Unit 2: Communications for Technicians

NQF Level 3: BTEC National

Guided learning hours: 60

Unit abstract

The ability to communicate effectively is an essential skill in all aspects of life. The usual methods of communication — speaking, reading and writing receive considerable attention and learning time during all stages of education. For engineers, these skills are of no less importance but there are further complications with the need to also convey technical information such as scale, perspective and standards of working.

The drive towards greater use of information and communication technology (ICT) is also very much a part of modern life and this again is certainly the case for engineering. The engineering industry is in the front line of working towards paperless communication methods, for example the electronic transfer of data from the concept designer straight to the point of manufacture. On occasions, this point of manufacture is not in the same building or even the same continent!

This unit will provide a foundation for employment in a wide range of engineering disciplines (eg manufacturing, maintenance, communications technology) in addition to providing a foundation for further study. It aims to develop learners' ability to communicate using a diverse range of methods. These include visual methods, such as drawing and sketching, and computer-based methods, such as two dimensional (2D) computer aided drawing (CAD) and graphical illustration packages. It will also develop learners' ability to write and speak within a framework of technology based activities using relevant and accurate technical language appropriate to the task and the audience.

The unit will also introduce learners to a variety of skills and techniques to obtain and use information, for example, the presentation of technical reports, business and technical data and the use of visual aids for presentations. Learners will also consider how to make best use of ICT within technological settings that are relevant to their programme of study or area of employment.

Learning outcomes

On completion of this unit a learner should:

1 Be able to interpret and use simple engineering drawings/circuit/network diagrams and sketches to communicate technical information

2 Be able to use verbal and written communication skills in engineering settings

3 Be able to obtain and use engineering information

4 Be able to use information and communication technology (ICT) to present information in engineering settings.

Unit content

1 **Be able to interpret and use simple engineering drawings/circuit/network diagrams and sketches to communicate technical information**

Interpret: obtain information and describe features eg component features, dimensions and tolerances, surface finish; identify manufacturing/assembly/ process instructions eg cutting lists, assembly arrangements, plant/process layout or operating procedures, electrical/electronic/communication circuit requirements; graphical information used to aid understanding of written or verbal communication eg illustrations, technical diagrams, sketches

Engineering drawings/circuit/network diagrams: working documents eg first and third angle projections, detail and assembly drawings, plant/process layout diagrams, electrical/electronic/communications/circuit diagrams, system/network diagrams; use of common drawing/circuit/network diagram conventions and standards eg layout and presentation, line types, hatching, dimensions and tolerances, surface finish, symbols, parts lists, circuit/component symbols, use of appropriate standards (British (BSI), International (ISO))

Sketches: free-hand illustration of engineering arrangements using 2D and 3D techniques eg components, engineering plant or equipment layout, electrical/electronic circuits/network diagrams, designs or installations

2 **Be able to use verbal and written communication skills in engineering settings**

Written work: note taking eg lists, mind mapping/flow diagrams; writing style eg business letter, memo writing, report styles and format, email, fax; proofreading and amending text; use of diary/logbook for planning and prioritising work schedules; graphical presentation techniques eg use of graphs, charts and diagrams

Verbal methods: speaking eg with peers, supervisors, use of appropriate technical language, tone and manner; listening eg use of paraphrasing and note taking to clarify meaning; impact and use of body language in verbal communication

3 **Be able to obtain and use engineering information**

Information sources: non-computer-based sources eg books, technical reports, institute and trade journals, data sheets and test/experimental results data, manufacturers' catalogues; computer-based sources eg inter/intranet, CD ROM-based information (manuals, data, analytical software, manufacturers' catalogues), spreadsheets, databases

Use of information: eg for the solution of engineering problems, for product/service/topic research, gathering data or material to support own work, checking validity of own work/findings

4 **Be able to use information and communication technology (ICT) to present information in engineering settings**

Software packages: word processing; drawing eg 2D CAD, graphics package; data handling and processing eg database, spreadsheet, presentation package, simulation package such as electrical/electronic circuits, plant/process systems; communication eg email, fax, inter/intranet, video conferencing, optical and speech recognition system

Hardware devices: computer system eg personal computer, network, plant/process control system; input/output devices eg keyboard, scanner, optical/speech recognition device, printer, plotter

Present information: report that includes written and technical data eg letters, memos, technical product/service specification, fax/email, tabulated test data, graphical data; visual presentation eg overhead transparencies, charts, computer-based presentations (PowerPoint)

Grading grid

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

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 the learner is able to:**	**To achieve a distinction grade the evidence must show that the learner is able to:**
P1 interpret an engineering drawing/ circuit/network diagram and sketches P2 produce an engineering drawing/circuit/ network diagram and sketches P3 identify and use appropriate standards, symbols and conventions in the production of an engineering drawing/ circuit/network diagram P4 communicate information effectively in written work P5 communicate information effectively using verbal methods P6 identify and use appropriate information sources to solve an engineering task P7 select and use appropriate ICT software packages and hardware devices to present information.	M1 evaluate a written communication method and identify ways in which it could be improved M2 review the information sources obtained to solve an engineering task and explain why some sources have been used but others rejected M3 use an ICT software package and its tools to prepare and present clearly laid out work.	D1 justify their choice of a specific communication method and the reasons for not using a possible alternative D2 critically evaluate their use of an ICT presentation method and identify an alternative approach.

Essential guidance for tutors

Delivery

Delivery of this unit at an early stage of the learning programme would help learners communicate effectively in the other units of the programme. The unit assumes that the underpinning skills (eg ability to produce an engineering drawing/circuit/network diagram, ability to use ICT) are in place and focuses on developing these skills to communicate information.

Opportunities should be provided for learners to develop their communication skills and enable them to add to the breadth and depth of the their experience. In particular, an emphasis should be placed on the development of 'hands-on' skills. Formative learning activities (either stand alone or, ideally, activities integrated with other units in the programme) could be constructed around the following typical engineering tasks:

- reading and using an engineering drawing/circuit/network diagram and sketches to obtain information/understand a task
- preparing an engineering drawing/circuit/network diagram template (to include standard drawing/circuit/network information)
- using a 2D ICT-based software package to produce a detailed engineering component drawing or circuit/layout/network diagram (using the template produced previously)
- producing freehand sketches (2D and 3D) of engineering arrangements eg a component, circuit, layout arrangement
- delivering a brief presentation (of eight minutes or more) using appropriate visual aids and responding appropriately to questions
- conducting a brief interview (lasting no longer than 15 minutes) with another learner and taking notes to summarise the outcome
- taking part in a group discussion to identify or share technical information within a set task
- preparing a letter to an engineering supplier requesting modifications to an engineered component
- preparing a brief technical report concerning a design modification
- producing a data sheet for a simple engineered product or service
- using information sources (literature, CD ROM and websites) to obtain data relating to an engineered product and summarise this in the form of a brief technical report
- sending and receiving email correspondence to convey engineering ideas and technical data.

The teaching and learning strategies used to deliver the unit must be set within an engineering context. There is a strong case for the delivery of this unit to be integrated, as far as possible, with other units in the programme rather than being taught as a stand-alone unit. This would ensure that the skills required (producing drawings and documents, finding, using and presenting information, using ICT) are developed as they are needed. By not adopting an integrated approach there is a risk that it could lead to a loss of relevance and the need for learners to undertake unnecessary learning development and assessment activities.

Note that the use of 'eg' in the content is to give an indication and illustration of the breadth and depth of the area or topic. As such, not all content that follows an 'eg' needs to be taught or assessed.

Assessment

Unit 3: Engineering Project could provide an excellent vehicle for an integrated approach to the assessment of this unit. The project work undertaken will require learners to use communication skills to interpret information, prepare sketches and drawings, give presentations, develop and use data sheets, produce technical reports and letters etc. Other units within the programme could also be used to provide effective and relevant learning and formative or even summative assessment opportunities. However, using *Unit 3: Engineering Project* for assessment has the advantage of providing a structured focus for the work and a coherent source of relevant evidence.

To achieve a pass, learners should be able to interpret (P1) and produce (P2) engineering drawings/circuit/network diagrams and sketches (2D and 3D). This will need to be at a level sufficient for them to understand and communicate technical information. This must include identification and use of appropriate standards, symbols and conventions (P3). The use of 'drawings/circuit/network diagrams' in the criteria P1 and P2 is intended to indicate a choice that will depend on the focus of the learning programme in which this unit is being delivered. For example a learner on a mechanical programme is likely to choose to interpret and produce engineering drawings, whilst a learner studying electrical/electronics is more likely to interpret and produce circuit diagrams.

A single assessment activity could be used to link and capture evidence for the first three pass criteria (P1, P2 and P3). The activity would need to ensure that learners had an opportunity to obtain information, describe features, identify instructions and make use of graphical information (P1). For example, the task could be to work with written operating instructions that include supporting diagrams and sketches (2D and 3D). From the initial investigation, the activity could then require learners to produce their own drawing and sketches (P2). The criterion P3 would need to be applied to both the interpretation (identify) and the production (use) of their working document.

Learners should also be able to use written (P4) and verbal (P5) communication methods. The written work must include evidence of note taking, the ability to use a specific writing style, proofread and amend text, use a diary/logbook and use graphical presentation techniques. It might be that all of these will not necessarily occur in a single task/activity. If not, it would be acceptable for a number of pieces of assessment evidence to be brought together to meet this criterion.

The use of verbal methods (P5) will require learners to demonstrate speaking and listening skills and an understanding of the impact and use of appropriate body language. The evidence for this should come from one task/activity so that all three aspects are being dealt with at the same time. This could be a meeting with either peers and/or a supervisor, or could come from a presentation delivered by the learner to a group. It would be important to ensure that the learner had to take questions from the group to enable the tutor to capture evidence of their ability to listen. The evidence for this criterion is likely to be a tutor observation record or witness statement.

P6 can be assessed using any structured activity that requires learners to identify and use appropriate information sources to solve an engineering task. It is essential that the information comes from both computer-based and non-computer based sources. The evidence for this criterion could be as simple as suitably referenced work (a bibliography would not be sufficient). However, it would be preferable to have a record of the original source and a hard copy, annotated to show the information identified and used for the task (or at least an example of this process).

The final pass criterion (P7), could also be assessed using any relevant tasks that require learners to select and use appropriate ICT software packages and hardware devices to present information. It is essential that the task or tasks chosen for this criterion provide learners with opportunities to use appropriate software to cover all the ICT applications listed in the content, ie there must be evidence of learners' selection and use of ICT for word processing, drawing, data handling and communication (such as email). The requirement for hardware devices is limited to the choice and use of a computer system and relevant input/output devices that would be needed for the task carried out. It is expected that the range of information presented using ICT will include a technical report and visual presentation material eg overhead transparencies, chart, computer-based presentation (PowerPoint).

As already suggested, *Unit 3: Engineering Project* could provide an excellent vehicle for assessment of this unit since it could provide a central focus and therefore a source of coherent assessment evidence. Any alternatives should try to establish a similar coherence and avoid fragmentation of the pass criteria wherever possible.

To achieve a merit, learners should be able to evaluate a written communication method and identify ways in which it could be improved (M1). This could be learners' own written work or the written work of someone else. The important aspect of this criterion is the learners' ability to use their skills and understanding of communication methods to appraise the work and identify enhancements.

In addition, learners will need to be able to review the information sources obtained to solve an engineering task and explain why some sources have been used but others rejected (M2). This criterion is about reflection and the need to carefully consider, measure and express the value (or not) of other people's work as a source of information. Learners need to have identified both non-computer-based and computer-based information sources for P6 and it is this material that they should be reviewing for M2. Achievement might well be implicit if the task undertaken for P6 has reached a satisfactory solution. However, the expected evidence for this criterion would be a copy of the source material used, suitably annotated to explain its value or why it has been rejected.

Finally, merit criterion M3 requires learners to use an ICT software package and its tools to prepare and present clearly laid out work. This criterion requires learners to

have taken time to reflect on the impact of their work and use the software tools available to improve the presentation (eg good/consistent use of font size/colour, alignment of text, positioning on the page, use of automated labels, legends and titles for graphs).

To achieve a distinction, learners should be able to justify their choice of a specific communication method and the reasons for not using a possible alternative (D1). This could be any communication method that the learner has chosen to use (eg drawings, written, verbal). It does require learners to have considered at least one possible alternative during the initial selection of the method used. Learners will therefore need to be briefed to collect evidence of this selection process, which might otherwise be lost or ignored (eg initial outlines/drafts, notes of any consultation with others on method to be employed). The key issue for this criterion is learners' ability to reflect and evaluate. At pass level, learners will have shown their ability to communicate information effectively and, at merit, to be critical of the content of their own or other people's work. At distinction level, they should be critical of the choice of communication method used.

The final distinction criterion (D2), requires learners to critically evaluate their use of an ICT presentation method and identify an alternative approach. This criterion is about the method of presentation and not the method of communication. It also has a direct link with related pass (P7) and merit (M3) criteria. At pass, learners needed to be able to use ICT to present information and, at merit, to reflect on and improve the presentation to a standard that would be acceptable in industry. For D2, learners should consider the overall approach taken. For example, could a word-processed technical report have been presented using a computer-based presentation package, such as PowerPoint, including automated routines and animated graphics or video clips? The evidence for this is likely to be a written evaluation. A rough outline illustrating their identified alternative approach or even a small section of the original reworked using an alternative approach could be used to support the written evaluation.

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

This unit will provide learners with the necessary skills to interpret, produce and use written and verbal communication methods in any of the units within the qualification. This unit will also provide the essential communication skills and understanding required during *Unit 3: Engineering Project*.

The unit also covers some of the knowledge and understanding associated with several of the SEMTA Level 3 National Occupational Standards, particularly:

- Level 3 NVQ in Engineering Leadership — Unit 3: Produce Detailed Drawings
- Level 3 NVQ in Business Improvement Techniques — Unit 2: Contributing to Effective Team Working
- Level 3 NVQ in Mechanical Manufacture — Unit 2: Using and Interpreting Engineering Drawings and Documents
- Level 3 NVQ in Engineering Maintenance — Unit 2: Using Engineering Drawings and Documents in Maintenance Activities.

Essential resources

Access to information and communication technology resources (including the internet) is essential for the delivery of this unit, as is a well-stocked source of reference material. Learners should be provided with access to an appropriate 2D engineering drawing package (such as AutoCAD, AutoSketch or equivalent).

Learners should also be provided with a variety of sample written materials (letters, memos, technical reports, data sheets, catalogues), drawings (general arrangement, assembly, detail drawings and circuit/network layout diagrams) and sketches. Centres will need to provide access to appropriate presentation and graphics software (eg Microsoft PowerPoint, Visio, CorelDraw), spreadsheet/database software (eg Microsoft Excel/Access) and computer hardware (eg scanners, printers, optical character recognition and speech recognition software, barcode readers).

Indicative reading for learners

Textbooks

Tooley M and Dingle L — *BTEC National Engineering, First Edition* (Newnes, 2002) ISBN 0750651660

Key skills

Achievement of key skills is not a requirement of this qualification but it is encouraged. Suggestions of opportunities for the generation of level 3 key skill evidence are given here. Staff should check that learners have produced all the evidence required by part B of the key skills specifications when assessing this evidence. Learners may need to develop additional evidence elsewhere to fully meet the requirements of the key skills specifications.

Communication Level 3	
When learners are:	**They should be able to develop the following key skills evidence:**
• communicating information effectively in group settings through the use of verbal methods	C3.1a Take part in a group discussion.
• communicating information effectively during a formal presentation through the use of verbal methods and graphical presentation techniques eg use of graphs, charts, diagrams, sketches and illustrations	C3.1b Make a formal presentation of at least eight minutes using an image or other support material.
• identifying and using appropriate information sources to solve engineering tasks (including information presented using graphical presentation techniques such as graphs, charts and diagrams)	C3.2 Read and synthesise information from at least **two** documents about the same subject. Each document must be a minimum of 1000 words long.
• communicating information effectively using written work (including information presented using graphical presentation techniques).	C3.3 Write **two** different types of documents, each one giving different information about complex subjects. One document must be at least 1000 words long.

Information and communication technology Level 3	
When learners are:	**They should be able to develop the following key skills evidence:**
• identifying and using appropriate information sources to solve engineering tasks eg using the worldwide web and/or CD ROM media or non-ICT sources when carrying out background research)	ICT3.1 Search for information, using different sources, and multiple search criteria in at least one case.
• communicating information effectively in written work using ICT based methods	ICT3.2 Enter and develop the information and derive new information.
• using appropriate software (eg PowerPoint) and hardware (eg laptop/PC, printer, projector) for the preparation and presentation of information.	ICT3.3 Present combined information such as text with image, text with number, image with number.
Improving own learning and performance Level 3	
When learners are:	**They should be able to develop the following key skills evidence:**
• planning and carrying out the communications assignments (including periodic reviews with the tutor as assignments progress).	LP3.1 Set targets using information from appropriate people and plan how these will be met. LP3.2 Take responsibility for your learning, using your plan to help meet targets and improve your performance. LP3.3 Review progress and establish evidence of your achievements.