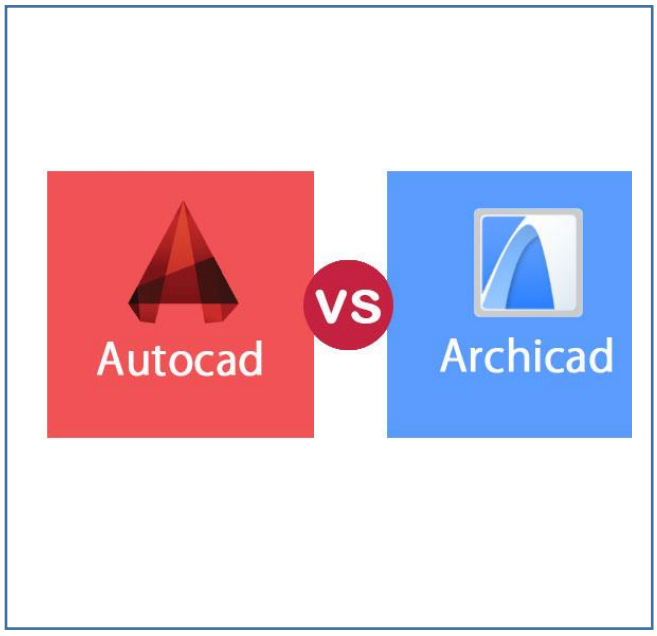
RQF LEVEL 5



TRADE: Graphic Art

MODULE CODE: GRADT501

TEACHER'S GUIDE

Module name: Digitization of Technical Drawings with CAD

Table of content

Acronyms

Introduction

This module describes the skills, knowledge and attitudes required to characterize, assess and grade CAD Illustrator. At the end of this module, learners will be able to Select CAD software based on their functionality, install them and Perform AutoCAD 2D Fundamentals. Learners will also be able to navigate AutoCAD user interface Layout based on Standards, create of basic drawings Based on Standards, produce 2D Solid and 3D Faces, and Create and modify Solid Faces, interpret complex 3D surfaces, and rendering of project.

Module Code and Title: GRADT501 DIGITIZATION OF TECHNICAL DRAWINGS WITH CAD

Learning Units:

1. Select CAD tools
2. Perform AutoCAD 2D Fundamentals
3. Produce 2D Solid and 3D Faces
4. Develop 3D Interface/Drawings

Learning Unit 1: Select CAD tools

STRUCTURE OF LEARNING UNIT

Learning outcomes:

1.1 Select CAD software
1.2 Identify hardware tools
1.3. Install CAD software

Learning outcome 1.1. Select CAD software

Duration: 5 hrs

Learning outcome 1 objectives:

By the end of the learning outcome, the trainees will be able to:

1. Introduction to CAD Software
2. Types of CAD software and their functionalities
3. Advantages and disadvantages of CAD Software
4. Applications of CAD

Resources

Equipment	Tools	Materials
Projector Computers Mouse Keyboard Drawing tablet 3D scanner 3D printer: Plotter	Paper Graphic pencil Ink pen Ruler Eraser	

 Advance preparation: . Familiarize yourself with basic CAD concepts . Learn industry-specific standards . Improve your math skills . Familiarize yourself with the software		

Indicative content 1.1: Definition and History of Computer Aided Design (CAD)

CAD (computer-aided design) software is used by architects, engineers, drafters, artists, and others to create precision drawings or technical illustrations. CAD software can be used to create two-dimensional (2-D) drawings or three-dimensional (3-D) models.
CAD is the use of computer software to design and document a product's design process. Engineering drawing entails the use of graphical symbols such as points, lines, curves, planes and shapes. Essentially, it gives detailed description about any component in a graphical form.
The beginnings of CAD can be traced to the year 1957, when Dr. Patrick J. Hanratty developed PRONTO, the first commercial numerical-control programming system. In 1960, Ivan Sutherland MIT's Lincoln Laboratory created SKETCHPAD, which demonstrated the basic principles and feasibility of computer technical.
In most engineering and archectural offices drafters and designers produce technical drawing using CAD systems . A CAD system consists of a personal computer (PC) or workstation coupled with a CAD software program, One of the most widely used CAD software program is called AutoCAD.
When AutoCAD was introduced in 1982 it was one of the first CAD programs that could operate on PC. Aotodesk the parent company that publishes AutoCAD software, reports that there are now millions of AutoCAD user worldwide. The price for a single station of AutoCAD for a professiona ser is about $4700,but at the present time ,Autodesk offer free downloads of AutoCAD 2017 and other CAD product to students ,educators , and educational institutional at its website; www.autodesk.com/education/home.
There are many other CAD programs on te market as well. Some CAD program are designed to perform wok in a specialzed area. In Mechanical design ,Inventor ,Creo, and Solidworks are three of principles CAD program, in electronics design, cadense ,and mentor are widely used.

In the civil and archetectural field ,land desktop, civil 3D and Microstation are poular CAD.

 Theoretical learning Activity

- ✓ In group of 4 trainee brainstorming about the history of computer aided design

 Points to Remember (Take home message)

CAD (Computer-Aided Design) is a digital tool that allows users to create, modify, and analyse 2D and 3D designs using specialized software on a computer.

Indicative content 1.2: Application of CAD

- CAD is widely used in the area of engineering.
- Is important in chips building, aerospace industries, automotive industries, textiles industries and architectural industries.
- It is used for manufacturing, planning, computer aided analysis.
- When it comes to material requirements, CAD inventory control and production planning, you can always use CAD.
- It also helps in purchasing, manufacturing, planning and several other activities.


Theoretical learning Activity

In group of 5 discuss about the application of CAD


Points to Remember (Take home message)

-The application of CAD (Computer-Aided Design) software can greatly enhance the design process by providing tools for precision, collaboration, experimentation, and analysis, making it an essential tool for industries such as engineering, architecture, manufacturing, and art

Indicative content 1.3: Types of CAD software

a) 2D CAD software: AutoCAD: AutoCAD is a computer-aided design (CAD) program used for 2-D and 3-D design and drafting. AutoCAD is developed and marketed by Autodesk Inc. and was one of the first CAD programs that could be executed on personal computers.

b) 3D CAD Software: ArchiCAD: ArchiCAD is architectural BIM CAD software for Windows developed by the Hungarian company

Graphisoft.ArchiCAD offers computer aided solutions for handling all common aspects of aesthetics and engineering during the whole design process of the built environment buildings, interiors, urban areas, etc.

c) Artlantis: Artlantis is a family of stand-alone rendering applications developed for architects and designers. Artlantis Render is designed for those wanting highresolution 3D renderings, while Artlantis Studio is ideal for quickly and easily creating highresolution 3D renderings. Recognized and recommended by leading software developers, Artlantis is compatible with models designed using most 3D software. Artlantis is the rendering software used by architects, designers and urban design professionals in more than 80 countries.

d) Plot maker: plot maker was a lay outing that was part of the ArchiCADpackage. This standalone application was optimized to prepare an architectural documentation set based on the views, drawings and images created in ArchiCAD. Plot maker could also accommodate data from external sources such as other CAD and image files, word processing documents and spreadsheets. Since ArchiCAD 10 the Plot maker is integrated into ArchiCAD. Thus, no ore separate layout files are needed.

Plot maker is primarily a sheet layout and numbering tool. Most of the task you will perform I Plot maker involve laying out viewports on a page, and cropping them to size. Plot maker will sequentially number you sheets and fill in most of your section & details references.

e) Solid Works: Solid Works is a solid modelling computer-aided design (CAD) and computer-aided engineering (CAE) computer program that runs on Microsoft Windows.

Solid Works is published by Dassault Systems.
Initially based in Waltham, Massachusetts, United States, Hirschtick recruited a team of engineers with the goal of building 3D CAD software that was easy-to-use, affordable, and available on the Windows desktop.


Theoretical learning Activity

In group of 4 discuss about the types of CAD software


Points to Remember (Take home message)

There are various types of CAD (Computer-Aided Design) software available, including 2D CAD for creating technical drawings, 3D CAD for creating complex 3D models, BIM for building design and construction, and CAM for computer-aided manufacturing, each with its unique features and benefits for specific industries and design needs.


Learning outcome 1 formative assessment

Written assessment

Q1. CAD stands for Computer-Aided Design. (True)

Q2. CAD software can only be used for 2D design. (False)

Q3. The first CAD software was developed in the 1950s. (True)

Q4. Which industry commonly uses CAD software for designing mechanical parts and components?

a. Fashion design

b. Automotive design

c. Fine arts

d. Advertising

Answer: b. Automotive design

Q5. Which type of CAD software is commonly used in architecture and construction for creating building designs?

a. 2D CAD

b. 3D CAD

c. BIM

d. CAM

Answer: c. BIM

Q6. Which industry commonly uses CAD software for creating electronic circuit designs?

a. Interior design

b. Graphic design

c. Electronics design

d. Industrial design

Answer: c. Electronics design

Q7. Which type of CAD software is commonly used for creating animations and visual effects in movies and video games?

a. 2D CAD

b. 3D CAD

c. CAM

d. BIM

Answer: b. 3D CAD

Q8. Which industry commonly uses CAD software for creating product designs and prototypes?

a. Textile design

b. Jewelry design

c. Packaging design

d. Industrial design

Answer: d. Industrial design

Q9. Which type of CAD software is commonly used for creating technical drawings such as blueprints and schematics?

a. 2D CAD

b. 3D CAD

c. BIM

d. CAM

Answer: a. 2D CAD

Q10. Which industry commonly uses CAD software for creating civil engineering designs such as roads, bridges, and infrastructure?

a. Aerospace engineering

b. Environmental engineering

c. Civil engineering

d. Chemical engineering

Answer: c. Civil engineering

Q11. Which type of CAD software is commonly used for creating molds and tooling designs in manufacturing?

a. 2D CAD

b. 3D CAD

c. CAM

d. BIM

Answer: b. 3D CAD

Q12. Which industry commonly uses CAD software for creating architectural interior designs such as floor plans and furniture layouts?

a. Industrial design

b. Graphic design

c. Interior design

d. Automotive design

Answer: c. Interior design

Practical assessment

Sure, here's a practical exercise for artists students at Ecole d'Arts de Nyundo in the computer lab about 3D CAD software, specifically ArchiCAD:

Title: Designing a 3D model of an art gallery using ArchiCAD

Objectives:

Learn the basics of ArchiCAD software

Understand how to create a 3D model of a space

Learn how to add and modify walls, doors, windows, and other architectural elements

Practice importing and exporting files to collaborate with other designers

Instructions:

Open ArchiCAD software on your computer.

Create a new project and set up the workspace with your preferred settings (units, measurements, etc.).

Begin by designing the layout of an art gallery space. Draw the walls, floor, and ceiling, and add dimensions to ensure accuracy.

Add doors, windows, and any other architectural elements you would like to include in the design.

Use the 3D modeling tools to view and edit the design in 3D space. Add texture, materials, and lighting to create a realistic representation of the space.

Use the walkthrough tool to explore the design in virtual reality.

Save your design as an ArchiCAD file, and export it as a 3D model file format (e.g. .obj or .fbx) for collaboration or 3D printing purposes.

Share your design with your classmates or instructor for feedback and critique.

Tips:

Use the help and tutorial resources provided in ArchiCAD to learn more about the software and its features.

Consider researching and referencing art gallery designs for inspiration and ideas.

Collaborate with your classmates to share tips and ideas, and to create a more diverse and creative final product.

Assessment:

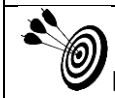
The design should be an accurate and creative representation of an art gallery space.

The design should demonstrate proficiency in using ArchiCAD software and its features.

The design should be saved and exported in the appropriate file formats for sharing and collaboration purposes.

Learning outcome 1.2. :Identify hardware tools

 **Duration: 5 hrs**

 Learning outcome 2 objectives:

By the end of the learning outcome, the trainees will be able to:

1. Computing machine
2. Data storage devices
3. User input devices
4. User output devices

 **Resources**

Equipment	Tools	Materials
Projector Computers Mouse	Paper Graphic pencil Ink pen	

Keyboard Drawing tablet 3D scanner 3D printer: Plotter	Ruler Eraser	

Advance preparation:

-Familiarize yourself with CAD software

-Understand the hardware requirements for CAD software

-Ensure your hardware meets the requirements

-Determine additional hardware tools needed

-Research best hardware tools for CAD

Indicative content 2.1: Advantages and disadvantages of CAD

Advantages	Disadvantages
- CAD Reduced storage space. - Corrections can be made easily. - Repetitive parts of the drawing can be saved and imported as part of a "CAD library." - CAD systems can be linked with CAM machines to produce objects straight from the drawings. - 3D CAD designs can be made to look realistic by using the material library for clients to see. - CAD designs can be easily shared between companies or department using email. - CAD can be used to create simulated environments to show the client.	- Work can be lost if the computer crash - Work could be corrupted by viruses. - Work could be stolen or hacked. - Time taken to learn how to use the software is too much. - Initial costs of buying a computers syst are high. - Time and cost of training staff. - Continual need for updating software c operating systems. - CAD/CAM systems mean less people need to be employed.

Theoretical learning Activity

In group of 4 discuss about the positive and negatives effects of CAD software

 Points to Remember (Take home message)

-Better visualization: CAD software enables designers to view and present their designs in 3D, making it easier to understand and communicate their ideas.

-Initial investment and training: The cost of CAD software and the required hardware can be significant, and it may take time to train designers to use the software effectively.

Indicative content 2.2: Application of AutoCAD and ArchiCAD software's

AutoCAD is a 2-D and 3-D computer-aided drafting software application used in architecture, construction, and manufacturing to assist in the preparation of blue prints and other engineering plans. Professionals who use AutoCAD are often referred to as drafters. AutoCAD is a commercial computer-aided design (CAD) and drafting software application. Developed and marketed by Autodesk, AutoCAD was first released in December 1982 as a desktop application running on micro-computers with internal graphics controllers.

AutoCAD application	ArchiCAD application
- AutoCAD is used worldwide across industries by architects, engineers, town planners and many experienced professionals. - It helps in applying different 3D modelling	- Used for Virtual Building Modelling. It has specific building tools like walls, slab, door, windows, etc. It is also used to create 2D/3D models.

techniques to create robust 3D models of products and their parts. - AutoCAD aids the user to create and design better buildings, deliver scalable and feasible infrastructure assignments, manage production cost and predict project outcomes. - In AutoCAD the users are able to control the appearance of the materials attached to the 3D models, they can view lighting and shadows in their scenes, thus helping them in attaining much realistic renders of 3D models. - Section planes one of the best features of AutoCAD, which helps to obtain crosssection view of 3D objects. These sections planes aid in examining the mirror details of 3D objects that helps them to cut through solids, surface meshes and regions. - A special feature in AutoCAD is that the user gets to link the tables. Within their 2D drawings directly to Microsoft Excel spreadsheet, with this feature they can even import formulas and data from excel into the table. Also, this feature has an auto update default setting. - The user can also import Pdf files into AutoCAD; they can import 2D geometry, true type text also. - Any non-Autodesk 3D models' geographic locations and online maps can also be imported into AutoCAD. Used for product designing, civil infrastructure, 2D drawings, drafts, documents, as well as 3D models.	- ArchiCAD is a very important program as it is the first application that includes both 2D/3D geometry and BIM program as well. - This software is used for real-time editing and communication which helps in boosting the overall BIM experience of the user. It allows aids in working more progressively and competently. - This software is a master in workspace arrangements and the only widelyused functions are displayed. - Rest all the functions are saved as favorites. ArchiCAD is a smooth application for its use in 2D zooming and panning experience, despite any - complexity. ArchiCAD enhances multiple workflows and productivity. The enhancements deliver realistic buildings, designs, accurate construction documentation, and precise cost estimations. With ArchiCAD, the user gets a façade design workflow that boosts to develop, design and detail hierarchical curtain wall systems with a lot of simplicity.


Theoretical learning Activity

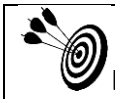
In group of 3 trainees brainstorming about the AutoCAD and ArchiCAD software's


Points to Remember (Take home message)

- In summary, Arch CAD is a type of CAD software specifically designed for architects and building professionals, while AutoCAD is a more general CAD software that can be used for various design purposes, including architecture

Learning outcome 1.3. : Install CAD software


Duration: 5 hrs



Learning outcome 3 objectives:

By the end of the learning outcome, the trainees will be able to:

1. Specifications assessment
2. Account creation and signing up
3. Installation elements

Resources

Equipment	Tools	Materials
Projector Computers Mouse Keyboard Drawing tablet 3D scanner 3D printer: Plotter	Paper Graphic pencil Ink pen Ruler Eraser	

Advance preparation:

- Pay attention to detail

-Collaborate with others

-Stay up-to-date with technology

Indicative content 2.3: Installation CAD

CAD (Computer-Aided Design) software is a valuable tool used by engineers, architects, and designers to create precise 2D and 3D designs.

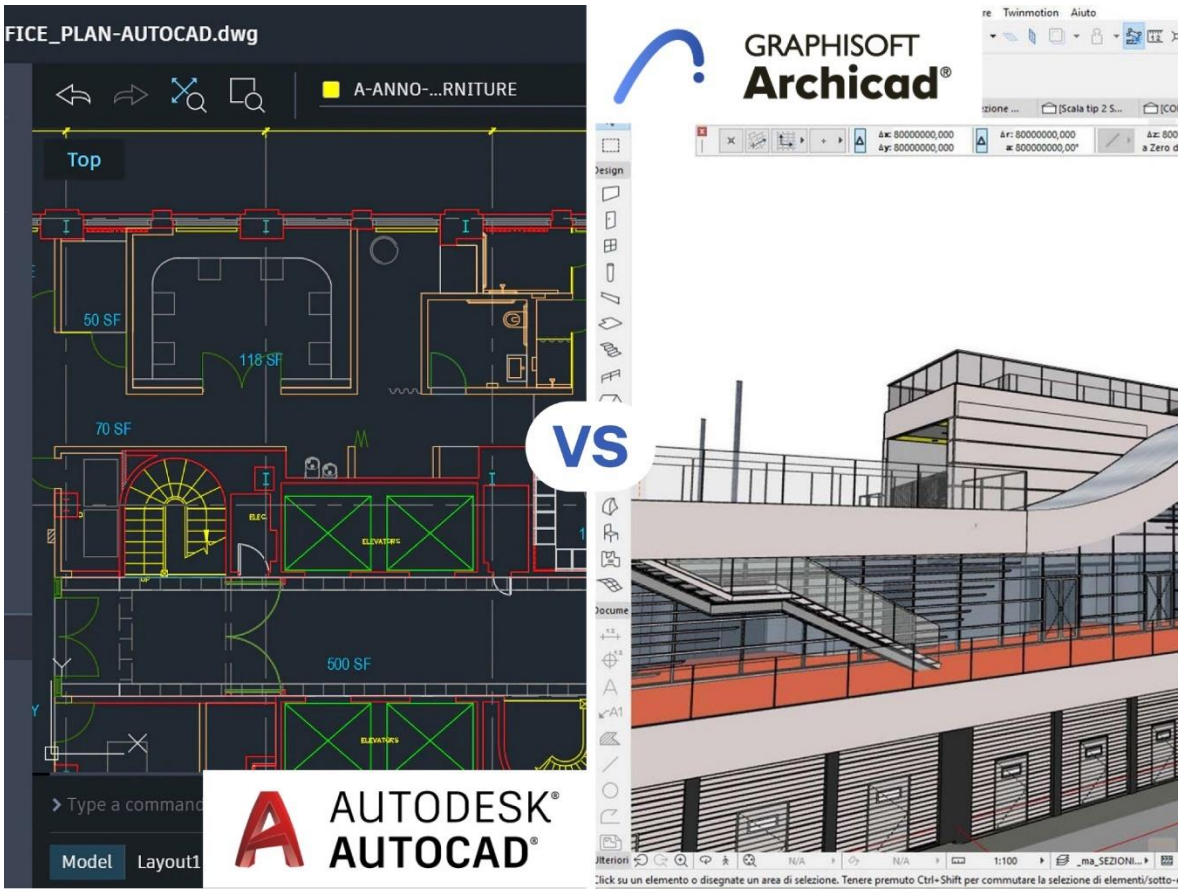
To install CAD software, you must first ensure that your computer meets the system requirements for the software you want to install. You can find this information on the manufacturer's website. Next, download the software from the manufacturer's website or installation media. Follow the installation instructions, which typically involve running an executable file and agreeing to any license agreements. Once the software is installed, you may need to enter registration or activation information. Finally, test the software to ensure it is working properly and familiarize yourself with its interface and features.

 Theoretical learning Activity

- ✓ In group of 4 trainee brainstorming about the Installation of CAD

 Points to Remember (Take home message)

-Check your computer meets the system requirements
-Download the software from the manufacturer's website or installation media
-Run the installation executable file and agree to license agreements
-Enter registration or activation information if required
-Test the software to ensure it is working properly and familiarize yourself with its -- interface and features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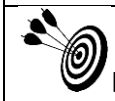
50 SF
118 SF
70 SF
500 SF
Type a command
Model
Layout1
AUTODESK®
AUTOCAD®
VS
GRAPHISOFT
Archicad®
Twinmotion
Aiuto

STRUCTURE OF LEARNING UNIT

Learning outcomes: 2.1. Navigate AutoCAD and archiCAD user interface 2.2. Create basic drawings 2.3. Description User Coordinate system

Learning outcome 2.1 : Navigate AutoCAD and archiCAD user interface

 **Duration: 5 hrs**

 Learning outcome 1 objectives:

By the end of the learning outcome, the trainees will be able to:

1. AutoCAD and ArchiCAD Control Menus

2. File management

3. AutoCAD and archiCAD visual reference commands

 **Resources**

Equipment	Tools	Materials
Projector Computers Mouse Keyboard Drawing tablet	Paper Graphic pencil Ink pen Ruler Eraser	

3D scanner 3D printer: Plotter		

Advance preparation:

-Familiarize yourself with the software's interface and tools

-Customize the interface to suit your workflow by rearranging toolbars and menus

-Learn keyboard shortcuts for frequently used commands to increase productivity.

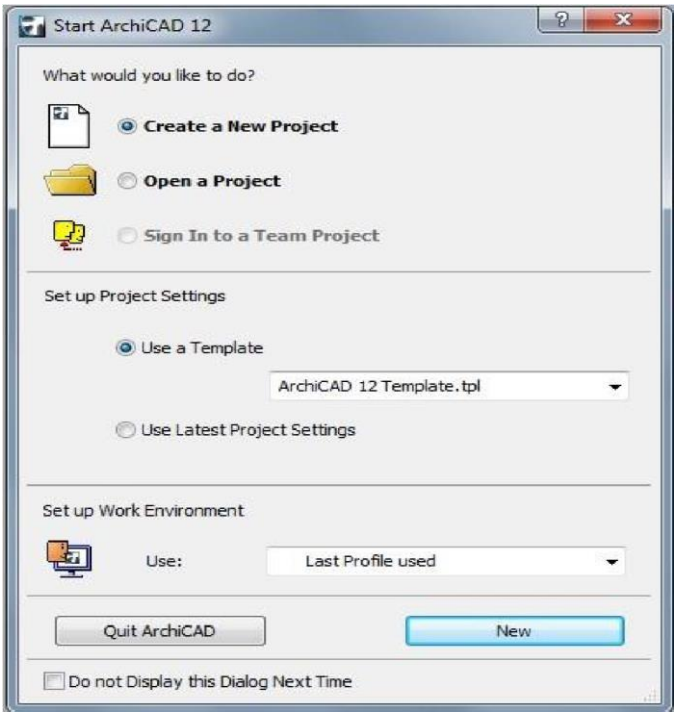
-Set up a file management system to organize your drawings and projects

-Understand the differences between 2D and 3D drawing

Indicative content 2.1: Introduction to ArchiCAD

A. Starting of ArchiCAD: When you start ArchiCAD, you are presented with several choices in how you begin your work. The Start ArchiCAD dialog offers three primary choices:

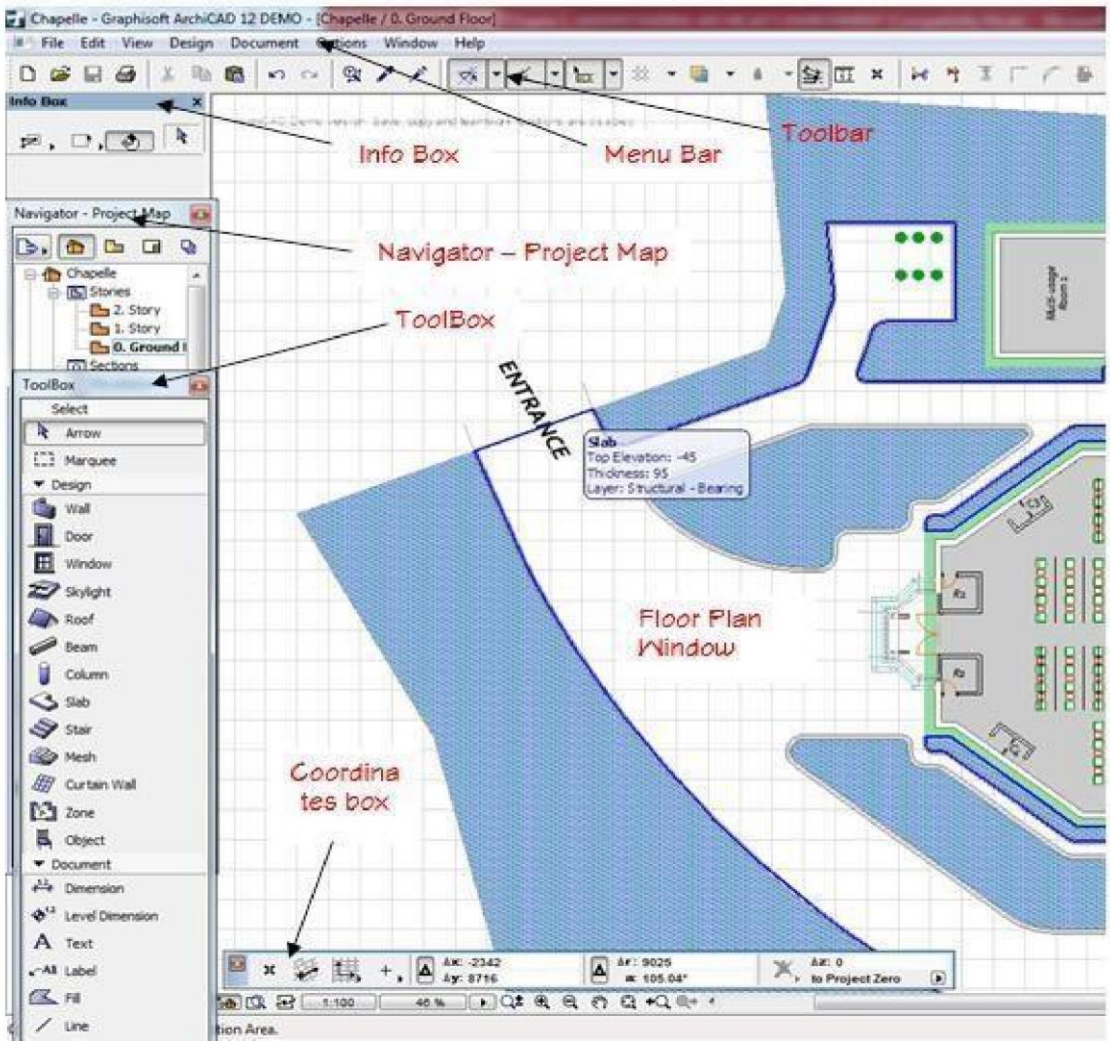
- Open ArchiCAD.
- The Start ArchiCAD dialog box will appear. Select the Create a New Project radio button at the top.
- Select the Use a Template radio button under Set up Project Settings.
- Select ArchiCAD 19 Residential Template.tpl from the drop-down list. If you have the International version of ArchiCAD, then the residential template may not be available.
- Click on New. This will open a blank project file.



B. ArchiCAD Workplace: This part introduces the visible elements of the ArchiCAD working environment, to help you find your way around the ArchiCAD workplace and understand the role of each component in ArchiCAD.

The interface provides plan, section, elevation, and detail and 3D views of the building and maintains a database of building information such as area calculations and door/window schedules.

The components of the working environment that first loads when a project is opened are: the title bar, menu bar, toolbar, the floor plan window, the control box, the toolbox, the navigator and the info box.



C. **Floor Plan Window:** The Floor Plan Window is the basic construction area where most editing operations take place. It shows a representation of the current project as a traditional architectural drawing. The center of the ArchiCAD workplace is the **Floor Plan** worksheet. This Window plays two roles at the same time:

- It displays a representation of the project as a traditional architectural drawing.
- It is a 2D/3D modelling environment that is interactive with the Sections/Elevations and 3D workspace.

The Floor Plan worksheet is like a sheet of drafting paper. However, a traditional mechanical drafting board is limited by the size of the paper you can fit on it, while the ArchiCAD worksheet can be as big as you want it to be. You can pan and zoom the Window within the full drawing space to obtain the best view of the work you are doing.

D. **Section/Elevation Window:** Section/Elevation window helps to access the building information (sections, North Elevation, South Elevation,

West Elevation and East Elevation) that has been created through the process of modelling the building (on the floor plan window)

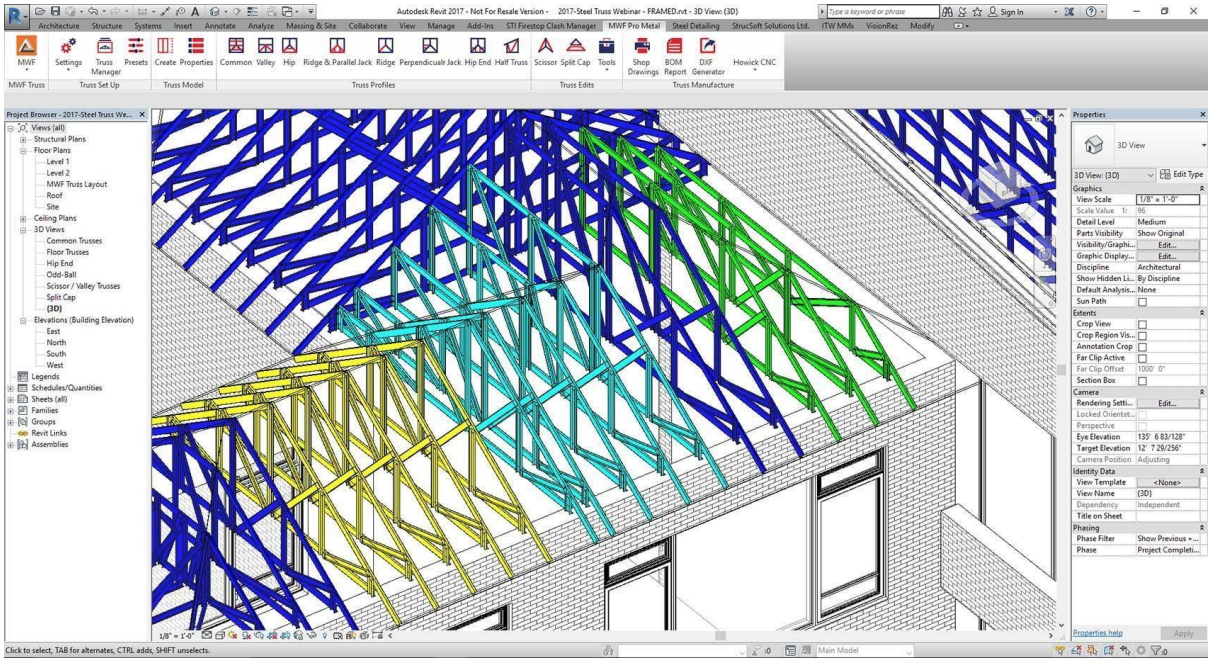
E. 3D Window: The 3D window gives you instant feedback on the construction operations performed in other views and at the same time allows you to directly edit your model in either perspective or axonometric view. The 3D Window is used to visualize the threedimensional components of an architectural project and as an editing environment. You can choose to display the complete project in the 3D Window, or only selected parts of plan view.

The 3D window is directly linked to the Floor Plan and to the Section/Elevation windows: any changes made on the Floor Plan or in any of the Section/Elevation windows will be visible in the 3D window and vice versa.

F. Concepts of parametric: Architectural studies are gradually moving towards very practical approach: developing BIM (building information modeling) technology skills, solving problematic tasks, bringing them closer to real-life situations.

BIM and parametric design-based software is very different in its approach and logics of modelling thus, while learners are prepared for real-life practice, it is generally understood that it is more important for them to learn BIM related programs. These, to name most relevant and popular, would be Revit or ArchiCAD.

Decent BIM modelling of the building this way requires a lot of knowledge about construction and building practice,



To make an object parametric, you have to use an input node. For example, you can create a Length node and connect it to the Size X input of the Block node.

Learning outcome 2.1: Create basic drawings

Duration: 5 hrs
Learning outcome 1 objectives: By the end of the learning outcome, the trainees will be able to: 1. AutoCAD and ArchiCAD Control Menus 2. File management 3. AutoCAD and archiCAD visual reference commands
Resources

Equipment	Tools	Materials

Projector Computers Mouse Keyboard Drawing tablet 3D scanner 3D printer: Plotter	Paper Graphic pencil Ink pen Ruler Eraser	
 Advance preparation: -Familiarize yourself with the software's interface and tools -Customize the interface to suit your workflow by rearranging toolbars and menus -Learn keyboard shortcuts for frequently used commands to increase productivity. -Set up a file management system to organize your drawings and projects -Understand the differences between 2D and 3D drawing		

Indicative content 2.1: Introduction to ArchiCAD

Introduction:

AutoCAD and ArchiCAD are computer-aided design (CAD) software programs that allow architects, engineers, and designers to create precise 2D and 3D designs. To effectively use these software programs, it is essential to become familiar with the user interface, including the Control Menus.

AutoCAD Control Menus

The Control Menus in AutoCAD are located in the upper-left corner of the screen and contain various tools and commands.

The File menu allows you to open, save, and print files, as well as to access recent files and set up new drawings.

The Edit menu provides commands for editing objects, such as copy, paste, and undo.

The View menu allows you to change the view of the drawing, including zooming in and out and rotating the view.

The Insert menu lets you add external files or blocks to your drawing.

The Format menu provides options for formatting text and dimensions.

The Tools menu gives you access to various tools, including the drawing tools and the measurement tools.

The Window menu allows you to manage multiple open drawings and switch between them.

The Help menu provides access to the software's documentation and support options.

ArchiCAD Control Menus

The Control Menus in ArchiCAD are located in the upper-left corner of the screen and contain various tools and commands.

The File menu allows you to open, save, and print files, as well as to access recent files and set up new projects.

The Edit menu provides commands for editing objects, such as copy, paste, and undo.

The View menu allows you to change the view of the drawing, including zooming in and out and rotating the view.

The Document menu provides options for managing the project's documents, such as the layout and publishing settings.

The Design menu gives you access to various design tools and commands, such as the Wall tool and the Roof tool.

The Options menu provides access to the software's settings and preferences.

The Help menu provides access to the software's documentation and support options.

References: