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COMPUTER AIDED DESIGNING (CAD)

CBT Curriculum

National Vocational Certificate Level 2

Version 1 - August 2019



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Introduction

Computer Aided Designing (CAD) 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.

This is a curriculum of CAD program which has been developed for implementation throughout Pakistan. This curriculum provides stake holders with guidance to encompass widely used 2D and mostly 3D processes for the product development. These practices produced by participants belonging to the different sub domains of Computer Aided Design.

Purpose of the training program

The purpose of these qualifications is to standardized competency standard across the globe for TVET practitioners who will serve as key elements in enhancing quality of training and assessment. Moreover, the purpose of this training program is to set and identify duties and tasks for the purpose of earning.

The specific objectives of developing these qualifications are as under:

- To set a high profile standard professions for the industry to generate standard outputs.
- To validate individual skills, 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.
- Improve the professional competence of TVET practitioners/instructional to fulfilled Job market demand.
- Capacitate the instructional staff in modern CBT&A tools, methodologies and processes as envisaged under NVQF.
- Provide flexible pathways and progressions in training and assessment field.
- Enable the TVET practitioners/instructional staff to perform their duties in efficient manner.

Overall Objective of the Training Program

The overall objective of this program is to produce employees who can provide sufficient assistance to their supervisors in creating 2D and 3D CAD drawings. Certified individuals of this program can also become entrepreneurs. However, this will require providing additional input on entrepreneurship development for the one who is willing to start his/her own business. More over the goals of these training programs are as under:

- 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, you must have attained the following competencies:

- Prepare computer system to work on CAD applications
- Prepare 2D/3D drawings in
 - AutoCAD
 - Google SketchUp
 - Revit
 - Max
- Prepare Submission Plan
- Manage Materials and Lighting to objects
- Manage image rendering

Possible available Job opportunities available immediately and later in the future

After completion of this course trainees can be employed in government / semi-government / private organizations or can be self-employ as a freelancer. Experienced resources may advance through promotions with the same employer or by moving to more advanced positions with other employers. They can become:

- CAD Operator
- CAD Designer
- CAD Technician
- Draftsman
- Assistant to Designer, Architect, Engineer (Civil, Electrical, Mechanical, Product, Interior, etc.)
- 3D Visualiser

Entry level for trainees

- 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.
- More preferably DAE level.

Minimum teaching qualification

Teaching staff should have at least two (2) years' experience related to the application of the CAD. Beside this the incumbent also holds a bachelor's degree (16 years) in relevant fields or DAE in relevant field. They should also hold or be working towards a formal teaching qualification or experience.

Recommended trainer: trainee ratio

Recommended trainer: trainee rations **1:25**, but can be vary as per the capacity of Institute.

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 are recommended.

Duration of the course

This curriculum comprises of 6 modules. The recommended delivery time is 1240 hours.

- Delivery of the course can therefore be full time (4 hours a business day), 6 days a week, for 12 months (on average 26 working days a month). Training providers are at liberty to develop other models of delivery, including part-time and evening delivery.

OR

- Delivery of the course can therefore be full time (5 hours a business day), 5 days a week, for 12 months (on average 22 working 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
061100488 Perform Basic Computer Operations	15	85	100
061100489 Develop 2D Drawings	15	285	300
061100490 Develop 3D Model using AutoCAD	15	185	200
061100491 Develop 3D Model using SKETCHUP	10	170	180
061100492 Develop 3D Model using REVIT	10	150	160
061100493 Develop 3D Model using 3D Studio MAX	20	280	300

Structure of the Programmes

The following is the details of the competency standards in the qualifications:

S.No.	Qualification	Competency Standards
1.	0611ICT08 National Vocational Certificate Level-2 in (Information Technology) "CAD-AutoCAD"	061100488 Perform Basic Computer Operations 061100489 Develop 2D Drawings 061100490 Develop 3D Model using AutoCAD
2.	0611ICT09 National Vocational Certificate Level-3 in (Information Technology) "CAD-REVIT & SKETCHUP"	061100491 Develop 3D Model using SKETCHUP 061100492 Develop 3D Model using REVIT
3.	0611ICT08 National Vocational Certificate Level-4 in (Information Technology) "CAD-3D Studio MAX"	061100493 Develop 3D Model using 3D Studio MAX

Overview of the Curriculum

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
<p>061100488 Module-1 Perform Basic Computer Operations</p> <p>Aim : To 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.</p>	<p>LU1: Configure Computer System LU2: Create a Document using MS Word LU3: Preparer a Worksheet using MS Excel LU4: Prepare a presentation using MS PowerPoint</p>	15	85	100
<p>061100489 Module-2 Develop 2D Drawings</p> <p>Aim : To provide skills and knowledge to create 2-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.</p>	<p>LU1: Develop 2D Objects LU2: Prepare Final Set of 2D Drawings</p>	15	285	300

<p>061100490 Module-3</p> <p>Develop 3D Model using AutoCAD</p> <p>Aim : 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.</p>	<p>LU1: Develop 3D Objects LU2: Manipulate 3D objects using 3D Editing Tools LU3: Render 3D Model</p>	15	185	200
<p>061100491 Module-4</p> <p>Develop 3D Model using SKETCHUP</p> <p>Aim : This Module is designed to provide drawing and designing tools using SketchUp. You can use this software to work under real-world time constraints. From broadcasters to designers, architects and engineers, virtually every industry uses SketchUp to create prototype models and animate 3D objects and environments.</p>	<p>LU1: Develop 3D Objects LU2: Modify 3D objects LU3: Apply material and textures on 3D objects LU4: Render 3D model</p>	10	170	180
<p>061100492 Module-5</p> <p>Develop 3D Model using REVIT</p> <p>Aim :</p>	<p>LU1: Setup Interface LU2: Create building layout LU3: Create construction document</p>	10	150	160

<p>This module is develop 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.</p>	<p>LU4: Render model</p>			
<p>061100493 Module-6 Develop 3D Model using 3D Studio MAX</p> <p>Aim : To provide a comprehensive 3ds Max modelling 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.</p>	<p>LU1: Create Objects using geometry and shapes LU2: Modify objects LU3: Apply material and textures to objects LU4: Render 3D model</p>	<p>20</p>	<p>280</p>	<p>300</p>

Teaching and Learning Guide for CAD

The learning modules are as under:

061100488 Module 1: Perform Basic Computer Operations

Objective of the Module: The objective of this module is to 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.

Duration: 100hrs.

Theory: 15hrs.

Practice: 85 hrs.

Learning Unit	Learning Outcomes	Learning Elements	Duration	Material/Tools Required	Learning Place
LU1: Configure Computer System	<p>You will be able to</p> <ul style="list-style-type: none"> • Connect Computer components and peripherals as per requirements. • Install System software and application software according to the Instructional Manual. • Troubleshoot Applications to trace and fix faults (if any) to bring it in a running condition. • Follow health, safety and 	<ul style="list-style-type: none"> • Identify basic components and peripheral devices of computer system. • Demonstrate knowledge and understanding of the following Software <ul style="list-style-type: none"> ▪ Windows ▪ Linux/Unix ▪ Office Suite <ul style="list-style-type: none"> ○ MS Office ○ Google Docs, Sheets and Slides • Install/uninstall computer Software • Demonstrate troubleshooting of Hardware and software • Follow health and safety procedures 	20 hrs	<ul style="list-style-type: none"> • Computer system • CD ROM • CD's • Internet Facilities • Marker • White Board • Duster • Multimedia Projector • UPS • Data traveler /USB • Printer 	<p>Theory: Class/Computer Lab</p> <p>Practical: Computer Lab</p>

	<p>security procedures to ensure safe working environment.</p>	<p>Practice-1 Install Windows Operating Systems</p> <p>Practice-2 Connect and Configure printer for printing. Scan documents by using Scanner.</p> <p>Practice-3 Install Anti-Virus software and scan computer for malicious software to fix viruses.</p>		<ul style="list-style-type: none"> • Scanner • Software Sources 	
<p>LU2: Create a Document using MS Word</p>	<p>You will be able to</p> <ul style="list-style-type: none"> • Compose a document as per the requirements. • Assign name and location to save a file in word file format. • Format Word Document according to given requirements. • Generate hard copy according to job requirements. 	<p>Compose a document Compose document in Word Processing and save document in</p> <ul style="list-style-type: none"> • One drive location • Computer location <p>Format and modify document by using</p> <ul style="list-style-type: none"> • Editing tools (Cut/copy/paste, Undo/redo, Delete/insert, etc.) • Page orientation • Alignments • Headers/Footers • Page numbering 	<p>20 hrs</p>	<ul style="list-style-type: none"> • Workbooks • Pen • Case studies • Internet connection • Computers Systems • Marker • White Board • Duster • Multimedia Projector 	<p>Theory: Class/Computer Lab</p> <p>Practical: Computer Lab</p>

		<ul style="list-style-type: none"> • Page / Paragraph borders • Page size • Background color • Themes/Style • Page margin • Table of contents • References • Review option <p>Print document</p> <p>Apply different settings of print command to print documents.</p>		<ul style="list-style-type: none"> • UPS • Papers/Sheets • Ruler • Printer 	
		<p>Practice-1</p> <p>Create Business Cards using Shapes, text, colors and take a print.</p> <p>Practice-2</p> <p>Create Resume with the following requirement</p> <ul style="list-style-type: none"> • Name of Candidate must be in center with “Capitalize each word” case. • First heading size = 16 pt. • 2nd Heading size= 14 pt. • Insert Picture to left top corner • Font family = Calibri. 			

		<ul style="list-style-type: none"> • Apply water mark • Take a print of the Resume. <p>Practice-3 Practice hyperlink and create links between word document texts.</p> <p>Practice-4 Take a double column newspaper and create similar paragraph style in the word document.</p> <p>Practice-5 Download the Educational template in Microsoft Word from Internet and edit those templates with your content.</p>			
LU3: Prepare a Worksheet using MS Excel	<ul style="list-style-type: none"> • Develop a worksheet as per given data. • Format the worksheet according to given job requirement. • Apply Formulas according to given criteria. • Generate Charts/Graphs according to the given data. 	<p>Develop worksheet</p> <ul style="list-style-type: none"> • Demonstrate the main elements of the Excel spreadsheet work (Tools bars, Formula bar, Functions, etc) <p>Format cells to prepare worksheet (Merge/Unmerge cells, Bullets & Number, Table, etc.)</p> <p>Apply formulas to create the functional worksheet</p>	30 hrs.	<ul style="list-style-type: none"> • Workbooks • Pen • Case studies • Internet connection • Computer Systems • Marker • White Board 	<p>Theory: Class/Computer Lab</p> <p>Practical: Computer Lab</p>

		<ul style="list-style-type: none"> • Explain and demonstrate basics of creating a formula / function in spreadsheet • Apply formula to create different sheets as required. <p>Demonstrate charts/graphs and its use in the Excel sheets with examples</p> <ul style="list-style-type: none"> • Create different kinds of charts according to the requirement (Line charts, pie chart, bar chart, column chart, scatter chart, etc.) 		<ul style="list-style-type: none"> • Duster • Multimedia Projector • UPS • Papers/sheets • Printer 	
		<p>Practice-1</p> <p>Create marks sheet in excel worksheet with the following criteria</p> <ul style="list-style-type: none"> • Minimum 5 subjects to enter • Each subject carry 100 marks • Find <ul style="list-style-type: none"> ○ Obtain marks ○ Percentage ○ Average ○ Auto Grade calculation with the following conditions <ul style="list-style-type: none"> ▪ If marks $\geq 90\%$ then grade = "A+" 			

		<ul style="list-style-type: none"> ▪ If marks \geq 80% then grade= "A" ▪ If marks \geq 70% then grade= "B+" ▪ If marks \geq 60% then grade= "B" ▪ If marks \geq 50% then grade= "C" ▪ If marks $<$ 50% then grade= "F" <ul style="list-style-type: none"> ○ Auto Status calculation with the following conditions <ul style="list-style-type: none"> ▪ Status "Fail" if grade="F" ▪ Also "Fail" if subject marks below then 40% ▪ Else "Pass" <p>Practice-2</p> <p>Develop a column chart for above Marks sheet and Print the selected data on A4 size paper with Landscape orientation.</p>			
LU 4: Prepare a presentation using MS PowerPoint	<ul style="list-style-type: none"> • Insert Slides with different Layouts according to requirements of presentation. • Insert text, tables, images, 	<ul style="list-style-type: none"> • Demonstrate the interface and different layouts of Power Point • Define Master Slide as per options available in the software of Power Point. 	30 hrs.	<ul style="list-style-type: none"> • Workbooks • Pen • Case studies • Internet connection 	Theory: Class/Computer Lab

	<p>etc. according to the requirements.</p> <ul style="list-style-type: none"> • Apply a set of effects to animate the slide according to requirements. • Apply Slide Transitions on Slides according to requirement. • Apply Sound Effects on Objects/text/images according to job requirements. 	<ul style="list-style-type: none"> • Demonstrate how to <ul style="list-style-type: none"> ○ Input text in slide ○ Create new slide ○ Create table within the slide ○ Apply different effects to data. ○ Apply different transition and animation. ○ Apply different design as a whole and also to a single slide. ○ Insert picture, shapes and action button in slides ○ Insert textbox, header/footer, date and numbering to slide. 		<ul style="list-style-type: none"> • Computer Systems • Marker • White Board • Duster • Multimedia Projector • UPS • Paper/sheets • Printer 	<p>Practical: Computer Lab</p>
		<p>Practice-1</p> <p>Create 10 slides presentation about your Institute with the following instructions</p> <ol style="list-style-type: none"> 1. Create a slide design template 2. Apply any option from following Animations <ol style="list-style-type: none"> a. Entrance effects: b. Emphasis effects: 3. Apply Sound Effects to each slide 4. Set transaction timing up to 3 seconds 5. Set animation timing up to 5 seconds 6. Set animation on auto. 			

		<p>7. Each slide have different design</p> <p>8. Apply motion path on object in at least one slide.</p>			
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061100489 Module 2: Develop 2D Drawings using AutoCAD

Objective of the Module: Objective of this module is to provide skills and knowledge to create 2-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.

Duration: 300 hrs.

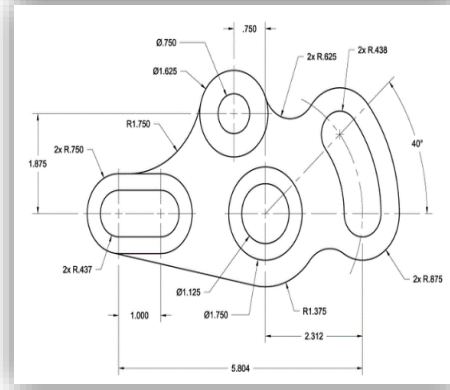
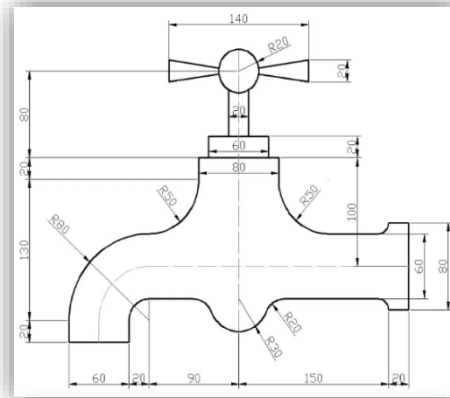
Theory: 15 hrs.

Practice: 285 hrs.

Learning Unit	Learning Outcomes	Learning Elements	Duration	Material/Tools Required	Learning Place
LU1: Develop 2D Objects	<p>You will be able to</p> <ul style="list-style-type: none"> • Setup drawing interface for required specifications. • Setup user interface settings for required specifications. • Create 2D objects with given measurements. • Save AutoCAD drawing files in different file 	<ul style="list-style-type: none"> • Basic Drawing Concepts according to the trade. • Save drawing and Activate all Tabs required for 2D to work with 2D drawing. <ul style="list-style-type: none"> ◦ Customize User Interface Editor ◦ How to reset AutoCAD to defaults • Prepare 2D interface including work space setting (Units and Limits setting, UCS and WCS, etc.) • Execute 2D Commands in AutoCAD to develop 2D drawing in AutoCAD by using the commands and tools (Coordinate, 	150 hrs.	<ul style="list-style-type: none"> • Workbooks • Pen • Case studies • Internet connection • Computer Systems • Marker • White Board • Duster • Multimedia 	<p>Theory: Class/Computer Lab</p> <p>Practical: Computer Lab</p>

	<p>formats (e.g. dwg, PDF, JPG).</p> <ul style="list-style-type: none"> • Edit 2D Objects to meet set standards. 	<p>Absolute, Relative, Polar, etc.).</p> <ul style="list-style-type: none"> • Execute Basic Drawing commands (Line, Circle, Rectangle, etc.) • Execute Modifying commands (Offset, Trim, Extend, Dimensioning, Mode Setting Buttons, etc) • Save the drawing in different format (dwg, PDF, etc.) 		<p>Projector</p> <ul style="list-style-type: none"> • UPS • Papers/Sheets • Printer 	
		<p>Practice-1</p> <p>Create 2D 'House Plan' in AutoCAD having dimensions of (25' x 40') with the following requirements.</p> <ul style="list-style-type: none"> ○ One Master Bedroom (12' x 12') attached bath (8' X 5') ○ One Bedroom (10'-9" X 12'-0") with attached bath (6' X 5') ○ One kitchen (12' X 10') ○ TV Lounge (As per space) ○ Car Porch (10' X 15') ○ Proper Ventilation ○ Space Utilization <p>Practice-2</p>			

Prepare the following object with its defined dimension.



<p>LU2: Prepare Final Set of 2D Drawings</p>	<p>You will be able to</p> <ul style="list-style-type: none"> • Use appropriate command and tools to develop 2D drawing • Develop 2D Drawing with given project specification and measurements. • Create title block layout as required. • Plot drawing on scale according to required size and orientation. 	<p>Develop and demonstrate final drawing by using submission plan techniques as under</p> <ul style="list-style-type: none"> • Site Plan • Propose Plan • Detail drawing • Foundation detail • Block Layouts of the plan • Cross sections • Elevations • Schedule of Opening • Schedule of Area • Detail of RCC (if any) • Use of Tool Palettes <p>Demonstrate Plot command to print Plan with different scale to size and orientations.</p>	<p>150 hrs</p>	<ul style="list-style-type: none"> • Workbooks • Pen • Case studies • Internet connection • Computers Systems • Marker • White Board • Duster • Multimedia Projector • UPS • Paper/Sheets • Printer 	<p>Theory: Class/Computer Lab</p> <p>Practical: Computer Lab</p>
<p>Practice-1 Develop a set of submission drawings in AutoCAD.</p> <p>Practice-2 Print the completed submission plan with the following requirements</p> <ul style="list-style-type: none"> • Plotter : XPS Document Writer 					

		<ul style="list-style-type: none">• Paper Size: A3• What to Plot : Extents• Plot scale : Fit to Paper• Plot offset : Center• Drawing Orientation : Landscape			
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061100490 Module 3: Develop 3D Model using AutoCAD

Objective of the Module: The Objective of this module is 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.

Duration: 200 hrs.

Theory: 15 hrs.

Practice: 185 hrs.

Learning Unit	Learning Outcomes	Learning Elements	Duration	Material/Tools Required	Learning Place
LU1: Develop 3D Objects	<p>You will be able to</p> <ul style="list-style-type: none"> Setup & save 3D drawing interface for required specifications. Setup 3D user interface settings for required specifications. 3. Create 3D objects with given measurements. 	<ul style="list-style-type: none"> Prepare 3D interface including work space setting Save drawing and Activate all Tabs required for 3D to work with 3D modeling. Execute 3D Commands in AutoCAD (3D solids, surfaces, meshes, and Wireframe objects, 3D face and Edges, etc.) <p>Practice1 Create a cylindrical shape object with Radius of 6” and Height 12” by using cylinder command.</p> <p>Practice-2 Create a cylindrical shape object with</p>	50 hrs.	<ul style="list-style-type: none"> Workbooks Pen Papers/Sheets Case studies Computer Systems Internet connection 	<p>Theory: Class/Computer Lab</p> <p>Practical: Computer Lab</p>

		<p>radius of 6" and height 12" by using extrudes command.</p> <p>Practice-3 Develop a BOX with Dimensions of 3'-0 x 4'-0 x 8'-0.</p> <p>Practice-4 Develop a Pyramid with 10" radius with the Height of 12".</p>			
LU2: Manipulate 3D objects using 3D Editing Tools	<p>You will be able to</p> <ul style="list-style-type: none"> • Modify 3D objects in line with the requirements. • Make customized 3D models according to the requirement of given job. • 3. Convert 3D Face objects into a single mesh objects. 	<ul style="list-style-type: none"> • Execute Boolean operation to modify 3D objects (Subtraction, Intersection, Union, etc.) • Manipulate 3D object by using the following command (Extrude, Rotate/Rotate3D, Revolve/Revolve-surface, Shell, Sweep, Loft, etc.) • Demonstrate Different Views to view the objects (Preset views, Viewports, Visual Styles, Perspective projection and parallel projection, Orbits, etc.) 	100 hrs	<ul style="list-style-type: none"> • Workbooks • Pen • Papers/Sheets • Case studies • Computer Systems • Internet connection 	<p>Theory: Class/Computer Lab</p> <p>Practical: Computer Lab</p>

		<p>Practice-1</p> <p>Develop an architectural 3D model of 35' X 65' plot dimension as per the following requirements</p> <ol style="list-style-type: none"> 1) Two Rooms with attached bath 2) Lounge 3) Drawing 4) Kitchen 5) Powder Bath 6) Store 7) Servant Bath 8) Porch <p>Practice-2</p> <p>Make 3D Fan with 3 blades with dimension 12 Inches in diameter.</p> <p><i>(Note: Adjust the blade as per diameter of the Fan)</i></p>			
LU3: Render 3D Model	<p>You will be able to</p> <ul style="list-style-type: none"> • Apply material to required 3D Model as per given specification • Apply lights to get the requisite scene of required 3D model 	<ul style="list-style-type: none"> • Material and light control (Planner mapping, Texture map, Opacity control, Render context, Render sampling, etc.) • 3D Navigate control (camera settings, scene creation, Walk, Constrained 	50 hrs	<ul style="list-style-type: none"> • Workbooks • Pen • Papers/Sheets • Case studies • Computer Systems 	<p>Theory: Class/Computer Lab</p> <p>Practical:</p>

	<ul style="list-style-type: none"> Assign cameras to execute different views of required 3D Model. 4. Render and print the 3D model according to required size & orientation 	<p>Orbit, etc.)</p> <p>Practice-1 Create and Apply wood material with the following material settings to previously created object in AutoCAD</p> <ol style="list-style-type: none"> Opacity 70% Adjust Bitmap setting <ol style="list-style-type: none"> Fit to object Un check tiles Visual style : realistic <p>Practice-2 Apply spot and point light to previously created drawing and then render the drawing to show applied materials and lights.</p>		<ul style="list-style-type: none"> Internet connection 	Computer Lab
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061100491 Module 4: Develop 3D Model using SketchUp

Objective of the Module: This Module is designed to provide drawing and designing tools using SketchUp. You can use this software to work under real-world time constraints. From broadcasters to designers, architects and engineers, virtually every industry uses SketchUp to create prototype models and animate 3D objects and environments.

Duration: 180 hrs.

Theory: 10 hrs.

Practice: 170 hrs.

Learning Unit	Learning Outcomes	Learning Elements	Duration	Material/Tools Required	Learning Place
LU1: Develop 3D Objects	<p>You will be able to</p> <ul style="list-style-type: none"> Set up template for required specifications. Import/create 2D Drawing/image as per assigned specification. Create 3D object from 2D drawing/image in line with given measurements. 	<ul style="list-style-type: none"> Demonstrate how to select Google SketchUp Template. Save and Reopen the Models. Explore the Google SketchUp Interface. Illustrate Google SketchUp with the following common commands (Arc, Circle, Eraser, Follow Me, Line, Look, Around, Move, Offset, Orbit, etc.) Take a Backup of a SketchUp file Restore an Auto-save file Demonstrate SketchUp Quick Reference Card Demonstrate how to Import 2D objects in Google SketchUp. Capture image from a Google Map Converting 2D model to 3D model 	60 hrs.	<ul style="list-style-type: none"> Workbooks Pen Case studies Internet connection Computer Systems Marker White Board Duster Multimedia Projector UPS Papers/Sheets Printer 	<p>Theory: Class/Computer Lab</p> <p>Practical: Computer Lab</p>

		<p>Practice-1</p> <ol style="list-style-type: none"> 1. Create a Cone shape object with height of 5'-0 and Radius 2'-0. 2. Develop a Chair Model with 2'-0 Length, 2'-0 Width and 4'-0 Height by using SketchUp common commands. Group all the components together. 3. Create a cylindrical shape object with radius of 12 Inches and height 18 Inches. <p>Practice-2</p> <p>Import 2D AutoCAD drawing and convert it, into 3D model in Google SketchUp.</p> <p>Practice-3</p> <p>Capture Image of your Building Location from Google map and create a Footprint of that image.</p>			

LU2: Modify 3D Objects	<p>You will be able to</p> <ul style="list-style-type: none"> • Navigate 3D objects as per required job. • Modify 3D objects in line with the requirements. 	<ul style="list-style-type: none"> • Illustrate how to view the model from all sides by using (Orbit, Zoom, Pan, etc.) • Manipulate and Modify 3D objects by using the following commands and Tools (Outer Shell, Union, Subtract, Trim, Intersect, Split, Adding Text, Labels, Dimensions to a Model, Adjust Drawing Axes, Customize Model, Premade Components and Dynamic Components, layers, Grouping Geometry, etc) 	35 hrs	<ul style="list-style-type: none"> • Workbooks • Pen • Case studies • Internet connection • Computer Systems • Marker • White Board • Duster • Multimedia Projector • UPS • Papers/Sheets • Printer 	<p>Theory: Class/Computer Lab</p> <p>Practical: Computer Lab</p>
<p>Practice-1 Develop an architectural 3D model in Google SketchUp of 35' X 65' plot dimension as per the following requirements</p> <ol style="list-style-type: none"> 1) Two Rooms with attached bath 2) Lounge 3) Drawing 4) Kitchen 5) Powder Bath 6) Store 7) Servant Bath 8) Porch <p>Practice-3 Make 3D Fan having 3 blades with</p>					

		dimension of 12" in diameter by using Google SketchUp.			
LU3: Apply material and textures on 3D objects	<p>You will be able to</p> <ul style="list-style-type: none"> • Create/assign specified materials and textures to 3D Model. • Modify materials and textures according to the object size. • Use appropriate tools and commands for applications of materials and textures on 3D objects. • Edit materials and textures to get realistic outcome. 	<ul style="list-style-type: none"> • Develop a 3D model more realistic by applying the following (Colors, Photos, Materials, and Textures, Replace one material with another, Edit material, Calculate material, Organizing materials, Create own materials, etc.) • Use 3D Navigate controls (Functions of different camera setting, Parallel Projection, Perspective, PAN side to side, PAN up and down, Zoom, View, etc) <p>Practice-1 Create and Apply material to objects (previously created in LU-2→ Practice-2 and Practice-3) by using Google SketchUp.</p> <p>Practice-2 Show the objects (Last created in LU-2→ Practice-2) in different perspective view.</p>	50 hrs	<ul style="list-style-type: none"> • Workbooks • Pen • Case studies • Internet connection • Computer Systems • Marker • White Board • Duster • Multimedia Projector • UPS • Papers/Sheets • Printer 	<p>Theory: Class/Computer Lab</p> <p>Practical: Computer Lab</p>
LU-4: Render 3D Model	<ul style="list-style-type: none"> • Install plug-ins to meet specific outcome as per requirement. 	<ul style="list-style-type: none"> • Install different Plug-Ins (Extensions) from "Extension Warehouse" for all category as follow <ul style="list-style-type: none"> ○ Categories (Productivity, Rendering, 	35 hrs	<ul style="list-style-type: none"> • Workbooks • Pen • Case studies 	<p>Theory: Class/Computer Lab</p>

	<ul style="list-style-type: none"> • Add scene of 3D model according to specification • Add lights for illumination to get the requisite scene of 3D model. • Assign cameras to execute different views of 3D Model. • Add shadows and realistic effects to get different rendered views. • Add Render Components to make scene more realistic. • Render the 3D model according to required image size or resolution & orientation. 	<p>Drawing, Architecture, Construction, Interior, etc.)</p> <ul style="list-style-type: none"> ○ Plug-Ins (Ruby, LightUp for SketchUp, VRay DIBAC for SketchUp, etc.) • Create a basic section animation to add Section and Scene to a Model • Apply render effects by using the Plug-ins • Viewing a Model by using Camera and its tools • Google SketchUp can display accurate shadows by using the options (Geo-location snapshot, Model Info dialog box, etc.) 		<ul style="list-style-type: none"> • Internet connection • Computer Systems • Marker • White Board • Duster • Multimedia Projector • UPS • Papers/Sheets • Printer 	<p>Practical: Computer Lab</p>
		<p>Practice-1</p> <p>Apply the following effects to Model (Previously Created LU-2→ Practice-2) to show the Model more realistic.</p> <ul style="list-style-type: none"> • Shadow effects • Light effect • Add Section • Add scene • Render the Model 			

061100492 Module 5: Develop 3D Model using REVIT

Objective of the Module: This module is developed to provide skills and knowledge to use Autodesk Revit for building information models 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.

Duration: 160 hrs.

Theory: 10 hrs.

Practice: 150 hrs.

Learning Unit	Learning Outcomes	Learning Elements	Duration	Material/Tools Required	Learning Place
LU1: Setup Interface	<p>You will be able to</p> <ul style="list-style-type: none"> • Create custom user interface as per requirement of specific technology. • Create and apply Families for given specifications and requirements. • Use common tools and commands to develop a model. 	<ul style="list-style-type: none"> • Use the Revit Interface along with the Integrated Development Environment (Launching the screen, Ribbon Menu, Palette Property, Drawing Area, 2D/3D navigators, etc.) • Demonstrate Revit using the common concepts of (Parameters, Levels, Projects, Templates, Families) • Develop a model using (Walls, Wall openings, Doors and Windows, Curtain Walls, Floors and it's types, Shaft Openings, Ceilings, Fixtures, Roofs and it's types, Stairs and it's types, Railings, Ramps, etc.) 	50 hrs.	<ul style="list-style-type: none"> • Workbooks • Pen • Case studies • Internet connection • Computer Systems • Marker • White Board • Duster • Multimedia Projector • UPS 	<p>Theory: Class/Computer Lab</p> <p>Practical: Computer Lab</p>

		<p>Practice-1</p> <p>Generate a simple unit plan for (15'-0 x 25'-0) plot area with the following requirements</p> <ol style="list-style-type: none"> 1. Single hall 2. Attached bath 3. Window (6 ft. width and 4 ft. Height) 4. Ventilator (2'-0 x 2'-0) 5. Double Leaf Door (5 ft. width and 8 ft. height) <p>Primary Revit tools that you will be using:</p> <ol style="list-style-type: none"> 1. Wall Tool 2. Door Tool 3. Window Tool 4. Wall opening tools <p>Practice-2</p> <p>Develop 3 Levels of detail drawing for the above drawing developed in practice-1.</p>		<ul style="list-style-type: none"> • Papers/Sheets • Printer 	
LU2: Create Building Layout	<p>You will be able to</p> <ul style="list-style-type: none"> • Create/import drawings to make layout according to the given requirements. • Use appropriate commands 	<ul style="list-style-type: none"> • Import 2D AutoCAD drawing in Revit. • Build layout in Revit by using different tools • Create 3D models using modifying tools (Select and Filter Elements, Move/Copy 	50 hrs	<ul style="list-style-type: none"> • Workbooks • Pen • Case studies • Internet connection 	Theory: Class/Computer Lab

	<p>and tools to create building layouts.</p> <ul style="list-style-type: none"> • Modify drawings and objects to meet given criteria. • Create 3D prototype model of the drawing according to given measurements. 	<p>Elements, Rotate and Mirror elements, Arrays, Split elements, Trim and Extend elements, Offset, Apply different Views, Elevations, Sections, Callouts, etc.)</p>		<ul style="list-style-type: none"> • Computer Systems • Marker • White Board • Duster • Multimedia Projector • UPS • Papers/Sheets • Printer 	<p>Practical: Computer Lab</p>
		<p>Practice-1 Import 2D AutoCAD drawing and convert it, into 3D model by using Revit Architecture.</p> <p>Practice-2 Develop an architectural 3D model in Revit Architecture of 35' X 65' plot dimension as per the following requirements</p> <ol style="list-style-type: none"> 1) Two Rooms with attached bath 2) Lounge 3) Drawing 4) Kitchen 5) Powder Room 6) Store 7) Servant Bath 8) Porch 			

<p>LU3: Create Construction Document</p>	<p>You will be able to</p> <ul style="list-style-type: none"> • Create specification/detail for various parts according to given requirements. • Apply specified detail to objects according to given requirements. • Annotate the drawings using set parameters as per given details. 	<ul style="list-style-type: none"> • Create Construction Documents and specifications using (Setup Sheets, Place and Modify, Views on Sheets, Setup Detail Views, Printing Sheets) • Annotate Construction Documents using (Dimensions, Text, Detail Lines and Symbols, Creating Legends, etc.) <hr/> <p>Practice-1 Create construction documents for 3D Model by using Revit.</p>	<p>20 hrs</p>	<ul style="list-style-type: none"> • Workbooks • Pen • Case studies • Internet connection • Computer Systems • Marker • White Board • Duster • Multimedia Projector • UPS • Papers/Sheets • Printer 	<p>Theory: Class/Computer Lab</p> <p>Practical: Computer Lab</p>
<p>LU-4: Render Model</p>	<ul style="list-style-type: none"> • Add scene of 3D model according to specification • Add lights for illumination to get the requisite scene of 3D model. • Assign cameras to execute different views of 3D Model. • Render the 3D model according to required image 	<ul style="list-style-type: none"> • Install different Plug-Ins (Extensions) from “AUTODESK App Store” for different categories as follow. <ul style="list-style-type: none"> ○ Annotations Tools ○ Architectural Design ○ Building Performance, etc. • Add Camera to adjust different views. • Use Camera to add different Scenes • Add different lights to illuminate the model. 	<p>30 hrs</p>	<ul style="list-style-type: none"> • Workbooks • Pen • Case studies • Internet connection • Computer Systems • Marker • White Board 	<p>Theory: Class/Computer Lab</p> <p>Practical: Computer Lab</p>

	<p>size or resolution & orientation.</p>	<ul style="list-style-type: none"> • Apply different render techniques 		<ul style="list-style-type: none"> • Duster • Multimedia Projector • UPS • Papers/Sheets • Printer 	
		<p>Practice-1</p> <p>Apply the following effects to Model to show:</p> <ul style="list-style-type: none"> • Light effects • Shadow effects • Add Section • Add camera • Rendering 			

061100493 Module 6: Develop 3D Model using 3D Studio MAX

Objective of the Module: This module 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.

Duration: 300 hrs.

Theory: 20 hrs.

Practice: 280 hrs.

Learning Unit	Learning Outcomes	Learning Elements	Duration	Material/Tools Required	Learning Place
LU1: Create Objects using geometry and shapes	<p>You will be able to</p> <ul style="list-style-type: none"> • Create/import/link/fetch/merge 2D drawing to make 3D objects according to given specification • Use Geometry & shapes to make 3D objects according to given specification. 	<ul style="list-style-type: none"> • Demonstrate 3ds Max Interface by using the Integrated Development Environment. (Quick Access toolbar, Main toolbar, The Ribbon, Scene Explorer, Command Panel, View Ports, Viewport Navigation, Primitives, Transforms, etc.) • Develop a Box model using different modeling techniques (NURBS, Polygon, Spline, etc.) • Develop 3D objects by using the following 3ds Max basic tools (Geometry, Shapes, Helpers, Space Warps, etc.) • Demonstrate File Link Settings and then: <ul style="list-style-type: none"> ○ Merge Autodesk 3ds Max Scene Files ○ Import/Link DWG Files ○ Link FBX and RVT Files 	50 hrs.	<ul style="list-style-type: none"> • Workbooks • Pen • Case studies • Internet connection • Computer Systems • Marker • White Board • Duster • Multimedia Projector • UPS • Papers/Sheets • Printer 	<p>Theory: Class/Computer Lab</p> <p>Practical: Computer Lab</p>

- Link Sketchup Files

Practice-1


Develop a Dice of size 250mm as shown in figure-1



Figure-1

Practice-2

Develop a 3D LED illusion Lamp of size 18 inches in Height using 2 different colours

		 <p style="text-align: center;">Figure-2</p>			
LU2: Modify objects	<p>You will be able to</p> <ul style="list-style-type: none"> • Modify Parameters of 3D objects according to given specification. • Apply modifiers for object manipulation to meet the specific requirements. 	<ul style="list-style-type: none"> • Modify 3D models using different Modifiers (Edit Mesh, Delete Mesh, Extrude, Bend, Bevel, etc.) • Work with parameters of modifier to modify objects. • Explain the Modifier stack controls. <p>Practice-1 Import 2D AutoCAD drawing and convert it, into 3D model by using 3ds Max.</p> <p>Practice-2 Make a 3D Fan with 4 blades with dimension 12 Inches in diameter.</p> <p style="text-align: center;"><i>(Note: Adjust the blade as per diameter of the Fan)</i></p>	50 hrs	<ul style="list-style-type: none"> • Workbooks • Pen • Case studies • Internet connection • Computer Systems • Marker • White Board • Duster • Multimedia Projector • UPS • Papers/Sheets • Printer 	<p>Theory: Class/Computer Lab</p> <p>Practical: Computer Lab</p>

<p>LU3: Apply Material and Textures to Objects</p>	<p>You will be able to</p> <ul style="list-style-type: none"> • Create/assign specified materials and textures to 3D Model. • Edit materials and textures to get realistic outcome. 	<ul style="list-style-type: none"> • Explain the importance of material • Demonstrate the use of Material on objects in the Scene <p>(Create and apply material, Material Editor, Material/Map Browser, Material Explorer, Types of Materials, etc.)</p> <p>Practice-1 Apply material to last developed 3D LED lamp in LU-1→Practice-2 as shown in Figure-2.</p> <p>Practice-2 Apply material to the model (Previously created in LU-2→ Practice-1) by using 3ds Max.</p>	<p>20 hrs</p>	<ul style="list-style-type: none"> • Workbooks • Pen • Case studies • Internet connection • Computer Systems • Marker • White Board • Duster • Multimedia Projector • UPS • Papers/Sheets • Printer 	<p>Theory: Class/Computer Lab</p> <p>Practical: Computer Lab</p>
<p>LU-4: Render 3D Model</p>	<ul style="list-style-type: none"> • Assign/Install Renderer to meet specific outcome as per requirement. • Add scene of 3D model according to specification • Add lights for illumination to 	<ul style="list-style-type: none"> • Install different Plug-Ins (Extensions) from “AUTODESK App Store” for different categories • Add different Cameras to adjust scene. • Add Light to illuminate the models • Apply different rendering techniques 	<p>30 hrs</p>	<ul style="list-style-type: none"> • Workbooks • Pen • Case studies • Internet connection 	

	<p>get the requisite scene of 3D model.</p> <ul style="list-style-type: none"> • Assign cameras to execute different views of 3D Model. • Render the 3D model according to required image size or resolution & orientation. 	<p>Practice-1</p> <p>Apply the following effects to Model (Previously Created in LU-2→ Practice-1)</p> <ul style="list-style-type: none"> • Shadow effects • Light effects • Add Section • Render the Model 		<ul style="list-style-type: none"> • Computer Systems • Marker • White Board • Duster • Multimedia Projector • UPS • Papers/Sheets • Printer 	
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List of Tools and Equipment

Sr#	Description
1.	Computer Systems/Laptops
2.	Multimedia Projector
3.	Software (MS Office Suite, AutoCAD, 3D Studio Max, SketchUp, Revit, VRay, IRender)
4.	Scanner
5.	Printer/Plotter
6.	USB sticks
7.	Internet Connection (Wi-Fi)
8.	White Board
9.	White Board markers/eraser
10.	Printing Papers/Sheets
11.	Tracing Sheets
12.	Pens/Pencils
13.	Scissor/Cutter
14.	Notebooks
15.	Codes of conduct
16.	NVQF/Policy documentation
17.	Learning Platforms (online)

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