat Objects from 3D Models	09	31	40
11: Customise Rendering, Materials and Lights	37	126	163

This is a curriculum of AutoCAD programme which has been developed for implementation throughout Pakistan. This curriculum provides stakeholders with guidance to encompass most widely used 3D processes for the product development, (Surfaces, Solids, Rendering and Lights). These practices produced by participants belonging to the different sub domains of Computer Aided Design.

Main Objective of course

The overall objective of this programme is to produce employees who can provide sufficient assistance to their supervisors in creating 3D AutoCAD drawings. Then certified of this programme will also be able to become entrepreneurs. However, this will require providing additional input on entrepreneurship development for the one who is willing to start his/her own business. (Not included in the curriculum).

Central aim of the training provider (trainer / teacher)

Aim of the instructor for AutoCAD tool curriculum is to develop drawing related skills through practical (action oriented work). Action orientation can be understood as the willingness and ability of a student to act in different situations in a socially responsible manner.
Teaching staff will support student in developing his/her willingness and ability, through their managerial, technical knowledge and capabilities, to solve tasks and problems that are goal-oriented. They will need to use student-centred, practical oriented methods. They will also need to develop a programme of practical assessment that reflects the learning outcomes stated in this curriculum.
Student will develop ability as an individual to clarify issues, think thorough and to assess development opportunities. He/she should learn to consider requirements and constraints in day to day routine life and to develop his/her own projects / products.
Teaching staff will also support students in developing characteristics such as articulateness, assertiveness, prudent self-reliance, resilience, responsibility, and a sense of duty and negotiation tactics.

This curriculum can serve as a quality improvement initiative geared to helping institution build their capacity to produce resources for AutoCAD. By leveraging the guided discussions, activities, resources, and other materials in these trainings, participant will build his/her knowledge, skills, and abilities related to:

- Knowledge about 2D and 3D design environment
- Differentiation between different types of layouts
- Explanation of problem solving techniques

- Practical experience of designing drawings (Surfaces, Solids, Rendering)
- Understanding of the coordinates
- Ability to deal with clients
- Information about light functions
- Practical experience of command line usage
- Adequate presentation skills
- Team coordination skills

Entry level for trainees

An interested individual with Higher Secondary School Certificate or equivalent with comfort level of English language and mathematics. Satisfactory completion of appropriate admission assessment test may also be applicable.

Minimum teaching qualification

Teaching staff should have at least five (5) years experience related to the application of the AutoCAD latest versions i.e. 2013. Beside this the incumbent also holds a bachelor's degree (16 years) in relevant fields. Apart from this s/he must be familiar with device integration particularly to CAD/CAM, Plotter. They should also hold or be working towards a formal teaching qualification.

Medium of instruction

Instructions will be provided in Urdu and English languages. For employment in the different demographic regions, orientations to specific linguistic expression with language conversion tools (worked with UNI codes) are recommended.

Terminology

This curriculum is for AutoCAD (Computer Aided Design). Some organisations may use alternative terms to describe this job role, for example Draftsman, Drawing Assistant, Animator, etc. Training providers should examine the scope of the curriculum to determine whether this curriculum meets the needs of potential candidates/incumbents.

Laws and Regulations

AutoCAD work may govern by the specific applicable territorial laws, imposed from competent authorities; mentor should abide by the laws.

Suggested distribution of modules

This qualification is made up of eleven (11) modules including the general practices. Final assessment is not included here. Trainer can utilize Eight (8) hours for internal assessment. Suggested distribution of these modules is presented overleaf. This is not prescriptive, and training providers may modify this according to given circumstances.
One module is interdependent: Module 1: Perform Duties and Exhibit Rights at workplace. This is illustrated in the distribution table.
Rest of the module 2 to 11 should be taught in sequence.
Each module covers a range of learning components. These are intended to provide detailed guidance to teachers (*learning elements*) and give them additional support for preparing their lessons (*materials required*). The detail provided by each module will contribute to a standardised approach of teaching, ensuring that training providers in different parts of the country have clear information on what should be taught.

The distribution table is shown below:

Module 1: Duties and rights at the workplace	27 Hours
Module2: Orientation to AutoCAD 2D Fundamentals	70 Hours
Module 3: Create 3D Interface	79 Hours
Module 4: Draw Coordinates	64 Hours
Module 5: Draw 3D Orbit, Navigation and Model	116 Hours
Module 6: Produce 2D Solids and 3D Faces	48 Hours
Module 7: Insert Surfaces	93 Hours

Module 8: Develop Solids	67 Hours
Module 9: Modify Solid Faces	33 Hours
Module 10: Navigate Sections and Flat Objects from 3D Models	40 Hours
Module 11: Customise Rendering, Materials and Lights	163 Hours

Definition

AutoCAD professional draws the 2-dimensional and 3-dimensional objects/artifacts with user coordinates for the Architectural design of the building, render them with light shadows. Use of surfaces, solids, navigation helps to visualize the model in a simulated perspective. An individual with little supervision from inline manager(s) and with little autonomy will be able to update the drawings for real world scenarios.

Overall objectives of this course

- ✓ To assist architects team in 2D/3D drawings
- ✓ Equip resources with technical skills
- ✓ Provide skilled resource for CAM (Computer Aided Manufacturing) design integration
- ✓ Work closely with other team members to ensure excellent service is provided to management
- ✓ Ensure the team is working as per company policies
- ✓ Achieve organizational process assets.

Competencies gained after completion of the course:

At the end of the course, the student must have attained the following competencies:

- ✓ Prepare 2D/3D drawings
- ✓ Manage image rendering
- ✓ Create solid faces

Personal requirements

Trainee needs the following characteristics:

- A genuine interest in computer aided design industry (i.e. Mathworks Matlab, Autodesk AutoCAD.)
- Good health and stamina – Capacity to work for a longer period of time in tough environment
- Ability to lead and work as a member of a team
- Willing to maintain the high standard of standard operating procedure necessary in any project / product development
- Flexibility, Integrity
- Desire to learn

Opportunities for employment and advancement

Trainees can be employed in government / semi-government / private (MNC's) organizations. Experienced resources may advance through promotions with the same employer or by moving to more advanced positions with other employers. They can become:

- Draftsman
- Assistant Architect
- Associate Architect
- Architect (Civil and Mechanical)

There are good prospects of travelling within Pakistan and abroad. The employment outlook in this occupation will be influenced by a wide variety of factors including:

- Employment turnover (work opportunities generated by people leaving existing positions)
- Occupational growth (work opportunities resulting from the creation of new positions that never existed before)
- Size of the industry
- Flexibility of the applicant (concerning location and schedule of work).

2. Overview of the curriculum for AutoCAD

Module Title and Aim	Learning Units	Timings
Module 1: Exhibit Duties and Rights at the workplace **Aim:** To develop code of ethics and professional conduct, improve planning capabilities, and awareness to provision of applicable territorial business / employment related rights at workplace.	**LU1:** Practise Ethics and professional conduct **LU2:** Process business activities **LU3:** Create awareness of rights	**Timeframe of module** 27 hours **Theory Days/hours** 10 hours **Workplace Days/hours** 17 hours
Module 2: Perform orientation about AutoCAD 2D Fundamentals **Aim:** To provide knowledge and skills to create geometric entities quickly and accurately. In learning to use a CAD system, **lines** and **circles** are the first two, and perhaps the most important two, geometric entities that one should master the skills of creating and modifying.	**LU1:** Control the display in drawings **LU2:** Create basic drawings **LU3:** Manipulate objects	**Timeframe of module** 70 hours **Theory Days/hours** 10 hours **Workplace Days/hours** 60 hours
Module 3: Create 3D Interface drawings **Aim:** The module explores the basic Three (3) dimensional interfaces with thickness and elevation to visualize the model.	**LU1:** Develop familiarity with 3D Basics interface **LU2:** Know about Thickness and Elevation **LU3:** Visualize the Model	**Timeframe of module** 79 hours **Theory Days/hours** 13 hours **Workplace Days/hours** 66 hours

Module 4: Draw Coordinates **Aim:** The module explores the basic of 3D User and Z Cartesian (X, Y, Z) coordinates system.	**LU1:** Acquire basic terminologies of Z Coordinates **LU2:** investigate User Coordinates System	**Timeframe of module** 64 hours **Theory Days/hours** 14 hours **Workplace Days/hours** 50 hours
Module 5: Draw 3D Orbit, Navigations and Model **Aim:** The module explores the use of 3D orbit for a model, creation of a camera and aspects of 3D model objects in detail.	**LU1:** Develop familiarity with 3D Orbit **LU2:** Research Three dimensional navigation **LU3:** Inspect 3D Object	**Timeframe of module** 116 hours **Theory Days/hours** 19 hours **Workplace Days/hours** 97 hours
Module 6: Produce 2D Solids and 3D Faces **Aim:** The module explores the two dimensional solids and three dimensional faces with Edge and invisible Edge.	**LU1:** Inspect 2D Solids and 3D Faces **LU2:** Study Edge	**Timeframe of module** 48 hours **Theory Days/hours** 9 hours **Workplace Days/hours** 39 hours

Module 7: Insert Surfaces **Aim:** To study, and analyze basic and complex 3D surfaces.	**LU1:** Know about Basic 3D surfaces **LU2:** Comprehend Complex surfaces	**Timeframe of module** 93 hours **Theory Days/hours** 16 hours **Workplace Days/hours** 77 hours
Module 8: **Develop Solids** **Aim:** To explore the composites of solids and their three dimensional editing.	**LU1:** Create Solids **LU2:** Edit 3D **LU3:** Study Solid composites	**Timeframe of module** 67 hours **Theory Days/hours** 14 hours **Workplace Days/hours** 53 hours
Module 9: Modify Solid Faces **Aim:** To learn the modification of the 3D solid faces.	**LU1:** Modify Solid Faces **LU2:** Edit Solids	**Timeframe of module** 33 hours **Theory Days/hours** 07 hours **Workplace Days/hours** 26 hours

Module 10: Navigate Sections and merge Flat Objects from 3D Model **Aim:** To learn the creation of the Section and the Flat objects from three dimensional models.	**LU1:** Handle Section Objects **LU2:** Handle Flat Objects	**Timeframe of module** 40 hours **Theory Days/hours** 09 hours **Workplace Days/hours** 31 hours
Module 11: Customize Rendering, Materials and Lights **Aim:** To learn the application of Rendering, its environment and background, and advance features. Use of different Materials and Lights highlighted for 3D drawings.	**LU1:** Study Rendering **LU2:** Employ Materials **LU3:** Employ Lights	**Timeframe of module** 163 hours **Theory Days/hours** 37 hours **Workplace Days/hours** 126 hours

3. Teaching and Learning Guide for AutoCAD

The aim of the training for student is to be able to act independently and responsibly in his/her field of work, by following an educational program where this is a part of the overall methodological concept.

Different methodologies can therefore contribute to achieve this objective. Theory methodologies should be well supported by appropriate resources, as indicated in the 'materials required' column of the learning unit specifications. Teachers should also illustrate theory sessions with examples of how the learning can be applied in the workplace. Practical methodologies should be set in an appropriate environment and supported by appropriate resources. Methods that directly promote capacity-building for the student are particularly suitable, for example practical work, mock up, role play, emergency and contingency situational training, case study, situational problem solving, body language, positive impression, dignity in labor, and therefore should be included appropriately in the teaching approach.

Module 1: Exhibit Duties and Rights at the workplace

Objective of the module: To develop code of ethics and professional conduct, improve planning capabilities, and awareness to provision of applicable territorial business / employment related rights at workplace.

Duration 27 hours **Theory:** 10 hours **Practical:** 17 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Demonstrate Ethics and Professional Conduct	**The learner will be able to:** Perform the mandatory standard for responsibility, respect, fairness and honesty against the applicable territorial laws.	**1.** Take ownership for the decisions/actions he/she makes or fails to make and their consequences. (Role Play) **2.** Show high regard for resources entrusted to him/her. Including subordinates, tangible assets (equipment), company profile. **3.** Make decisions and act impartially/objectively free from self-interest. (Quantified Self-assessment can be performed e.g. case study.) Area like conflict of interest **4.** Understand truth and act in truthful manner in conduct/communication e.g. daily attendance register.	Total Hours: 06 hours **Theory:** 02 hours **Practical:** 04 hours	• Workbooks • Pen • Case studies • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

LU2: Plan Business Process activities	**The learner will be able to:** Identify tasks, their scheduling, define milestones, and learn optimal utilization of resources.	**1.** Provide due assistance to in-line manager e.g. coordinating recurring meetings, intimate resource availability, create and keep documentations, validate applicable company defined standards. **2.** Define activities, e.g. Apply specific life cycle methodologies – (Requirement gathering, design solution, prototype, testing, documentations) **3.** Estimate time, e.g. hour calculation for an activity; consider calendar year official leaves, company working timings. **4.** Achieve work breakdown, divide module in smaller and more manageable components e.g. testing a drawing may have components like interface, coordinates, and render cases. **5.** Level resource due to work load, e.g. calculation of leisure hours of a worker.	**Total Hours:** 15 hours **Theory:** 05 hours **Practical:** 10 hours	• Workbooks • Pen • Case studies • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

LU3: Create Awareness about Rights	**The learner will be able to:** **1.** Recognize the inspirational requirement of human rights in employment context.	**1.** Inform the concerned authority and uphold the policies, rules/regulations that govern the work and workplace. **2.** Report illegal conduct or illegitimate action to appropriate management. **3.** Protect propriety or confidential information. (Intellectual Property Rights, Copy Rights).	Total: 06 hours Theory: 03 hours Practical: 03 hours	• Workbooks • Pen • Case studies • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

Module2: Perform Orientation about AutoCAD 2D Fundamentals

Objective of the module: Aims to provide knowledge and skills to create geometric entities quickly and accurately. In learning to use a CAD system, **lines** and **circles** are the first two, and perhaps the most important two, one should master the skills of creating and modifying geometric entities.

Duration 70 hours **Theory:** 10 hours **Practical:** 60 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Control the displays in drawings	**The student will be able to:** **1.** Create and save AutoCAD drawing files. **2.** Use the AutoCAD visual reference commands.	Perform **1.** Precision **2.** Zoom Extent **3.** Drawing LIMITS **4.** Status Bar **5.** GRID Display **6.** PAN Realtime	**Total Hours:** 15 hours **Theory:** 3 hours **Practical:** 12 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab
LU2: Create basic drawings	**The student will be able to:** **1.** Draw using Line and Circle commands **2.** Define Positions using the Basic Entry methods	Perform **1.** Format **2.** Units Setup **3.** LINE command **4.** Coordinates **5.** Interactive Input method **6.** SNAP Option **7.** World space **8.** User coordinate system **9.** World coordinate system	**Total Hours:** 35 hours **Theory:** 05 hours **Practical:** 30 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

		10. UCS icon Display **11.** TTR, circle **12.** Relative Coordinate **13.** Coordinate systems **14.** Cartesian coordinate system **15.** Absolute coordinates **16.** Positions, defining **17.** LINE, Close option **18.** CIRCLE command **19.** TTT, circle **20.** ARC command			
LU3: Manipulate objects as desire	**The student will be able to:** **1.** Use the ERASE command **2.** Use the AutoCAD Pan Real-time option	1. ERASE command 2. Select window	**Total Hours:** 20 hours **Theory:** 04 hours **Practical:** 16 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

Module 3: 3D Create 3D Interface Drawings

Objective of the module: The module explores the basic Three (3) dimensional interfaces with thickness and elevation to visualize the model.

Duration 79 hours **Theory:** 13 hours **Practical:** 66 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Develop familiarity with 3D Basics interface	**The student will be able to:** **1.** Apply 3D Basic Ribbons and Pull down. **2.** Gain sound knowledge of 3D Modelling interface (Panels Pull down menus). **3.** Explain Viewports, Named Views, Steering Wheel. **4.** Define the V point, DDV point and Plan View techniques.	**1.** Introduce 3D Basic Ribbons including Create, Edit, Draw, Modify, Selection, Coordinates, Layers and Views. **2.** Execute steps involved in executing Pull-down menus that includes Home, Render, Insert, Manage, Output, Plug-ins, online, and Express Tools. **3.** Enlist steps to apply 3D Modelling panels including Modelling, Mesh, Solid, Editing, Draw, Modify, Section, Coordinates, View,	**Total Hours:** 35 hours **Theory:** 05 hours **Practical** 30 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

		Selection, Layers and Groups. **4.** Explain steps of applying 3D Modelling Pull down menus that are Home, Solid, Surfaces, Mesh, Render, Parametric, Insert, Annotate, View, Manage, Output, Plug-ins, Online, and Express Tools. **5.** Viewports (-VPORTS command), pre-set 3D Viewports and Named Views. **6.** Apply the technique to track the cursor (Steering Wheel) over wedge as full navigation wheel, view object wheel, orbit, walk up/down, rewind and its setting. **7.** Viewpoints (-VPOINT command with Rotate switch, DDVPOINT command), and PLAN command.			

LU2: Introduce Thickness and Elevation	**The student will be able to:** **1.** Apply the Thickness command. **2.** Set the Elevation of object.	**1.** Execute the "Thickness" command at command prompt with different values or modify general properties of an object. **2.** Execute the "Elev" command at command prompt with different values.	**Total Hours:** 10 hours **Theory:** 02 hours **Practical** 08 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab
LU3: Visualise the Model	**The student will be able to:** **1.** Manage Visual Panel, Styles and Manager. **2.** Apply different visual functions (hide, grid).	**1.** Control the display of edges and shading (Visual Styles) in the viewport that are 2D Wireframe, 3D Wireframe, 3D Hidden, Realistic, Shaded, Shaded with Edges, Shades of Gary, Sketchy and X-Ray. **2.** Regenerate a three-dimensional model with hidden lines using HIDE command. **3.** Set the grid with DSETTINGS command.	**Total Hours:** 34 hours **Theory:** 06 hours **Practical** 28 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

Module 4: Draw Coordinates

Objective of the module: The module explores the basic of 3D User and Z Cartesian (X, Y, Z) coordinates system.

Duration 64 hours **Theory:** 14 hours **Practical:** 50 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Explain Basic terminologies of Z Coordinates	**The student will be able to:** **1.** Grasp the different commonly known terminologies of 3D coordinates **2.** Understand the tracking and movement in Z direction **3.** Become familiar with 3D point filters **4.** Implement "Helix" function for 3D spiral.	**1.** Explain 3D Cartesian coordinates against 3DPOLY command by specifying start and end points. **2.** Describe the process to track in Z direction by "O Snap" tracking or F11 key and "Polar" tracking or F10 key. **3.** Run "move" command to move in Z direction by specifying displacement. **4.** Acquire 3D point filters, e.g. specifying radius of circle command. **5.** Create 3D spiral using	**Total Hours:** 26 hours **Theory:** 06 hours **Practical:** 20 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

		"helix" command by defining number of turns, diameter and height.			
LU2: Define User Coordinates System	**The student will be able to:** **1.** Configure User Coordinates System (UCS) properties. **2.** Apply different functions to UCS. **3.** Restore the UCS. **4.** Generate View cube.	**1.** Orientation of the user coordinate system (UCS) axes and the location of the current UCS origin with the execution of command "ucsicon". **2.** Present an overview of "ucs" command with multiple switches including ✓ Face ✓ Named ✓ Object ✓ Previous ✓ New ✓ View ✓ World ✓ X/Y/Z. **3.** Define the UCS toolbar. **4.** Explain the Plan UCS procedure with "PLAN" command. **5.** Incorporate Dynamic UCS with short keys of	**Total Hours:** 38 hours **Theory:** 08 hours **Practical:** 30 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

		Ctrl+D. **6.** Restore a saved and named UCS with “R” key. **7.** Explore UCS dialog box using “UCSMAN” command. **8.** Get the visual feedback of the model by Viewcube.			

Module 5: Draw 3D Orbit, Navigation and Model

Objective of the module: The module explores the use of 3D orbit for a model, creation of a camera and aspects of 3D model objects in detail.

Duration 116 hours **Theory:** 19 hours **Practical:** 97 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Develop familiarity with 3D Orbit	**The student will be able to:** **1.** Apprehend the working of 3D Orbit (constrained, free and continuous). **2.** Explain different projection and navigational modes. **3.** Assist in applying visual aids and styles.	**1.** Define 3D orbit with the command of "3DOrbit" for constrained orbit on selected object. **2.** Provide due assistance in developing zoom and pan facility in 3D orbit. **3.** Apply projection mode by selecting "Perspective" option in 3D orbit. **4.** Select different visual styles e.g. 3D Hidden, 3D Wireframe, Conceptual, and Realistic. **5.** Select different visual aids e.g. Compass, Grid and UCS Icon. **6.** Set the 3D view while in the orbit command using preset views. **7.** Differentiate between	**Total Hours:** 52 hours **Theory:** 07 hours **Practical:** 45 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

		Free and Continuous orbit. Highlight the use of "Esc" key. **8.** Discover other navigational modes including but not limited to Walk, Fly, Swivel, and Adjust Distance.			
LU2: Perform 3D navigation	**The learner will be able to:** **1.** Design and create Camera. **2.** Plot and adjust the Camera. **3.** Walk and Fly settings. **4.** Maintain the different animation paths.	**1.** Functions of Camera including: ✓ Creation ✓ View ✓ Preview ✓ Properties ✓ Plotting ✓ Display ✓ Adjust ✓ Swivelling ✓ Distance **2.** Define parallel projection or perspective views by using a camera and target with the help of "DVIEW" command. **3.** Simulate walking and	**Total Hours:** 32 hours **Theory:** 07 hours **Practical:** 25 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

		flying through a 3D drawing and their setting. **4.** Execute “ANIPATH” command for animation path.			
LU3: Operate 3D Object	**The learner will be able to:** **1.** Constitute Structure of Wireframes. **2.** Apply Surfaces **3.** Create of Solids.	**1.** Create wireframe models by positioning 2D objects anywhere in 3D space i.e. 3D polylines. **2.** Define faceted surfaces using a polygonal mesh. **3.** Combine different simple shapes to create more complex solids by joining or subtracting them or finding their intersecting (over-lapping) volume.	**Total Hours:** 32 hours **Theory:** 05 hours **Practical:** 27 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

Module 6: Produce 2D Solids and 3D Faces

Objective of the module: The module explores the two dimensional solids and three dimensional faces with Edge and invisible Edge.

Duration 48 hours **Theory:** 09 hours **Practical:** 39 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Draw 2D Solids and 3D Faces	**The student will be able to:** **1.** Create solid-filled triangles and quadrilaterals. **2.** Create four sided surface anywhere in 3D space.	**1.** Execute "SOLID" command with points to be filled. **2.** Execute "3DFACE" command with points to be filled. **3.** Make a three-dimensional polyface mesh vertex using "PFACE" command and pick points.	**Total Hours:** 24 hours **Theory:** 05 hours **Practical:** 19 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab
LU2: Draw Edges	**The student will be able to:** **1.** Create edges. **2.** Draw 3D faces with invisible edges.	**1.** Execute the "EDGE" command with toggle visibility and hidden edges. . **2.** Enter i or invisible before the first point of an edge makes the edge invisible.	**Total Hours:** 24 hours **Theory:** 04 hours **Practical:** 20 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

Module 7: Insert Surfaces

Objective of the module: To study, and analyze basic and complex 3D surfaces.

Duration 93 hours **Theory:** 16 hours **Practical:** 77 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Draw Basic 3D surfaces	**The student will be able to:** 1. Explore different Mesh primitive options. 2. Create smooth and refine Meshes. 3. Edit existing Meshes. 4. Convert Meshes.	**1.** Locate Mesh tab from 3D Modelling dropdown option of solids panel (primitive panel, drop-down). **2.** Apply different Mesh primitive options including; **3.** Apply smoothness and refinement on Meshes (even legacy 2D drawings) with following commands; ✓ MESHSMOOTHMORE ✓ MESHSMOOTHLESS ✓ MESHSMOOTHREFINE **4.** Add or Remove Mesh Creases using; ✓ MESHCREASE ✓ MESHUNCREASE **5.** Enable Mesh editing	**Total Hours:** 49 hours **Theory:** 09 hours **Practical:** 40 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

		using; _MESHEXTRUDE _MESHSPLIT (mid-point) _MESHMERGE _MESHCAP (close hole) **6.** Perform convert Meshes using the command; CONVTOSURFACE			
LU2: Draw Complex surfaces	**The student will be able to:** 1. Explore different Surfaces (Revolved, Tabulated, Ruled, Edge, Extrude, and Offsetting). 2. Edit Surfaces. 3. Apply NURB controls on Surfaces. 4. Analyse Surfaces.	**1.** Develop following Surfaces: ✓ Revolved Surface (REVSURF) ✓ Tabulated Surface (TABSURF) ✓ Rule Surface (RULESURF) using "Surf tab" variables ✓ Edge Surface (EDGESURF) ✓ Plane Surface (PLANESURF) ✓ Extrude Surface (EXTRUDE) **2.** Develop 3D solid or surface in the space between several cross sections using "LOFT" command. **3.** Create 3D surface by sweeping a 2D or 3D curve	**Total Hours:** 44 hours **Theory:** 07 hours **Practical:** 37 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

		along a path using "SWEEP" command. **4.** Explain Surface Network. **5.** Blend two existing surfaces using "SURFBLEND" command. **6.** Create a new surface or cap to close an open edge of an existing surface using "SURFPATCH" command. **7.** Produce a parallel surface at a specified distance from the original surface using "SURFOFFSET" command. **8.** Edit the existing surfaces Add and edit control vertices on a NURBS surface or sp line using Surface CV edit bar. **9.** Convert object to NURBS using "CONVTONURBS" command. **10.** Apply following NURB Vertex Controls: ✓ Surface CV-Show			

		✓ Surface CV-Hide ✓ Surface CV-Rebuild ✓ Surface CV-Add ✓ Surface CV-Remove **11.** Conduct surface analysis via: ✓ Analyse Zebra ✓ Analyse Curvature ✓ Analyse Draft **12.** Describe Surface associatively.			

Module 8: Develop Solids

Objective of the module: To explore the composites of solids and their three dimensional editing.

Duration 67 hours **Theory:** 14 hours **Practical:** 53 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Create Solids	**The student will be able to:** 1. Explore Solid primitives. 2. Run Extrude with Taper and Path. 3. Execute commands (Polysolid, Revolve, Sweep and Loft).	**1.** Launch Solid primitives tab from 3D Modelling dropdown option of solids panel. **2.** Convert an existing line, 2D polyline, arc, or circle to a solid with a rectangular profile using "Polysolid" command. **3.** Create unique solid primitives by extruding existing two-dimensional objects using "Extrude" command **4.** Execute following commands on Solids: ✓ Revolve ✓ Sweep ✓ Loft	**Total:** 19 hours **Theory:** 03 hours **Practical:** 16 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

LU2: Edit effectively 3D objects	**The student will be able to:** **1.** Explore different methods to convert the object/drawing to Solid or Surface. **2.** Operate the Solid using 3D Move, Rotate, Align, Mirror, and Array. **3.** Apply different edge effects or extract edges.	**1.** Convert polylines and circles with thickness to 3D solids using "convtosolid" command. **2**. Convert polylines and circles with thickness to surfaces using "convtosurface" command. **3**. Edit the existing solids through; ✓ 3D Move ✓ 3D Rotate ✓ 3D Align ✓ 3D Mirror ✓ 3D Rectangular Array ✓ 3D Polar Array **4**. Extract edges of a 3D object using "_xedges" command. **5**. Adjust the smoothness of shaded and rendered objects using "FACETRES" command with valid values range. **6.** Apply "ISOLINES" and "REGEN" command to regenerate the 3D drawing in 3D view.	**Total:** 26 hours **Theory:** 06 hours **Practical:** 20 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

LU3: Develop 3D Solid composites	**The student will be able to:** **1.** Explore different composite functions applicable to solids (Union, Subtract, and Intersect). **2.** Thicken the Solids. **3.** Check interference on solid objects.	**1.** Apply following Composite functions on solids: ✓ Union ✓ Subtract ✓ Intersect **2.** Create 3D solid by thickening a surface using "THICKEN" command. **3.** Highlight 3D solids that overlap using "INTERFERE" command.	**Total:** 22 hours **Theory:** 05 hours **Practical:** 17 hours	• Workbooks • Pen • Manuals/hand outs • CBT • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

Module 9: Modify Solid Faces

Objective of the module: To learn the modification of the 3D solid faces.

Duration 33 hours **Theory:** 07 hours **Practical:** 26 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Modify Solid Faces	**The student will be able to:** **1.** Explore Solid faces pattern. **2.** Run Imprint functionality. **3.** Execute shell (hollow) effects.	**1.** Modify solids face using ✓ Taper ✓ Extrude ✓ Delete ✓ Copy ✓ Colour **2.** Apply "Imprint" facility on arcs, circles, lines, 2D and 3D poly lines, ellipses, sp lines, regions, bodies, and 3D solids object. **3.** Create shell or a hollow thin wall with a specified thickness from 3D solid object.	**Total Hours:** 18 hours **Theory:** 04 hours **Practical:** 14 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab
LU2: Edit Solids	**The student will be able to:** **1.** Explore different methods to manipulate sub-objects in solids. **2.** Use Grip tool. **3.** Pull and press the bounded areas.	**1.** Select and manipulate a selection set of more than one sub object on any number of solids that include more than one type of sub object using "CTRL" key to	**Total Hours:** 15 hours **Theory:** 03 hours **Practical:**	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

		hold or toggle **2.** Constrain the movement or rotation of a selection set of objects to an axis or a plane using “Move” or “Rotate” command. **3.** Press or pull bounded areas by pressing and holding CTRL +ALT, or by clicking the Press pull button on the dashboard and then picking the bounded area.	12 hours		

Module 10: Navigate Sections and merge Flat Objects from 3D Model

Objective of the module: To learn the creation of the Section and the Flat objects from three dimensional models.

Duration 40 hours **Theory:** 09 hours **Practical:** 31 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Navigate Section Objects	**The student will be able to:** **1.** Understand Section plane. **2.** Manipulate Sections. **3.** Generate 2D and 3D Sections. **4.** Perform Section commands (Slice, etc.)	**1.** Create section object that exposes the interior details of a model created with 3D objects using "SECTIONPLANE" command. **2.** Apply following options to manipulate Section using Grips: ✓ Base grip ✓ Directional arrow grip ✓ Segment end grip ✓ Menu grip **3.** Apply following commands on Section: **4.** Generate 2D and 3D Sections using option of right click button of mouse.	**Total:** 19 hours **Theory:** 04 hours **Practical:** 15 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

		5. Use the intersection of a plane and solids to create a region using "Section" command. **6.** Apply "Slice" command on the 3D object.			
LU2: Merge Flat Objects	**The student will be able to:** **1.** Perform Flat representation of the 3D objects. **2.** Create 3D view using user coordinate system **3.** Configure solid profile.	**1.** Create 2D or "flattened" representation of all 3D objects in the current view using "flat shot' command. **2.** Execute "SOLVIEW" command. **3.** Generate profiles and sections in viewports created with SOLVIEW using "SOLDRAW" command. ✓ Develop 3D view using UCS. ✓ Run "SOLPROF" command.	**Total:** 21 hours **Theory:** 05 hours **Practical:** 16 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

Module 11: Customise Rendering, Materials and Lights

Objective of the module: To learn the application of Rendering, its environment and background, and advance features. Use of different Materials and Lights are highlighted for 3D drawings.

Duration 163 hours **Theory:** 37 hours **Practical:** 126 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Execute Rendering	**The student will be able to:** **1.** Perform Render command, destination, quality, selection, crop, and file. **2.** Recognize environment (Render, Gradient) and background (Solid, Image). **3.** Explain advance features of Rendering as Sampling, Shadow, Ray Tracing, Illumination, Diagnostic processing.	**1.** Create a photorealistic or realistically shaded image of a three- dimensional wireframe or solid model using "Render" command. **2.** Determine the output site that the renderer uses to display the rendered image using "RPERF" command and selecting "Destination". **3.** Determine the output quality that the renderer uses to display the rendered image using "RPERF" command and selecting "Quality level". **4.** Control the parts of the model that gets processed during rendering for following three settings: ✓ View	**Total Hours:** 83 hours **Theory:** 17 hours **Practical:** 66 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

		✓ Crop ✓ Selected **5.** Render cropped window using "RPERF" command and selecting "Procedure". **6.** Execute the process to Render to File and Turn off Render to File. **7.** Use environmental features to set up atmospheric effects or background images using "RENDERENVIRONMENT" command. **8.** Apply following Backgrounds: ✓ Single colour ✓ Multi-colour gradient ✓ Bitmap image Using "View" command and later selecting "New". **9.** Define settings that affect how materials are handled by the renderer as: ✓ Apply Materials ✓ Texture Filtering ✓ Force 2-Sided **10.** Execute how renderer controls sampling by allocating values to; ✓ Min Samples			

		✓ Max Samples ✓ Filter Type ✓ Filter Width and Filter Height ✓ Contrast colour ✓ Contrast Alpha **11.** Apply settings that affect how shadows appear in the rendered image in Simple, Sort, or Segments modes. **12.** Apply settings that affect the shading of a rendered image (Ray tracing) with following options; ✓ Enable ✓ Max Depth ✓ Max Reflection ✓ Max Refraction **13.** Show how scene is illuminated with the following options: ✓ Enable ✓ Radius ✓ Max Depth ✓ Max Reflection ✓ Max Refraction **14.** Explain "Diagnostic" and "Processing" features.			
LU2: Apply/Configure Materials	**The student will be able to:** **1.** Explore different methods to add/edit Materials to 3D	**1.** Add Material to drawing using "Materials" or "Marbrowseropen" commands.	**Total Hours:** 49 hours	• Workbooks • Pen	**Theory:** Class room

	drawings. **2.** Adjust Material scale/layer. **3.** Manage the Material mapping (Photo, Shapes). **4.** Purge Materials from objects.	**2.** Apply Material by layers using "MATERIALATTACH" command. **3.** Create own Material e.g. photo. **4.** Achieve Material mapping of photo or shapes using "MATERIALMAP" command. **5.** Configure "Cut out Materials" procedure. **6.** Apply "Bump Map" option of the Material command. **7.** Execute "_VSMATERIALMODE" command to On/Off Materials.	**Theory:** 11 hours **Practical:** 38 hours	• Case studies • Computer • Internet connection	P**ractical learning:** Classroom/Computer Lab
LU3: Apply Lights	**The student will be able to:** **1.** Explore point and spot Lights. **2.** Study Lights tool palette. **3.** Perform geographic location settings for a particular object. **4.** Study properties of the Sun for Light issues.	**1.** Turn On/Off the default Lighting using "DEFAULTLIGHTING" command. **2.** Execute command "POINTLIGHT" that radiates light in all directions from its location. **3.** Execute command "SPOTLIGHT" that emits a directional cone of light. **4.** Modify Lights in a drawing using "LIGHTLIST" command. **5.** Customize Photometric (light energy" light for lighting units, Luminaries, Weblight, Halogen effect, Candela intensity, etc. **6.** Apply the available functionality of	**Total Hours:** 31 hours **Theory:** 09 hours **Practical:** 22 hours	• Workbooks • Pen • Case studies • Computer • Internet connection	**Theory:** Class room P**ractical learning:** Classroom/Computer Lab

		Lights tool palette by pressing CTRL+3. **7.** Display uniform parallel light rays in one direction only using "DISTANTLIGHT" command and mentioning from and to points. **8.** Incorporate natural light based on climate into the drawing by specifying the latitude and longitude of a location for the sunlight using "GEOGRAPHICLOCATION" command. **9.** Adjust the Sun properties using the "SUNPROPERTIES' command.			

4. Assessment guidance

Good practice in Pakistan makes use of sessional and final assessments, the basis of which is described below. Good practice by vocational training providers in Pakistan is to use a combination of these sessional and final assessments, combined to produce the final qualification result.

Sessional assessment goes on all the time. Its purpose is to provide feedback on learning:

- To the student: to identify achievement and areas for further work
- To the teacher: to evaluate the effectiveness of teaching to date, and to focus on future plans.

Assessors need to devise sessional assessments for both theoretical and practical work. Guidance is provided in the assessment strategy.

Final assessment is usually taken on completion of a course or module, which says whether or not the student has "passed". It is – or should be – undertaken with reference to all the objectives or outcomes of the course, and is usually fairly formal. Considerations of security – ensuring that the student who gets the credit is the person who did the work – assume considerable importance in final assessment.

Methods of assessment

For lessons with a high quantity of theory, written or oral tests related to learning outcomes and/ or learning content can be conducted. For workplace lessons, assessment can focus on the quality of planning the related process, the quality of executing the process, the quality of the product and/or evaluation of the process.

Methods include direct assessment, which is the most desirable form of assessment. For this method, evidence is obtained by direct observation of the student's performance.

Examples for direct assessment include:

- surprise quizzes, for example conduct small test on the fly
- Work performances, for example supervising the task given in the computer lab
- Demonstrations, for example demonstrating the use of a particular training tool in preparation for staff development
- Direct questioning, where the assessor will ask the student from the syllabus taught in the class room or lab
- Paper-based tests, such as multiple choice or short answer questions form taught material

Indirect assessment is the method used where the performance cannot be watched and evidence is gained indirectly.

Examples for indirect assessment include:

- Home Work, such as assignments are given to be completed from home
- Final project, at the end of each module; a project is given to check the progress of the trainee

Module wise assessment methods

This course contains eleven modules. Suggestions for assessment of these modules are given below.

- **Assessment of Module 1: Exhibit Duties and Exercise Rights at the workplace**

  Learner may be asked to:

  - Explain the Conflict of Interest
  - Define relation between objectives and tasks

- **Assessment of Module 2: Perform Orientation about AutoCAD 2D Fundamentals**

  Learner may be asked to:

  - What are the advantages and disadvantages of using CAD systems to create engineering drawings?
  - What is the default AutoCAD filename extension?
  - How do the *GRID* and *SNAP* options assist us in sketching?
  - List and describe the different coordinate entry methods available in AutoCAD?
  - When using the Line command, which option allows us to quickly create a line- segment connecting back to the starting point?
  - List and describe the two types of coordinate systems commonly used for planar geometry.
  - Which key do you use to quickly cancel a command?
  - When you use the Pan command, do the coordinates of objects change?

- **Assessment of Module 3: Create 3D Interface drawings**

  Learner may be asked to:

  - Explain Visual Styles.
  - Make a balanced “Grid”
  - Provide example of “Elev” command.

- **Assessment of Module 4: Draw Coordinates**

  Learner may be asked to:

  - Define UCS.
  - Restore a UCS.
  - Execute “Helix” function.

- **Assessment of Module 5: Draw 3D Orbit, Navigations and Model**

  Learner may be asked to:

  - Generate Camera.
  - Draw an animation path.
  - Explain Visual aids.

- **Assessment of Module 6: Produce 2D Solids and 3D Faces**

  Learner may be asked to:

  - Explain Face benefits.
  - Design an invisible edge of a 3D view.
  - Run “Edge” command.

- **Assessment of Module 7: Insert Surfaces**

  Learner may be asked to:

  - Explain NURB CV.
  - Develop Mesh tessellation.
  - Compose extrude surface.

- **Assessment of Module 8: Develop Solids**

  Learner may be asked to:

  - Explain procedure of Isolines.
  - Develop 3D Mirror.

- Execute “Loft” command for 3D object.

- **Assessment of Module 9: Modify Solid Faces**

  Learner may be asked to:

  - Explain grip tools.
  - Extrude Imprint.
  - Taper face.

- **Assessment of Module 10: Navigate Sections and Merge Flat Objects from 3D Model**

  Learner may be asked to:

  - Explain Soldraw function.
  - Execute “Section plane” command.
  - Apply Slice factorization.

- **Assessment of Module 11: Customise Rendering, Materials and Light**

  Learner may be asked to:

  - Explain sampling techniques.
  - Implement “Ray tracing” on shape.
  - Describe “Diagnostic” procedure.
  - Why “processing” is useful?
  - How to apply Gradient environment?
  - What is Material mapping?
  - Differentiate between “Bump Map” and “Cut out” Material.
  - Define different “Photometric lights” options.
  - Configure “Distant Light” for an object.
  - Customize “Sun properties” for Central-Asia.
  - What is the role of “Geographic Location” settings?

Principles of assessment

All assessments should be valid, reliable, fair and flexible:

Fairness means that there should be no advantages or disadvantages for any person assessed. For example, it should not happen that one student gets prior information about the type of work performance that will be assessed, while another candidate does not get any prior information.

Validity means that the assessment assesses what it claims to assess.

Flexibility means that the assessor has to be flexible concerning the assessment approach. For example, if there is a power failure during the assessment, the assessor should modify the arrangements to accommodate the student's needs.

Assessment strategy for the AutoCAD

This curriculum consists of eleven modules:

- **Module 1:** Exhibit Duties and Rights at the workplace
- **Module 2:** Perform Orientation about AutoCAD 2D Fundamentals
- **Module 3**: Create 3D Interface drawings
- **Module 4:** Draw Coordinates
- **Module 5**: Draw 3D Orbit, Navigation and Model
- **Module 6:** Produce 2D Solids and 3D Faces
- **Module 7:** Insert Surfaces
- **Module 8:** Develop Solids
- **Module 9:** Modify Solid Faces
- **Module 10:** Navigate Sections and merge Flat Objects from 3D Models
- **Module 11:** Customise Rendering, Materials and Lights

Sessional assessment

The sessional assessment for all modules shall be in two parts: theoretical assessment and practical assessment. The sessional marks shall contribute to the final qualification.

Theoretical assessment for all learning modules must consist of a written paper lasting at least half an hour per module. This can be a combination of multiple choice and short questions and answers.

For practical assessment, all procedures and methods for the modules must be assessed on a sessional basis. Guidance is provided below under Planning for assessment.

Final assessment

Final assessment shall be in two parts: theoretical assessment and practical assessment. The final assessment marks shall contribute to the final qualification.

The final theoretical assessment shall consist of one 3-hour paper. The paper should include at least two extended answer questions. The remainder shall consist of half multiple choice and half short-answer question.

For the final practical assessment, each student shall be assessed over a period of two days, with two 3-hour session on each day. This represents a total of four sessions totalling 12 hours of practical assessment for each student. During this period, each student must be assessed using either subjective paper or practical lab assignment, depending on his or her aptitude.

Planning for assessment

Sessional assessment: Assessors need to plan in advance how they will conduct sessional assessments for each module. The tables on the following pages are for assessors to use to insert how many hours of theoretical and practical assessment will be conducted and what the scheduled dates are.

Final assessment: Training providers need to decide ways to combine modules and practical assignments into a cohesive two-day final assessment programme. This should include a meeting with the assessors to discuss a standardised methodology for awarding marks.

Planning aid for sessional assessment

Module 1: Exhibit Duties and Rights at the workplace			
Learning Units	**Recommended formative assessment**	**Recommended Methodology**	**Scheduled Dates**
LU1: Practise Ethics and professional conduct			
LU2: Process business activities			
LU3: Create awareness of rights			

Module 2: Perform Orientation about AutoCAD 2D Fundamentals			
Learning Units	**Recommended formative assessment**	**Recommended Methodology**	**Scheduled Dates**
LU1: Control the display in drawings			
LU2: Create basic drawings			

LU3: Manipulate objects			

Module 3: Create 3D Interface drawings			
Learning Units	**Recommended formative assessment**	**Recommended Methodology**	**Scheduled Dates**
LU1: Develop familiarity with 3D Basics interface			
LU2: Know about Thickness and Elevation			
LU3: Visualize the Model			

Module 4: Draw Coordinates			
Learning Units	**Recommended formative assessment**	**Recommended Methodology**	**Scheduled Dates**
LU1: Acquire basic terminologies of Z Coordinates			

LU2: investigate User Coordinates System			

Module 5: Draw 3D Orbit, Navigation and Model			
Learning Units	**Recommended formative assessment**	**Recommended Methodology**	**Scheduled Dates**
LU1: Develop familiarity with 3D Orbit			
LU2: Research Three dimensional navigation			
LU3: Inspect 3D Object			
Module 6: Produce 2D Solids and 3D Faces			
Learning Units	**Recommended formative assessment**	**Recommended Methodology**	**Scheduled Dates**
LU1: Inspect 2D Solids and 3D Faces			
LU2: Study Edge			

Module 7: Insert Surfaces			
Learning Units	**Recommended formative assessment**	**Recommended Methodology**	**Scheduled Dates**
LU1: Know about Basic 3D surfaces			
LU2: Comprehend Complex surfaces			

Module 8: Develop Solids			
Learning Units	**Recommended formative assessment**	**Recommended Methodology**	**Scheduled Dates**
LU1: Create Solids			
LU2: Edit 3D			
LU3: Study Solid composites			

Module 9: Modify Solid Faces			
Learning Units	**Recommended formative assessment**	**Recommended Methodology**	**Scheduled Dates**
LU1: Modify Solid Faces			
LU2: Edit Solids			
Module 10: Navigate Sections and merge Flat Objects from 3D Models**)**			
Learning Units	**Recommended formative assessment**	**Recommended Methodology**	**Scheduled Dates**
LU1: Handle Section Objects			
LU2: Handle Flat Objects			
Module 11: Customise rendering, materials and lights			
Learning Units	**Recommended formative assessment**	**Recommended Methodology**	**Scheduled Dates**
LU1: Study Rendering			

LU2: Employ Materials			
LU3: Employ Lights			

List of Tools and equipment

Documents, policies and guidelines
(Anticipated Class size: 20 trainees/students, it may vary)

20 copies per class	Text book(s) for this course
20 copies per class	Reference book(s) for this course
20 copies per class	Syllabus for this course
1 class set	Bio-Sketch of Trainer
1 class set	Copies of job advertisements extract
1 class set	Information on sources of Knowledge Management
Contact details for colleagues, supervisor	

Tools and Equipment
(Class size: 20 trainees/students)

1 set **1 set** **1 set** **1 set**	Fire equipment including the provision of fire extinguishers Alarm systems Emergency lighting Fire safety and exit signs.

20 **1** **1** **1** **1**	Computers Scanner Printer Multimedia Projector Internet Connection
On each computer	Software • Microsoft® Office (any version)- Enterprise Edition • Microsoft® Windows 8 or above • AutoDesk AutoCAD 2013 or above version/release

List of consumables

- Notebooks
- CDs Rewriteable
- Photocopy Papers
- Ball pens
- Pencils
- Erasers
- Sharpeners
- Board Markers
- Plastic files
- Flip chart papers
- Pin-board pins
- Whiteboard
- Whiteboard Eraser

- Paper knifes
- Glue sticks
- Paper clips
- Scissors
- Punching machines

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