

Unit 15: Undertake Computer Aided Design in Horticulture, Treework and Blacksmithing

Unit reference number: M/600/9919

QCF Level 3: BTEC National

Credit value: 10

Guided learning hours: 60

● Aim and purpose

This unit aims to provide learners with an understanding of how to undertake computer aided design in the land-based industries and how these can be put into practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or to further education and training.

● Unit introduction

Computer aided design (CAD) has become an important tool in the development and presentation of design work. It is now possible to produce a range of two- and three- dimensional drawings in a professional manner, using a range of specialist soft and hardware. This unit provides learners with the skills to create two-dimensional drawings and design proposals within a CAD environment. It enables learners to manipulate drawings and print plans to meet different purposes and therefore will be useful to anyone within the land-based, design, engineering or construction sector.

● Learning outcomes

On completion of this unit a learner should:

- 1 Be able to produce two-dimensional drawings using a Computer Aided Design package
- 2 Be able to edit and modify two-dimensional drawings using a Computer Aided Design package
- 3 Understand the production and modification of two-dimensional drawing using a Computer Aided Design package
- 4 Understand the usefulness of Computer Aided Design packages in land-based industries.

Unit content

1 Be able to produce two-dimensional drawings using a Computer Aided Design package

Use of CAD software in specialist area: interpretation of design brief (customer needs, technical needs); use of basic functions; use of graphic illustrative techniques (geometric shapes, lines, circles, arc); selection of line styles and types (scales, hatching, patterns, textures); two-dimensional drawings (layers, formal features, informal features); hard copies (paper size, orientation, scale, positioning, clarity); composite drawings

2 Be able to edit and modify two-dimensional drawings using a Computer Aided Design package

Edit and modification of CAD designs in specialist area: demands of design brief (customer needs, technical needs); use of editing tools (offset, trim, array, mirror, extend, rotate, copy, bisect); modification of existing two dimensional drawings (addition of items/layers, removal of items/layers); manipulation techniques (scale, line style, colour, layers, symbols, text size and font)

3 Understand the production and modification of two dimensional drawing using a Computer Aided Design package

Production and modification of CAD design in specialist area: features, techniques and styles available (uses, appropriateness); importance of editing and manipulation; use of drawing aids eg grids, constraints; techniques for plotting/printing plans (sizes, scales, formats); userguide (range, use and function of CAD tools/techniques); presentation requirements (whole drawings, sections); clarity of design

4 Understand the usefulness of Computer Aided Design packages in land-based industries

Advantages: quality of presentation; accuracy; time; storage

Potential disadvantages: cost; skills level; limitations of computer facilities.

Health and safety: VDU workstation assessment; working pattern; musculoskeletal, disorders (back injuries, repetitive strain injuries); current relevant legislation eg Health and Safety at Work Act 1974, Health and Safety (Display Screen Equipment) Regulations 1992

Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
P1 implement graphic illustrative techniques for geometric shapes, lines circles arc	M1 create a composite drawing using a range of line styles and layers	D1 create a detailed composite drawing using a range of line styles and layers which fully meets an established brief in a professional manner
P2 select appropriate lines styles and types, scales, hatching and patterns		
P3 produce two-dimensional drawings, incorporating layers and a variety of formal and informal features		
P4 produce hard copies of drawings, selecting appropriate paper size, orientation, scale and positioning [CT, SM, EP]		
P5 use editing tools to offset, trim, array, mirror, extend, rotate, copy, bisect	M2 edit existing drawings to meet design briefs or changes within customer or technical requirements	
P6 modify two-dimensional drawings by adding and removing items and layers		
P7 modify two-dimensional drawings by manipulating the scale, line styles, colour, layers, symbols and text sizes and fonts		

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
P8 evaluate the techniques and styles available and their appropriate uses [IE, RL]	M3 demonstrate clear understanding in the use of computer drawing and editing commands within a CAD package	D2 produce a 'users guide' for the use of a drawing package.
P9 explain why editing and manipulation may be needed		
P10 explain the use of drawing aids, including grids, constraints and other tools to aid accuracy		
P11 describe techniques for plotting/printing plans to different sizes, scales and formats		
P12 evaluate Computer Aided Design (CAD) software packages, their operating requirements and suitability for use within horticulture, treework or blacksmithing	M4 evaluate the benefits of CAD compared to more traditional drawing systems.	
P13 explain the function of components of computer hardware, including RAM, ROM, monitor types, mouse types, graphics tablets upgrades		
P14 explain the benefits of CAD for presenting in a professional format		
P15 explain the health and safety implications of working on CAD.		

PLTS: This summary references where applicable, in the square brackets, the elements of the personal, learning and thinking skills applicable in the pass criteria. It identifies opportunities for learners to demonstrate effective application of the referenced elements of the skills.

Key	IE – independent enquirers	RL – reflective learners	SM – self-managers
	CT – creative thinkers	TW – team workers	EP – effective participators

Essential guidance for tutors

Delivery

Tutors delivering this unit have opportunities to use as wide a range of techniques as possible. This unit will primarily be using the workshop technique to allow learners maximum time to become familiar with the software and have opportunities to explore the range of tools available. However, lectures, discussions, seminar presentations, workshops, internet and/or library-based research and the use of personal and/or industrial experience would all be suitable. Delivery should stimulate, motivate, educate and enthuse learners. Whichever delivery methods are used, it is essential that tutors stress the importance of IT systems and the need to manage the resource using legal methods. Health and safety issues relating to working with computers and electrical equipment must also be stressed and regularly reinforced, and risk assessments plus workstation assessments must be undertaken prior to practical activities.

Tutors should consider integrating the delivery, private study and assessment for this unit with other relevant units and assessment instruments learners are taking as part of their programme of study.

Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan gives **an indication of the volume of learning it would take the average learner** to achieve the learning outcomes. It is **indicative and is one way of achieving the credit value**.

Learning time should address all learning (including assessment) relevant to the learning outcomes, regardless of where, when and how the learning has taken place.

Topic and suggested assignments/activities and/assessment
Introduction to basic tools and functions.
Workshop activity: developing basic CAD drawing skills and knowledge.
Health and safety issues and legislations.
Workshop activity: use of line, text, hatch and layers.
Assignment 1: Production of Drawing to Meet Client Brief (P1, P2, P3, P4, M1, D1)
Workshop activity: editing and manipulation of drawings.
Assignment 2: Production of Modified Drawing (P5, P6, P7, M2)
Workshop activity: establish brief for users assignment.
Student research and production of written reports/presentations.
Assignment 3: Users Guide and Comparison (P8, P9, P10, P11, P12, P13, P14, P15, M3, M4, D2)
Learner research and production of written reports/presentations.
Unit evaluation.
Unit review.

Assessment

For P1, by implementing graphic illustrative techniques while using CAD systems learners will create a variety of lines, arc, curve and geometric shapes using a range of drawing tools

For P2, learners will select appropriate lines styles and types, scales, hatching and pattern, using a range of drawing tools to represent features which meet given objectives

For P3, learners will produce two-dimensional drawings, incorporating layers and a variety of formal and informal features. To ensure fairness of assessment the size and complexity of the tasks should be the same for all learners.

For P4, learners will produce hard copies of drawings, selecting appropriate paper size, orientation, scale and positioning, using hardware effectively to print the work to appropriate sizes and scales.

For P5, learners will use editing tools such as offset, trim, array, mirror, extend, rotate, copy, bisect; they must use these tools to modify existing drawings to meet new or changed objectives as discussed with the tutor or through a client brief.

For P6, learners will modify two-dimensional drawings, by adding and removing items and layers, they will be familiar with the use and advantages of layers within a CAD drawing, using them to aid the development of their drawing.

For P7, learners will modify two-dimensional drawings by manipulating the scale, line styles, colour, layers, symbols and text sizes and fonts. The pass criteria may be linked to P1, P2 and P3 where drawings are generated and modified to meet changing requirements.

For P8, learners must understand and use a range of CAD techniques and evaluate their application within the drawing process. This may be evidence through a project or presentation that would link with many of the previous pass criteria.

For P9, learners must understand and explain why editing and manipulation may be needed and evaluate their application within the drawing process. This may be evidence through a project or presentation that would link with previous Pass criteria including P6 and P8.

For P10, learners must understand and explain the use and function of drawing aids, including grids, constraints and other tools to aid accuracy and evaluate their application to support the drawing process. This may be evidence through a project or presentation that would link with previous pass criteria.

For P11, learners must be able to describe and undertake techniques for plotting/printing plans to different sizes, scales and formats.

For P12, learners must explain the advantages and disadvantages of at least three CAD software packages, including their operating requirements and suitability for use within a specific land-based industry. Tutors should identify the CAD system or agree it through discussion with learners. Where possible, to ensure fairness of assessment, the size and complexity of the tasks should be the same for all learners. The CAD system used should be able to produce high quality drawings that can be printed for different purposes.

For P13, learners will understand and explain the basic function of components of computer hardware, including RAM, ROM, monitor types, mouse types, graphics tablets and upgrades

For P14, learners must explain the benefits of CAD for presenting work in a professional format

For P15, learners must explain the health and safety implications when working on CAD and computer systems

M1 requires learners to create a composite drawing of existing information. They should manipulate the scale and objects in layers and present it as one view that contains a plan of the original layout of the site. Evidence could be in the form of a landscape plan that learners have translated from a paper plan or survey data.

M2 requires learners to modify an existing composite drawing to include proposed information. They should create and manipulate the objects in layers and present it as multiple views that contain a plan of the original layout of the site and addition layers to illustrate the design proposal. Evidence may be in the same format as M1.

M3 requires learners to demonstrate a clear understanding the use of a range of computer drawing and editing commands within a CAD package. These should include such commands as offset, multiple array, mirror functions and similar complex commands depending on the particular CAD software in use by the learner. Evidence may be in the same format as M1 and M2.

M4 requires learners to evaluate the benefits of using CAD compared with a paper-based drawing system. They should be able to realistically evaluate the benefits of installing CAD and to be able to make a reasoned judgement on the value of this investment compared to the continued use of paper-based drawings. Evidence could be in the form of a project or presentation.

D1 requires learners to produce a detailed CAD drawing which fully meets with set and established site and client requirements. The presentation of this work should be of a high and professional quality using a full range of the CAD systems in its production. Evidence may be in the same format as M1 and 2.

For D2, learners must demonstrate a comprehensive understanding of the range, use and function of the CAD tools. This may be achieved by the production of a 'users guide' explaining the tools used in the production of a CAD drawing. This assessment may be linked with the production of evidence for M1, M2 and D1.

Programme of suggested assignments

The following table shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1, P2, P3, P4, M1, D1	Production of Drawing to Meet Client Brief	The learner will generate a CAD drawing from survey data.	Production of a range of CAD drawings demonstrating of skills and a working knowledge of the software capabilities.
P5, P6, P7, M2	Production of Modified Drawing	The learner will work with and modify an existing CAD drawing to a set brief using appropriate software.	Production of a modified CAD drawing demonstrating a range of skills and a working knowledge of the software capabilities.
P8, P9, P10, P11, P12, P13, P14, P15, M3, M4, D2	Users Guide and Comparison	The learner will produce a user guide explaining the tools used in the production of their work and how they are used. The guide should also include comparisons with other software and Health and safety issues concerning the use of this technology.	Technical report, portfolio, posters or presentations.

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC land-based sector suite. This unit has particular links with:

Level 2	Level 3
Undertake Work Related Experience in the Land-based Industries	Undertake an Investigative Project in the Land-based Sector

Essential resources

Learners will need access to a computer with a CAD program installed, for example AutoCad or VectorWorks where possible, including the additional option relevant to their industry. There must also be facilities to print to a large-scale format, at least A2 and preferably A1. Most software now comes with full online help and tutorials within software. The program suppliers also have tutorials and support online on their websites. Reference manuals and websites for additional program tutorials and guidance should be available.

Employer engagement and vocational contexts

This unit focuses on the skills and principles of CAD, including issues concerning hardware requirements, health and safety, ethics and potential advantages. It will also provide learners with the knowledge and skills to undertake these activities using new and developing technology in a professional approach. Centres are encouraged to create and develop links with local, architects, engineers and designers via guest lectures, workshops or visits to gain an industrial perspective of this work.

Indicative reading for learners

Textbooks

Frey D – *AutoCAD 2005 and AutoCAD LT 2005* (Sybex Inc, 2004) ISBN 0782143415

Middlebrook M and Byrnes D – *AutoCAD 2006 for Dummies, 2nd Edition* (Hungry Minds Inc, 2005) ISBN 0764589253

Websites

www.autodesk.co.uk

Autodesk

Delivery of personal, learning and thinking skills (PLTS)

The following table identifies the PLTS opportunities that have been included within the assessment criteria of this unit:

Skill	When learners are ...
Independent enquirers	researching CAD software commonly used in the land-based industry researching current legislation regarding health and safety and copyright while using computers, including environmental or sustainability issues
Creative thinkers	applying techniques and knowledge while problem solving, design issues and line or hatch selection to illustrate ideas and concepts
Reflective learners	reflecting on the design and client needs evaluating design concepts and communicating ideas and concepts
Self-managers	showing initiative and imagination within the solutions of a design scenario building and maintaining relationships with a client.
Effective participators	participating in group discussions and workshops.

Although PLTS opportunities are identified within this unit as an inherent part of the assessment criteria, there are further opportunities to develop a range of PLTS through various approaches to teaching and learning.

Skill	When learners are ...
Independent enquirers	researching health and safety regulations investigating the roles and function of CAD within the land-based industry
Creative thinkers	applying techniques and design principles while participating in CAD activities
Reflective learners	analysing their own performance while participating in team discussions and presentations evaluating own work to reflect strengths and weaknesses
Team workers	being an active participant within presentations and workshop activities and supporting others
Self-managers	working to deadlines independently and within a team
Effective participators	applying the techniques, skills and knowledge learned in previous sessions to meet new targets, showing willingness to support others within the group if required.

● Functional Skills – Level 2

Skill	When learners are ...
ICT – Use ICT systems	
Select, interact with and use ICT systems independently for a complex task to meet a variety of needs	researching the internet for information on CAD software producing CAD drawings and presenting work using a range of interactive media.
Use ICT to effectively plan work and evaluate the effectiveness of the ICT system they have used	evaluating software
Manage information storage to enable efficient retrieval	producing and storing drawings
Follow and understand the need for safety and security practices	
Troubleshoot	
Mathematics	
Understand routine and non-routine problems in a wide range of familiar and unfamiliar contexts and situations	producing scales, using materials sizes and selection within design proposals using ergonomic data with landscape designs.
Identify the situation or problem and the mathematical methods needed to tackle it	
Select and apply a range of skills to find solutions	
Use appropriate checking procedures and evaluate their effectiveness at each stage	
Interpret and communicate solutions to practical problems in familiar and unfamiliar routine contexts and situations	
Draw conclusions and provide mathematical justifications	
English	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	participating in group interaction and discussion presenting design ideas and solutions to meet specific briefs.
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	researching appropriate thermal cutting processes for different situations.
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	