Computer Aided Design (7689)

Qualification Handbook

Contents

Qualification at a glance

Subject area	CAD
City & Guilds number	7689
Age group approved Level 1 and 2	Pre 16, 16-18 and 19+
Age group approved Level 3	16-18 and 19+
Entry requirements	None
Assessment	Assignment
Support materials	• Centre handbook • Assignments (PDF version) • Assignments (Word version)
Registration and certification	Consult the Walled Garden / Online Catalogue for last dates

Title and level	GLH	TQT	City & Guilds number	Accreditation number
Level 1 Award in Parametric Modelling	60	70	7689-01	601/5120/1
Level 2 Award in Parametric Modelling	60	110	7689-02	601/5113/4
Level 3 Award in Parametric Modelling	90	120	7689-03	601/5114/6
Level 2 Award in 2D Computer Aided Design	60	70	7689-04	601/5115/8
Level 3 Award in 2D Computer Aided Design	90	120	7689-05	601/5116/X
Level 3 Award in 3D Computer Aided Design	90	100	7689-06	601/5117/1
Level 2 Certificate in Computer Aided Design	120	180	7689-07	601/5118/3
Level 3 Certificate in Computer Aided Design	180	220	7689-08	601/5119/5

Version and date	Change detail	Section
3.1 September 2017	Added TQT details	**Qualification at a glance and Structure**
	Deleted QCF	**Throughout**
V2.0 November 2015	Corrected Unit Accreditation Number and credits for Unit 201	Structure Units
January 2017 Version 3.0	TQT added, pre 16 age group added where appropriate.	Centre requirements, Structure

2   Introduction

This document tells you what you need to do to deliver the qualifications.

Area	Description
Who are the qualifications for?	These provide learners with the essential skills in how to use Computer Aided Design software. You will learn how an object is designed in either 2D or 3D and how objects can be manufactured.
What do the qualifications cover?	They provide learners with the skills and knowledge to design object in either 2D or 3D. These qualifications allow candidates to learn, develop and practise the skills required for employment and / or career progression in the broad Engineering and Manufacturing sectors
What opportunities for progression are there?	They allow candidates to progress into employment or to the following City & Guilds qualifications: - Level 2 Certificate in Engineering - Level 3 Diploma in Engineering

Structure

The tables below outline the structure and rules of combination for these qualifications.

To achieve the **7689-01 Level 1 Award in Parametric Modelling** learners must achieve **7** credits from mandatory unit 101.

Level 1 Award in Parametric Modelling (7689-01)					
UAN	**City & Guilds unit number**	**Unit title**	**Group (if applicable)**	**Credit Value**	**GLH**
Mandatory					
Y/506/7819	101	Computer Aided Design Using Parametric Modelling Software	n/a	7	60

To achieve the **7689-02 Level 2 Award in Parametric Modelling** learners must achieve **11** credits from mandatory unit 201

Level 2 Award in Parametric Modelling (7689-02)					
UAN	**City & Guilds unit number**	**Unit title**	**Group (if applicable)**	**Credit Value**	**GLH**
Mandatory					
T/506/8203	201	Computer Aided Design Using Parametric Modelling Software	n/a	11	60

To achieve the **7689-03 Level 3 Award in Parametric Modelling** learners must achieve **12** credits from mandatory unit 301.

Level 3 Award in Parametric Modelling (7689-03)					
UAN	**City & Guilds unit number**	**Unit title**	**Group (if applicable)**	**Credit Value**	**GLH**
Mandatory					
D/506/7823	301	Computer Aided Design Using Parametric Modelling Software	n/a	12	90

To achieve the **7689-04 Level 2 Award in 2D Computer Aided Design** learners must achieve **7** credits from mandatory unit 202.

Level 2 Award in 2D Computer Aided Design (7689-04)

UAN	City & Guilds unit number	Unit title	Group (if applicable)	Credit Value	GLH
Mandatory					
L/506/7820	202	Using 2D Computer Aided Design Software	n/a	7	60

To achieve the **7689-05 Level 3 Award in 2D Computer Aided Design** learners must achieve **12** credits from mandatory unit 302.

Level 3 Award in 2D Computer Aided Design (7689-05)

UAN	City & Guilds unit number	Unit title	Group (if applicable)	Credit Value	GLH
Mandatory					
R/506/7821	302	Using 2D Computer Aided Design Software	n/a	12	90

To achieve the **7689-06 Level 3 Award in 3D Computer Aided Design** learners must achieve **10** credits from mandatory unit 303.

Level 3 Award in 3D Computer Aided Design (7689-06)

UAN	City & Guilds unit number	Unit title	Group (if applicable)	Credit Value	GLH
Mandatory					
H/506/7824	303	Using 3D Computer Aided Design Software	n/a	10	90

To achieve the **7689-07 Level 2 Certificate in Computer Aided Design** learners must achieve **18** credits from **both** mandatory units 201 and 202.

Level 2 Certificate in Computer Aided Design (7689-07)					
UAN	City & Guilds unit number	Unit title	Group (if applicable)	Credit Value	GLH
Mandatory					
T/506/8203	201	Computer Aided Design Using Parametric Modelling Software	n/a	11	60
L/506/7820	202	Using 2D Computer Aided Design Software	n/a	7	60

To achieve the **7689-08 Level 3 Certificate in Computer Aided Design** learners must achieve **22** credits from any **two** of the optional units 301, 302 and 303.

Level 3 Certificate in Computer Aided Design (7689-08)					
UAN	City & Guilds unit number	Unit title	Group (if applicable)	Credit Value	GLH
Optional					
D/506/7823	301	Computer Aided Design Using Parametric Modelling Software	n/a	12	90
R/506/7821	302	Using 2D Computer Aided Design Software	n/a	12	90
H/506/7824	303	Using 3D Computer Aided Design Software	n/a	10	90

Total qualification time (TQT)

Total Qualification Time (TQT) is the total amount of time, in hours, expected to be spent by a Learner to achieve a qualification. It includes both guided learning hours (which are listed separately) and hours spent in preparation, study and assessment.

Title and level	GLH	TQT
Level 1 Award in Parametric Modelling	60	70
Level 2 Award in Parametric Modelling	60	110
Level 3 Award in Parametric Modelling	90	120

Title and level	GLH	TQT
Level 2 Award in 2D Computer Aided Design	60	70
Level 3 Award in 2D Computer Aided Design	90	120
Level 3 Award in 3D Computer Aided Design	90	100
Level 2 Certificate in Computer Aided Design	120	180
Level 3 Certificate in Computer Aided Design	180	220

2 Centre requirements

Approval

Centres already approved to offer the qualification 7579 will be given automatic approval to deliver the new 7689 qualifications.

New centres will need to gain both centre and qualification approval to offer these qualifications. Please refer to the *Centre Manual – Supporting Customer Excellence* for further information.

Centre staff should familiarise themselves with the structure, content and assessment requirements of the qualifications before designing a course programme.

Resource requirements

Centre staffing

Staff delivering these qualifications must be able to demonstrate that they meet the following occupational expertise requirements. They should:

- be occupationally competent or technically knowledgeable in the area[s] for which they are delivering training and / or have experience of providing training. This knowledge must be to the same level as the training being delivered
- have recent relevant experience in the specific area they will be assessing
- have credible experience of providing training.

See also page 16 for details from the assessment strategy on the role of supervisors and managers in the assessment process.

Centre staff may undertake more than one role, eg tutor and assessor or internal verifier, but cannot internally verify their own assessments.

Learner entry requirements

City & Guilds does not set entry requirements for these qualifications. However, centres must ensure that candidates have the potential and opportunity to gain the qualifications successfully.

Age restrictions

For Level 1 and 2 City & Guilds will accept registrations for candidates aged pre 16, 16-18 and 19+.

For Level 3 City & Guilds will accept registrations for candidates aged 16-18 and 19+.

3 Delivering the qualification

Initial assessment and induction

An initial assessment of each candidate should be made before the start of their programme to identify:

- if the candidate has any specific training needs
- support and guidance they may need when working towards their qualifications
- any units they have already completed, or credit they have accumulated which is relevant to the qualifications
- the appropriate type and level of qualification.

We recommend that centres provide an induction programme so the candidate fully understands the requirements of the qualification, their responsibilities as a candidate, and the responsibilities of the centre. This information can be recorded on a learning contract.

Support materials

The following resources are available for these qualifications

Description	How to access
Fast track approval form	www.cityandguilds.com

4   Assessment

All units in these qualifications are assessed by assignments set by City & Guilds, internally marked by centres and externally verified. These assignments are graded Pass, Merit and Distinction.
Each assignment consists of practical tasks and short-answer questions.

These assessments have all been developed with input from experts in the industry.

Summary of assessment methods

Candidates must:
- successfully complete one assignment for each mandatory unit
- successfully complete one assignment for each chosen optional unit.

City & Guilds provides the following assessments:

		Assessment Types		
Unit	Level	Title	Assessment method	Where to obtain assessment materials
101	1	Computer Aided Design Using Parametric Modelling Software	Assignment 7689-101 This assignment covers all the learning outcomes in this unit. Assignment set by City & Guilds, internally marked, externally verified.	www.cityandguilds.com
201	2	Computer Aided Design Using Parametric Modelling Software	Assignment 7689-201 This assignment covers all the learning outcomes in this unit. Assignment set by City & Guilds, internally marked, externally verified.	www.cityandguilds.com
202	2	Using 2D Computer Aided Design Software	Assignment 7689-202 This assignment covers all the learning outcomes in this unit. Assignment set by City & Guilds, internally marked, externally verified.	www.cityandguilds.com
301	3	Computer Aided Design Using Parametric Modelling Software	Assignment 7689-301 This assignment covers all the learning outcomes in this unit. Assignment set by City & Guilds, internally marked, externally verified.	www.cityandguilds.com
302	3	Using 2D Computer Aided Design Software	Assignment 7689-302 This assignment covers all the learning outcomes in this unit. Assignment set by City & Guilds, internally marked, externally verified.	www.cityandguilds.com
303	3	Using 3D Computer Aided Design Software	Assignment 7689-303 This assignment covers all the learning outcomes in this unit. Assignment set by City & Guilds, internally marked, externally verified.	www.cityandguilds.com

Any electronic files or templates that are required to deliver the practical tasks within each assignment are provided on our website.

Time constraints

The following must be applied to the assessment of these qualifications:
- candidates must finish their assessment within six months
- assignments should take no longer than 8 hours. If they do, centres should consider why this is, and make sure that they are not trying to gather too much evidence.

Contextualised tasks

Centres are allowed to contextualise the practical tasks within each assignment to suit the needs of different industry sectors. Design specifications within a task can be contextualised, however the grading criteria and the mark sheet provided in each assignment **must** be used and cannot be changed, to ensure validity and comparability of the grades achieved by candidates.

City & Guilds provides a Word version of each assignment on the website that centres can use to contextualise tasks. Further guidance about this is provided in the Assessor Guidance section within each assignment.

If a centre would like to contextualise a task within an assignment they should complete the equivalent Word document of the assignment found on City & Guilds 7689 webpage and forward this to their External Quality Assurer (EQA) for review and approval.

Centres are **not** allowed to change or contextualise the short-answer questions within the assignments.

Recognition of prior learning (RPL)

Recognition of prior learning means using a person's previous experience or qualifications which have already been achieved to contribute to a new qualification.

RPL is **not** allowed for these qualifications.

5   Units

Structure of units

These units each have the following:
- City & Guilds reference number
- unit accreditation number (UAN)
- title
- level
- credit value
- guided learning hours
- relationship to NOS, other qualifications and frameworks
- unit aim
- information on assessment
- learning outcomes which are comprised of a number of assessment criteria
- notes for guidance if applicable.

Unit 101　　　Computer Aided Design Using Parametric Modelling Software

UAN:	Y/506/7819
Level:	Level 1
Credit value:	7
GLH:	60
Relationship to NOS:	Producing CAD Models (Drawings) using a CAD System
Aim:	This unit will equip candidates with an understanding of the CAD Parametric Modelling environment, in terms of hardware, software and physical surroundings. It will explore the typical composition of a CAD Parametric Modelling system and Health and Safety matters that are associated with safe working practices.
Assessment type	Assignment

Learning outcome:

The learner will:

1. Be able to use a parametric modelling workstation safely

Assessment criteria

The learner can:

1.1　identify **hardware** required for a parametric modelling system
1.2　identify **software** required for a parametric modelling system
1.3　manage files including file types
1.4　follow **legislation** associated with parametric modelling use
1.5　identify **safe working practices**
1.6　identify **common injuries** associated with extended computer use

Hardware

Processor type and speed, mother board, memory, RAM, ROM, file storage, external storage devices, graphics card, screen resolution, input devices – (mouse, keyboard, touch screen), output devices – (printer / plotter, speakers, monitor, consumables)

Software

Operating systems, device drivers, application programmes, antivirus software

Legislation

Health and Safety at Work (1974), Data Protection Act, copyright

Safe working practices

Lighting, ventilation, good posture, frequent breaks, ergonomics

Common injuries

Eye strain, back / neck strain, RSI

Learning outcome

The learner will:

2. Be able to use key components used in parametric modelling software

Assessment criteria

The learner can:

2.1 identify the **features** of a parametric modelling interface
2.2 use **parametric modelling** to create parts accurately
2.3 identify **viewing tools**
2.4 use standard templates to create parts and assemblies

Range

Features

Start-up menu, ribbon / toolbar, tabs, browser, design tree, dialogue boxes, properties, drawing aids, visual settings, background colour, units

Parametric modelling

Sketch, origin, default work planes, constraints, line-types, Cartesian co-ordinate system

Viewing tools

Zoom, pan, navigation tools, function keys

The learner will:

3. Be able to use commands to create and constrain sketches

Assessment criteria

The learner can:

3.1   identify the **standard work planes**
3.2   create sketches on the **standard work planes**
3.3   create **geometry** within the sketch environment
3.4   use **geometric constraints** when sketching
3.5   display and remove **geometric constraints**
3.6   add **dimensions** to sketch to further constrain **geometry**
3.7   create construction and centre lines

Range

Standard work planes
Origin, XY, XZ, YZ

Geometry
Lines, arcs, circles, rectangles, slots, ellipses, polygons

Geometric constraints
Coincident, collinear, concentric, parallel, perpendicular, horizontal, vertical, tangent, symmetric, equal

Dimensions
Linear, radius, diameter, angular, aligned, driven

Learning outcome

The learner will:

4.   Be able to use commands to produce features

Assessment criteria

The learner can:

4.1   create extruded features from sketched geometry
4.2   create revolved features from sketched geometry
4.3   select surfaces to act as sketch planes for the creation of new features
4.4   edit existing features and sketches by changing their definitions
4.5   create ribs and webs from open and closed profiles

Learning outcome

The learner will:

5.   Be able to use placed features to modify parametric models

Assessment criteria

The learner can:

5.1   identify **sketch driven features** and placed features
5.2   state the importance of **design intent** when producing a single part
5.3   create **placed features** on models
5.4   modify **placed features** on models

Range

Sketch driven features
Fillet, chamfer, circle, rectangle

Design intent
The importance of order of design/ logical order of creating design

Placed features
Fillet, chamfer, holes and threads, shell, pattern (circular, rectangular), drafts

The learner will:

6. Be able to create an assembly

The learner can:

6.1 place component parts into an assembly
6.2 use assembly **constraints** to assemble and align parts

Constraints
Mate, angle, tangent, insert, symmetry

The learner will:

7. Be able to produce output using the drawing layout environment

The learner can:

7.1 create a new drawing layout using an existing metric template
7.2 control the **appearance of the views** within a layout
7.3 add text annotations to views and title block
7.4 create a drawing layout in a presentation **format** to suit the software in use

Appearance of the views
Orthographic, isometric, hidden, shaded, scale

Format
Printed, PDF, DWF, JPG, BMP, STL

Unit 201   Computer Aided Design Using Parametric Modelling Software

UAN:	T/506/8203
Level:	Level 2
Credit value:	11
GLH:	60
Relationship to NOS:	Producing CAD Models (Drawings) using a CAD System
Aim:	This unit aims to deepen the learners' understanding of the CAD Parametric Modelling environment and its application. It will enable the learner to develop the knowledge and skills to create sketches, work features, table driven parts and assemblies, understand constraints and be able to create a drawing layout.
Assessment type	Assignment

Learning outcome:

The learner will:

1. be able to use a parametric modelling workstation safely

Assessment criteria

The learner can:

1.1   follow **legislation** associated with parametric modelling use
1.2   describe **safe working practices**
1.3   identify **common injuries** associated with extended computer use

Range

Legislation
Health and Safety at Work (1974), Data Protection Act, copyright

Safe working practices
Lighting, ventilation, good posture, frequent breaks, ergonomics

Common injuries
Eye strain, back / neck strain, RSI

Learning outcome

The learner will:

2.   Be able to create sketches

Assessment criteria

The learner can:

2.1   identify default **constraints**
2.2   use **equations** in sketch geometry to drive part design intent
2.3   use advanced sketching **features**

Range

Constraints
Standard 2D constraints (eg coincident, collinear)

Equations
Dimensional relationships, parameter names, visibility

Features
Mirror, offset, copy, move, rotate, pattern, shared sketch, roll back, projected geometry

Learning outcome

The learner will:

3.   Be able to create work features and use features

Assessment criteria

The learner can:

3.1   identify **work features**
3.2   create and edit **work features**
3.3   create and edit **features**
3.4   use advanced **hole definition features**

Range

Work features
User defined work planes, axes, points

Features
Face draft, rib, web, sweep, coil, loft, split, mirror, emboss (or indent), suppress, unsuppress

Hole definition features
Placement, counterbores, countersinking, thread details, clearances

Learning outcome:

The learner will:

4.   Be able to create table driven parts and assemblies

Assessment criteria

The learner can:

4.1   identify the **controls** when linking table driven parts and assemblies
4.2   create sketch **relational dimensions** to allow design intent to be identified
4.3   create new parts with features **derived** from existing parts within an assembly
4.4   create parts and assemblies controlled by a **linked table**
4.5   create tables to **control** features or parts within a part or assembly

Range

Controls
Parameters, prefixes, functions, algebraic operators

Derived
Copied geometry, projected geometry, referenced geometry

Relational dimensions
Dimension names, equations, user parameters

Linked table
Parameters table, equations

Control
Display or suppress

Learning outcome

The learner will:

5.   Understand motion and driven assembly constraints

Assessment criteria

The learner can:

5.1   describe the **types of assembly constraints**
5.2   use motion and driven **relationships** between assembly components

Range

Types of assembly constraints
Rotation, rotation-translation, linear

Relationships
Motion constraints

Learning outcome

The learner will:

6.   Be able to create a drawing layout to aid the interpretation of design intent

Assessment criteria

The learner can:

6.1   create a **custom template** file
6.2   output a **drawing presentation**
6.3   use **annotation functions**
6.4   produce a saved drawing output in a suitable **format**

Range

Custom template
ISO drawing sheet size, orientation, border, title block, first / third angle projection, projected views, auxiliary views, drafting standards, text styles, dimension styles, sketched symbol

Drawing presentation
Orthographic, exploded, isometric, section views, rendered, visual application, animated

Annotation functions
Hole and thread notes, centrelines, centre marks, notes, leaders, parts list, balloon referencing, revision tables and tags, service texture symbols, feature control frames, enquiry tools

Formats
Printed, BMP, GIF, IGES, JPEG, PDF, PNG, SAT, STEP, STL, TIFF, XML

Learning outcome

The learner will:

7. Be able to create presentation quality displays of parts and assemblies

Assessment criteria

The learner can:

7.1 create a presentation quality **scene layout**
7.2 identify suitable **file formats** for transferring to other graphics packages
7.3 export a presentation quality **rendered** graphics file in a suitable format

Range

Scene layout
Visual style, material / appearance, lighting, shadows, background, textures / material types, orthographic or perspective

File formats
BMP, JPEG, PNG

Rendered
Pixel resolution, camera, lighting style, scene style, render type

Unit 202   Using 2D Computer Aided Design Software

UAN:	L/506/7820
Level:	Level 2
Credit value:	7
GLH:	60
Relationship to NOS:	Producing CAD Models (Drawings) using a CAD System
Aim:	This unit will equip candidates with the basic understanding and principles of 2D drawing environment, in terms of hardware, software and physical surroundings. It will explore the typical composition of a CAD system and health and safety matters that are associated with safe working practices.
Assessment type	Assignment

Learning outcome:

The learner will:

1. Be able to use a CAD workstation safely

Assessment criteria

The learner can:

1.1   identify **hardware** required for a 2D CAD system
1.2   identify **software** required for a 2D CAD system
1.3   manage files including file types
1.4   follow **legislation** associated with computer use
1.5   describe **safe working practices**
1.6   describe how to prevent **common injuries** associated with extended computer use

Hardware

Processor type and speed, mother board, memory, RAM, ROM, file storage, external storage devices, graphics card, screen resolution, input devices – (mouse, keyboard, touch screen, scanner), output devices – (printer / plotter, speakers, monitor, consumables)

Software

Operating systems, device drivers, application programmes, antivirus software

Legislation

Health and Safety at Work (1974), Data Protection Act, copyright

Safe working practices

Lighting, ventilation, good posture, frequent breaks, ergonomics

Common injuries

Eye strain, back / neck strain, RSI

Learning outcome

The learner will:

2.   Be able to use key components in 2D CAD software

Assessment criteria

The learner can:

2.1   identify the features of a 2D CAD **interface**
2.2   modify **CAD settings** to create drawings to correct drawing standards
2.3   describe a range of **viewing tools**

Range

Interface

Start-up menu, toolbars, icons, menu bar, dialogue boxes, ribbon, command prompt, properties, drawing aids, visual settings, background colour, units, limits

CAD settings

Layers, colours, line-types, line weight, Cartesian co-ordinate system

Viewing tools

Zoom (extents, all, scale, object), pan, viewports, named views

The learner will:

3.   Be able to create lines and shapes relative to a co-ordinate system

Assessment criteria

The learner can:

3.1   describe the differences between **co-ordinate entry methods**
3.2   use drawing tools to create **lines** and **shapes** accurately
3.3   identify the properties between single line and a line with multiple vertices

Range

Co-ordinate entry methods
Absolute, relative, polar

Lines
Centre lines, hidden, dashed, arcs

Shapes
Rectangle, polygon, circles, ellipse

Learning outcome

The learner will:

4.   Be able to use text, hatch and simple dimensioning routines

Assessment criteria

The learner can:

4.1   create **text styles**
4.2   use text entry methods to annotate drawings accurately
4.3   justify text during input to specification
4.4   use hatch patterns to enhance drawings
4.5   perform basic **dimension commands** to specification

Range

Text styles
Name, font, font size

Dimension commands
Linear, aligned, angular, radius, diameter, leader

Learning outcome

The learner will:

5.   Be able to modify existing drawings

Assessment criteria

The learner can:

5.1   identify **editing routines** used to modify existing drawings
5.2   use editing routines to modify existing drawings

Range

Editing routines

Erase, chamfer, fillet, scale, rotate, trim / extend, break, offset / parallel, lengthen / shorten, explode / join, move, copy, mirror, array, stretch, divide

Learning outcome

The learner will:

6.   Be able to output a 2D drawing layout

Assessment criteria

The learner can:

6.1   produce a border and title block
6.2   **output** a drawing in presentation format to suit the CAD software in use

Range

Output

Printed, PDF, JPG, BMP

Unit 301　Computer Aided Design Using Parametric Modelling Software

UAN:	D/506/7823
Level:	Level 3
Credit value:	12
GLH:	90
Relationship to NOS:	Producing Mechanical Engineering Drawings using Computer Aided Techniques
Aim:	This unit will enable the learner to develop the knowledge and skills to generate and edit advanced models / assemblies using data driven parameters and to produce photorealistic rendered animations.

Assessment type　Assignment

Learning outcome:

The learner will:

1.　Be able to use a parametric modelling workstation safely

Assessment criteria

The learner can:

1.1　follow **legislation** associated with computer use
1.2　explain how **legislation** affects computer use
1.3　describe how to prevent **common injuries** associated with extended computer use

Range

Legislation
Health and Safety at Work (1974), Data Protection Act, copyright

Common injuries
Eye strain, back / neck strain, RSI

The learner will:

2.   Be able to use advanced features when modelling

Assessment criteria

The learner can:

2.1   manage **file types** to generate an advanced assembly
2.2   repair lost or **disjointed relationships** within a part or assembly
2.3   make a design change through editing a part or assembly
2.4   create **formed and modelled parts**
2.5   create a **shape**

Range

File types
SAT, STEP

Assembly modelling
Imported parts, design history browser

Disjointed relationships
Design error detection and correction, modelling constraints, file location error

Formed and modelled parts
Sheet metal, weldments

Shape
3D sketch, direct co-ordinate entry, spline, sweep, loft

Learning outcome

The learner will:

3. Be able to create advanced assemblies

Assessment criteria

The learner can:

3.1   describe assembly modelling techniques
3.2   create an assembly using **modelling techniques**
3.3   create and edit **new parts** within an assembly
3.4   import and constrain a **library feature** into a part / assembly
3.5   use **mating and fastening features** when constructing complex parts / assemblies

Range

Modelling techniques
Top-down, bottom-up, middle-out, design tree, design history browser

New parts
Adaptive features and dimensions

Library feature
Constraint tools, parts library (eg fasteners, bearings, circlips)

Mating and fastening features
Intelligent mating tools, bolted and screw connections

The learner will:

4. Be able to create and modify table driven parts and assemblies

Assessment criteria

The learner can:

4.1   identify the **control parameters** when linking a spreadsheet to a part or assembly
4.2   use a spreadsheet to manipulate **control parameters** within parts and assemblies
4.3   create equations within a spreadsheet to control **features** within parts and assemblies

Range

Control parameters
Parameters, prefixes, functions, algebraic operators, named dimensions

Features
Spreadsheet: dimensions, parameters, equations, define or suppress

Learning outcome

The learner will:

5. Be able to create presentation graphics

Assessment criteria

The learner can:

5.1   use techniques to produce a photorealistic **presentation**
5.2   create a **rendered animation** of a model and export to view in the resident visual software package
5.3   record a **rendered animation** in a suitable **file format** for exporting as a video clip

Range

Presentation
Orthographic or perspective, material / appearance, bitmap texture, lighting styles (directional, point, spot), scene styles, camera, render

Rendered animation
Animation timeline, animation options, render animation

File formats
AVI, MOV, WMV

Unit 302   Using 2D Computer Aided Design Software

UAN:	R/506/7821
Level:	Level 3
Credit value:	12
GLH:	90
Relationship to NOS:	Producing Mechanical Engineering Drawings using Computer Aided Techniques
Aim:	This unit will enable the learner to have the knowledge and practical skills to create complex drawings including annotations and output using multiple view layouts. It will also enable them to manage CAD drawing data and libraries in line with industry standards.

Assessment type   Assignment

Learning outcome:

The learner will:

1.   Be able to use a CAD workstation safely

Assessment criteria

The learner can:

1.1   follow **legislation** associated with computer use
1.2   explain how **legislation** affects computer use
1.3   describe how to prevent **common injuries** associated with extended computer use

Range

Legislation
Health and Safety at Work (1974), Data Protection Act, copyright

Common injuries
Eye strain, back / neck strain, RSI

The learner will:

2.   Be able to use layers, complex dimensions and text

Assessment criteria

The learner can:

2.1   describe the benefits of using **standards** in CAD drawings
2.2   create multiple **layers**
2.3   explain the purpose of layering systems
2.4   create and use multiple **text styles**
2.5   create and use **dimension styles**
2.6   explain why dimension styles are used
2.7   create **template files**

Range

Standards
Company standards, relevant British Standards (BS), International Organisation of Standards (ISO)

Layers
Centre, hidden, outline, border, text, line weight, line type, colour, visibility

Text styles
Font (italic, bold), height, colour

Dimension style
Sub styles (radial, diameter, aligned, angular, linear, leader)

Template files
Borders, layers, text style, dimension style, paper size, title block, output settings

The learner will:

3. Be able to use library items and external references

Assessment criteria

The learner can:

3.1 explain the benefits of creating and using **library items**
3.2 explain the benefits of using **external references**
3.3 create, edit and save **library items** from existing separate entities
3.4 use **library items** and **external references** for the production of drawings

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Range

Library items
Blocks / symbols (including attributes / attached text)

External references
Relevant CAD files, PDF, image files

Learning outcome

The learner will:

4. Be able to produce complex drawings

Assessment criteria

The learner can:

4.1 produce drawings using different **drawing methods**
4.2 describe the benefits of different **drawing methods**
4.3 explain why **drawing aids** and **keyboard shortcuts** are used to assist in drawing production

---

Range

Drawing methods
Orthographic, first angle, third angle, sectional, assembled, sectioned, isometric, oblique

Drawing aids / Keyboard shortcuts
Orthomode, grid and snap, snaps (eg endpoint, midpoint, centre), function keys, user co-ordinate system, default co-ordinate system

Learning outcome

The learner will:

5. Be able to carry out advanced editing processes

Assessment criteria

The learner can:

5.1   identify **numeric information** from existing drawings
5.2   modify properties and geometry of drawn entities using a variety of **methods**
5.3   manipulate **continuous sequences** of line and arc geometry

Range

Numeric information
X, Y co-ordinate point, distance, angle, radius, area

Methods
Pre-command selection, stretch, move, rotate, scale, mirror, match properties, dialogue boxes, keyboard entry, command prompts

Continuous sequences
Polyline / smartline, spline

Learning outcome

The learner will:

6. Be able to use methods to cleanse a CAD drawing

Assessment criteria

The learner can:

6.1   explain why unused items in a CAD drawing require removal
6.2   apply **methods** to delete and rename items within a CAD document

Range

Methods
Purge, rename (symbols, layers, line types, text styles, dimension styles)

The learner will:

7. Be able to output drawings using multiple scale views

Assessment criteria

The learner can:

7.1   create multiple print space **layouts** in preparation for drawing presentation
7.2   apply standard and custom scales to present various views
7.3   modify layer visibility settings in individual views
7.4   explain the **benefits** of producing electronic files for design documentation
7.5   define **output settings** to create an **electronic file / hard copy**

Range

Layouts
Title block, border, viewports, scale

Benefits
Speed, efficiency, cost effective, communication, backups, space saving, increased accuracy, interaction between hardware

Output settings
Paper size, orientation, scale, drawing position

Electronic file / hard copy
Printed, PDF, JPG, BMP**,** emails, fax, scanning, CAD drawings

Unit 303   Using 3D Computer Aided Design Software

UAN:	H/506/7824
Level:	Level 3
Credit value:	10
GLH:	90
Relationship to NOS:	Producing Engineering Drawings / Models using 3D Computer Aided Techniques
Aim:	This unit will allow candidates to develop the ability to apply the drafting procedures required to create and modify existing 3D objects, either surfaces or solids, at any position within Three Dimensional Space.

Assessment type   Assignment

Learning outcome:

The learner will:

1. Be able to use a CAD workstation safely

Assessment criteria

The learner can:

1.1   follow **legislation** associated with computer use
1.2   follow **safe working practices**
1.3   explain how **legislation** affects computer use
1.4   describe how to prevent **common injuries** associated with extended computer use

Range

Legislation
Health and Safety at Work (1974), Data Protection Act, copyright

Safe working practices
Lighting, ventilation, good posture, frequent breaks, ergonomics

Common injuries
Eye strain, back / neck strain, RSI

The learner will:

2. Be able to set the 3D modelling environment

Assessment criteria

The learner can:

2.1 create templates for 3D modelling using various **settings**
2.2 use and restore the default co-ordinate system
2.3 create and apply user co-ordinate systems
2.4 describe the **benefits** of setting up templates for 3D modelling

Range

Settings
Multi-view windows, drawing aids, system parameters, layers, user interface, icon style, limits, units

Benefits
Standardisation, customisation, ISO standards, company standards

Learning outcome:

The learner will:

3. Be able to construct and edit 3D surface models

Assessment criteria

The learner can:

3.1 use drawing tools to create open **2D shapes** using a variety of user co-ordinate systems
3.2 create 3D shapes using **surface modelling techniques**
3.3 describe **3D surface primitives**
3.4 describe **surface editing** routines used to modify existing surface objects

Range

2D shapes
Lines, arcs, multi-segment line

Surface modelling techniques
Extrude, revolve, planer, network, loft, sweep, mesh tools (edgesurf, rulesurf, tabsurf, revsurf)

3D surface primitives
Box, cylinder, sphere, wedge, cone, pyramid, torus

Surface editing
Fillet, trim, extend, sculpt

Learning outcome:

The learner will:

4.   Be able to construct and edit a 3D solid model

Assessment criteria

The learner can:

4.1   use drawing tools to create closed **2D shapes** using a variety of user co-ordinate systems
4.2   create 3D shapes using solid modelling techniques
4.3   describe **3D solid primitives**
4.4   perform **Boolean operations** on 3D objects
4.5   modify solid objects using **solid editing routines**

Range

2D shapes
Rectangle, polygon, circle, region, multi-segment line (closed)

Solid modelling techniques
Extrude, revolve, sweep, loft

3D solid primitives
Box, cylinder, sphere, polysolid, wedge, cone, pyramid, torus

Boolean operations
Join, subtract, intersect

Solid editing routines
Fillet, chamfer, shell, slice, thicken, imprint, taper face, extrude face, copy face, copy edge

Learning outcome:

The learner will:

5.   Be able to apply commands to manipulate a 3D model

Assessment criteria

The learner can:

5.1   use a 3D library item
5.2   perform **3D operations** on existing 3D models
5.3   obtain mass properties of a 3D solid model

Range

3D operations
3D pattern (rectangular and circular), 3D rotate, 3D mirror

Learning outcome:

The learner will:

6.   Be able to apply commands to view 3D models in a variety of display formats

Assessment criteria

The learner can:

6.1   produce **various views** of 3D models
6.2   view 3D models in a variety of **display modes**
6.3   explain **reasons** for creating multiple views of an object
6.4   explain the **benefits** of saving named views

Range

Various views
Cut-away view, cross-sectional view, orthographic views, isometric views, named views

Display modes
Wireframe, conceptual, hidden, realistic, shaded

Reasons
Visualisation, standardisation, clarity, projection, scaling

Benefits
Retrieval, regeneration, efficiency

Learning outcome:

The learner will:

7.   Be able to output a 3D model drawing layout

Assessment criteria

The learner can:

7.1   explain other **uses** for exported 3D CAD data
7.2   present a 3D model using a template
7.3   **output** a multiple view model in presentation format to suit the CAD software in use

Range

Uses
Rapid prototyping, CNC, associated software, 3D printer, laser cutting

Output
Printed, PDF, JPG, BMP, DXF, IGES, SAT, STL

Appendix 1   Relationships to other qualifications

Links to other qualifications

This qualification has connections to the:

* Level 2 NVQ Diploma in Performing Engineering Operations Level 3 NVQ Extended Diploma in Engineering Technical Support Level 3 Diploma in Engineering

Appendix 2   Sources of general information

The following documents contain essential information for centres delivering City & Guilds qualifications. They should be referred to in conjunction with this handbook. To download the documents and to find other useful documents, go to the **Centres and Training Providers homepage** on **www.cityandguilds.com**.

Centre Manual – Supporting Customer Excellence contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification, as well as updates and good practice exemplars for City & Guilds assessment and policy issues. Specifically, the document includes sections on:
- the centre and qualification approval process
- assessment, internal quality assurance and examination roles at the centre
- Registration and certification of candidates
- non-compliance
- complaints and appeals
- equal opportunities
- data protection
- management systems
- maintaining records
- assessment
- internal quality assurance
- external quality assurance.

Our Quality Assurance Requirements encompasses all of the relevant requirements of key regulatory documents such as:
- Regulatory Arrangements for the Qualifications and Credit Framework (2008)
- SQA Awarding Body Criteria (2007)
- NVQ Code of Practice (2006)

and sets out the criteria that centres should adhere to pre and post centre and qualification approval.

Access to Assessment & Qualifications provides full details of the arrangements that may be made to facilitate access to assessments and qualifications for candidates who are eligible for adjustments in assessment.

The **centre homepage** section of the City & Guilds website also contains useful information on such things as:
- **Walled Garden**: how to register and certificate candidates on line
- **Events**: dates and information on the latest Centre events
- **Online assessment**: how to register for e-assessments.

Centre Guide – Delivering International Qualifications contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification. Specifically, the document includes sections on:

- the centre and qualification approval process and forms
- assessment, verification and examination roles at the centre
- registration and certification of candidates
- non-compliance
- complaints and appeals
- equal opportunities
- data protection
- frequently asked questions.

Linking to this document from web pages

We regularly update the name of documents on our website, therefore in order to prevent broken links we recommend that you link to our web page that the document resides upon, rather than linking to the document itself.

Useful contacts

UK learners General qualification information	**T: +44 (0)844 543 0033** **E: learnersupport@cityandguilds.com**
International learners General qualification information	T: +44 (0)844 543 0033 F: +44 (0)20 7294 2413 **E: intcg@cityandguilds.com**
Centres Exam entries, Certificates, Registrations/enrolment, Invoices, Missing or late exam materials, Nominal roll reports, Results	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 **E: centresupport@cityandguilds.com**
Single subject qualifications Exam entries, Results, Certification, Missing or late exam materials, Incorrect exam papers, Forms request (BB, results entry), Exam date and time change	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 F: +44 (0)20 7294 2404 (BB forms) **E: singlesubjects@cityandguilds.com**
International awards Results, Entries, Enrolments, Invoices, Missing or late exam materials, Nominal roll reports	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 **E: intops@cityandguilds.com**
Walled Garden Re-issue of password or username, Technical problems, Entries, Results, e-assessment, Navigation, User/menu option, Problems	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 **E: walledgarden@cityandguilds.com**
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Publications Logbooks, Centre documents, Forms, Free literature	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413

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