IVQs in Electrical and Electronic Engineering (8030-2000)

Level 2 IVQ Technician Certificate in Electrical and Electronic Engineering (8030-21) (500/5812/5)

Qualification handbook for centres

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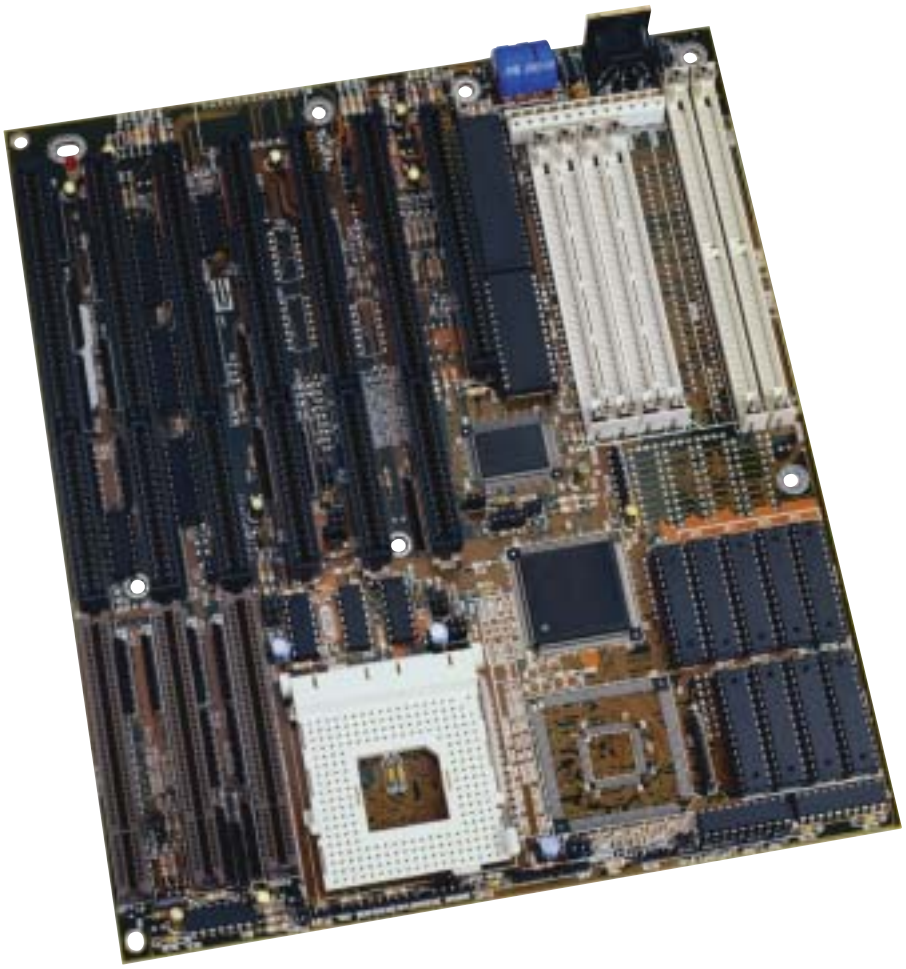

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Important notice

Following the accreditation of the Technician IVQs in Electrical and Electronic Engineering (8030-2000) on the National Qualifications Framework of England, Wales and Northern Ireland (NQF), some changes have been made to the qualification, at the request of the Office of the Qualifications and Examinations Regulator (Ofqual), the qualifications regulator in England.

These changes took effect on 1 June 2009 and are outlined on this page.

Note: the content of the qualifications has not changed following accreditation.

Changes to the qualification title
The qualification title has changed as follows:

Technician Certificate in Applied Electrical and Electronic Engineering (8030-21)
changed to
Level 2 IVQ Technician Certificate in Electrical and Electronic Engineering (8030-21)
Accreditation number: 500/5812/5

Changes to the unit titles
Following the accreditation of the Technician IVQs in Electrical and Electronic Engineering, each unit has been given an accreditation reference number which will appear on the Certificate of Unit Credit.

The content of the units is unchanged.

Level 2 IVQ Technician Certificate in Electrical and Electronic Engineering (8030-21)
Accreditation number: 500/5812/5

A/502/2601 – Engineering Fundamentals 1
F/502/2602 – Engineering Fundamentals 1 Practical Assignments
L/502/2604 – Electrical and Electronic Applications
R/502/2605 – Electrical and Electronic Applications Practical Assignments

Registration for theory examination
Registration process for the theory examination has not changed.

Result submission for practical assessment
Result submission process for the practical assessments has not changed.

Change to the grading
The grade 'Credit' has been changed to 'Merit'. All other grades are unchanged. The content of the units concerned is also unchanged.

Notification of Candidate Results (NCR) and Certificate of Unit Credit (CUC)
Notification of Candidate Results (NCR) and Certificate of Unit Credit (CUCs) continue to be available on completion of each assessment (theory or practical).

Final certificate will be issued on successful completion of all the required assessments.

'Theory only' route
The 'Theory only' route continues to be available as an unaccredited qualification.

Changes to the certificate layout
Certificates issued on completion of an accredited IVQ show the accredited title and the accreditation number for the qualification. The level in the accredited title refers to the NQF level the qualification is accredited at.

The certificate also lists all the units achieved, including the grade and the unit accreditation number.

The certificate carries the logos of the regulatory authorities in England, Wales and Northern Ireland indicating that the NQF accreditation only applies to these countries.

Levels of City & Guilds qualifications

All City & Guilds qualifications are part of an integrated progressive structure of awards arranged over eight levels, allowing people to progress from foundation to the highest level of professional competence. Senior awards, at levels 4 to 7, recognise outstanding achievement in industry, commerce and the public services. They offer a progressive vocational, rather than academic, route to professional qualifications. An indication of the different levels and their significance is given below.

NQF level#	City & Guilds qualifications/programmes	Other qualifications*
8	Fellowship (FCGI)	Doctorate
7	Membership (MCGI) Master Professional Diploma Level 5 vocational awards NVQ/SVQ Level 5	Master's Degree Postgraduate Diploma Postgraduate Certificate
6	Graduateship (GCGI) Associateship (ACGI)**	Bachelor's Degree Graduate Certificate and Diploma
5	Level 5 IVQ Advanced Technician Diploma Full Technological Diploma	Higher National Diplomas Foundation Degree Diplomas of Higher and Further Education
4	Licentiateship (LCGI) Higher Professional Diploma Level 4 vocational awards NVQ/SVQ Level 4	Certificate of Higher Education
3	Level 3 IVQ Advanced Diploma Level 3 IVQ Specialist Advanced Diploma*** Level 3 IVQ Technician Diploma Level 3 vocational awards NVQ/SVQ Level 3	A Level Scottish Higher Advanced National Certificate in Education BTEC National Certificate/Diploma
2	Level 2 IVQ Diploma Level 2 IVQ Specialist Diploma*** Level 2 IVQ Technician Certificate Level 2 vocational awards NVQ/SVQ Level 2	GCSE grades A*-C Scottish Intermediate 2/Credit S Grade BTEC First Certificate
1	Level 1 IVQ Certificate Level 1 vocational awards NVQ/SVQ Level 1	GCSE grades D-G Scottish Intermediate 1/General S Grade Scottish Access 1 and 2

\# National Qualifications Framework of England, Wales and Northern Ireland (NQF)
* Broad comparability in level
** Only graduates of the City & Guilds College, Imperial College of Science, Technology and Medicine, are awarded the Associateship (ACGI)
*** Part of a new qualification structure which is being introduced across the IVQ provision
IVQ International Vocational Qualifications
NVQ National Vocational Qualifications

IVQ in Electrical and Electronic Engineering 8030 (2000)

About City & Guilds

We provide assessment and certification services for schools and colleges, business and industry, trade associations and government agencies in more than 100 countries. We have over 120 years of experience in identifying training needs, developing assessment materials, carrying out assessments and training assessment staff. We award certificates to people who have shown they have mastered skills that are based on world-class standards set by industry. City & Guilds International provides a particular service to customers around the world who need high-quality assessments and certification.

Introduction to this programme

We have designed the Technician Awards in Engineering programme for those undergoing training or employed in this area of work. The programme aims to reflect the international nature of the knowledge and skills and activities needed for different countries or cultures.

We do not say how much time a candidate would need to carry out the programme, but we do give advice on guided learning hours for each unit at each level (see below). The programme has three related levels.

Certificate
The certificate (about 300 guided learning hours) provides a broad introduction to the theory and practical sides of engineering for a front-line worker or a person beginning an academic training programme.

Diploma
The diploma (about 600 guided learning hours) provides more practice involving a broader range of skills appropriate to a person who may also supervise, or who is going on into higher education.

Advanced Diploma
The advanced diploma (about 600 guided learning hours) takes these skills to the level appropriate for a person preparing for or working in first-level management. It is also appropriate for someone who wants to receive specialised training at a high level.

We stress that these figures are only a guideline and that we award certificates and diplomas for gaining and showing skills by whatever mode of study, and not for periods of time spent in study.

We provide certificates for all work-related areas at seven levels within our structure of awards shown in appendix C. This programme covers level 2. The standards and assessments for the diploma (level 3) and the advanced diploma (level 4) are published separately.

Full Technological Diploma
We will award the Full Technological Diploma (FTD) in Engineering to someone who is at least 21, who has had at least two years relevant industrial experience, and who has successfully finished the assessments for the diploma and advanced diploma levels of this award. If candidates enter for this diploma, they must also send us a portfolio of evidence to support their application.

Making entries for assessments

Candidates can only be entered for the assessments in this subject if the approved examination centres agree. Candidates must enter through an examination centre we have approved to carry out the assessments for 8030 Technician Awards in Engineering.

There are two ways of entering candidates for assessments.

Internal candidates
Candidates can enter for examinations if they are taking or have already finished a course at a school, college or similar training institution that has directed their preparation whether by going to a training centre, working with another institution, or by open learning methods.

External candidates
These are candidates who have not finished a programme as described above. The examination centres must receive their application for entry well before the date of the examination concerned. This allows them to act on any advice you give about assessment arrangements or any further preparation needed. External candidates must carry out practical assignments and projects if necessary, and they will need extra time and guidance to make sure that they meet all the requirements for this part of the assessment.

In this publication we use the term 'centre' to mean a school, college, place of work or other institution.

Resources

If you want to use this programme as the basis for a course, you must read this booklet and make sure that you have the staff and equipment to carry out all parts of the programme. If there are no facilities for realistic practical work, we strongly recommend that you develop links with local industry to provide opportunities for hands-on experience.

Assessments

There is one level of Technician Certificate Award in Engineering.

Certificate

We use a numbering system to allow entries to be made for our awards. The numbers used for this programme are as follows.

Award number

8030-21 Technician Certificate in Applied Electrical and Electronic Engineering

Technician Certificate in Electrical and Electronic Engineering Theory

We use award numbers to describe the subject and level of the award.

Component numbers

200 Engineering Fundamentals 1
201 Engineering Fundamentals 1 Practical Assignments
202 Electrical and Electronic Applications
203 Electrical and Electronic Applications Practical Assignments

We use component numbers to show units for which we may award a Certificate of Unit Credit.

We use these numbers throughout this booklet. You must use these numbers correctly if you send forms to us.

Technician Certificate in Applied Electrical and Electronic Engineering

To carry out what is needed for the Technician Certificate in Applied Electrical and Electronic Engineering, candidates must be successful in all of the following assessments.

8030-21-200 Engineering Fundamentals 1 (written multiple choice paper which lasts one and a half hours)

[8030-21-201] Engineering Fundamentals 1 Practical Assignments

8030-21-202 Electrical and Electronic Applications (written multiple choice paper which lasts one hour)

[8030-21-203] Electrical and Electronic Applications Practical Assignments

(Total two written papers)

The practical assignments are carried out during the learning programme and should be finished by the date of the written examination so you can send all the results to us. (See appendix B and C.)

To receive this award candidates must carry out the following practical assignments:

- practical assignments 201/8, 201/10, 201/14, 203/3;
- one of 201/2, 201/3, 201/4; and
- one of 201/6, 201/7; and
- one of 203/1, 203/2; and
- one of 203/4, 203/5; and
- two of 201/11, 201/12, 201/13.

Candidates must also choose one other practical assignment.

(Total eleven practical assignments)

Technician Certificate in Electrical and Electronic Engineering Theory

To carry out what is needed for the Technician Certificate in Electrical and Electronic Engineering Theory, candidates must be successful in all of the following assessments.

8030-21-200 Engineering Fundamentals 1 (written multiple choice paper which lasts one and a half hours)

8030-21-202 Electrical and Electronic Applications (written multiple choice paper which lasts one hour)

(Total two written papers)

There are no practical assignments for this award.

We provide assessments in two ways.

a Fixed date

These are assessments which are carried out on dates and times we set. These assessments have no brackets around their numbers.

b Free date

These are assignments which are carried out at a college or other training establishment on a date or over a period which the college chooses. These assessments have brackets around their numbers.

In this programme the written assessments are fixed date. The practical assessments and the projects are free date.

You must carry out assessments according to our International Directory of Examinations and Assessments. If there are any differences between information in this publication and the current directory, the Directory has the most up-to-date information.

Results and certification

Everyone who enters for our certificates, diplomas, and advanced diplomas receives a 'Notification of Candidate Results' giving details of how they performed.

If candidates successfully finish any assessment within this programme (for example, any one of the examination papers) they will receive a Certificate of Unit Credit towards the certificate or diploma for which they are aiming. We grade coursework assessments as pass or fail. We grade written assessments on the basis of fail, pass, credit or distinction. The Certificate of Unit Credit will not mention assessments which they do not enter, which they failed or from which they were absent.

Each certificate or diploma clearly states what candidates need for full certification at the relevant level, allowing schools, colleges and employers to see whether they have met the full requirements.

If candidates successfully finish all the requirements for a full certificate or a diploma, they will automatically receive the appropriate certificate.

We will send the 'Notification of Candidate Results', Certificates of Unit Credit, certificates, diplomas and advanced diplomas to the examination centre to be awarded to successful candidates. It is your responsibility to give the candidates the certificates. If candidates have a question about the results and certificates, they must contact you. You may then contact us if necessary.

We will also send you a results list showing how all candidates performed.

How to offer this programme

To offer this programme you must get approval from us. There are two categories of approval.

Subject approval
We give approval to offer a teaching course based on this syllabus.

Examination centre approval
We give approval to enter candidates for examinations.

To be approved by us to offer a teaching course you must send us the application form.

To enter candidates for examinations you must be approved by us as an examination centre. For this programme it is possible to act as a registered examination centre only, and accept external candidates. Approved examination centres must provide suitable facilities for taking examinations, secure places to keep the examination papers and materials, and may have an appointed visiting verifier to review practical work.

After we have received and accepted an application, we will send an approval letter confirming this. You can then send entries in at any time using the International Directory of Examinations and Assessments for guidance.

Please note that in this section we have provided an overview of centre approval procedures. Please refer to the current issue of 'Delivering International Qualifications – Centre Guide' for full details of each aspect of these procedures.

Other information

Designing courses of study

Candidates for the various Technician Awards in Engineering will have come from different backgrounds and will have different employment and training experiences. We recommend the following:

- carry out an assessment of the candidates' achievements so you can see what learning they already have and decide the level of entry they will need; and
- consider what learning methods and places will best suit them.

When you assess a candidate's needs, you should design teaching programmes that consider:

- what, if any, previous education qualifications or training the candidate has, especially in the various general vocational education certificates we provide; and
- what, if any, previous practical experience the candidate has which is relevant to the aims of the programme and from which they may have learned the relevant skills and knowledge.

When you choose learning methods and places, you should consider the results of your assessments and whether the following are available.

- Open or distance learning material.
- Workplace learning that can be carried out on site or between you and a local workplace. This will allow the candidates access to specialised equipment and work experience.
- Working with other registered centres to share facilities.
- Opportunities for co-operative learning between candidates for different certificates who need to gain similar skills.

As long as the candidates meet the aims of this learning programme the structures of courses of study are up to you. So, it is possible to include extra topics that meet local needs.

You should avoid teaching theory alone. As far as possible the practical work should be closely related to work in the classroom so that candidates use their theory in a realistic work environment. You can use formal lectures in the classroom with appropriate exercises and demonstrations. Candidates should keep records of the practical work they do so they can refer to it at a later date.

We assume that you will include core skills, such as numeracy, communication, working with people, and organisation and planning throughout a teaching programme.

Presentation format of units

Practical competences
Each unit starts with a section on practical competences which shows the practical skills candidates must have.

At times we give more details about important words in each 'competence statement'.

For example

'202.43 State that there are two types of junction (bipolar) transistor.
Types: npn, pnp.'

In the above statement the word 'types' is given as a range which the candidate should be familiar with. Candidates should cover the complete range. When a range starts with the abbreviation 'eg' the candidates only need to cover some of the ranged areas or you can use suitable alternatives.

Knowledge requirements
Immediately after the section on practical competences the unit tells you what knowledge is needed for that area. The knowledge needed is closely linked to the practical competences, so it is best to teach the two together so that the candidate will understand the topic better.

Practical assignments
You should make sure all practical assignments are supervised and instructors should make sure that the results reflect the candidate's own work. You must hold all the documents and material in a file (portfolio) for each candidate for eight weeks after the application for a certificate. You must also keep separate records of the dates of all attempts by each candidate.

Entry Levels

We consider the following programmes to be relevant preparation for this programme.

Background to Technology (3660)

Numeracy (3750)

Entry Level Mathematics (see appendix A on page 87)

We also consider the following Pitman Qualifications award as relevant alongside this programme.

English for Speakers of Other Languages – higher intermediate level

If candidates do not have the above qualifications, they should have secondary school leaving passes in English and mathematics.

Progression routes and recognition

We consider the following programmes to be relevant progression routes from this programme.

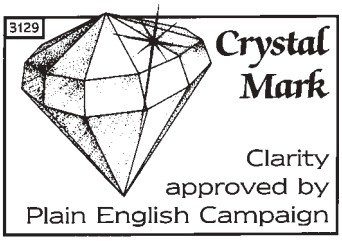
Technician Awards in Engineering Diploma Level (8030)

Technician Awards in Engineering Advanced Diploma Level (8030)

A number of UK universities and other higher-education institutions will accept success at diploma or advanced diploma level of this programme for direct entry onto higher-level programmes. The decision to accept a candidate on to a degree programme, and the level of entry, is up to the institution. We provide details of organisations recognising achievement in this programme.

Useful publications

We can provide a list of suggested text books covering specific areas of this programme. We may also have knowledge about other support materials. You should make sure that you have the latest information. We will automatically send updated lists to centres we have approved to offer this programme.



Plain English Campaign's Crystal Mark only covers the regulations.

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Syllabus
IVQ in Electrical and Electronic Engineering 8030 (2000)

Sections
Component numbers
200 Engineering Fundamentals 1
201 Engineering Fundamentals 1 – Practical Assignments
202 Electrical and Electronic Applications
203 Electrical and Electronic Applications – Practical Assignments

Mathematics

Practical competences

The candidate must be able to do the following:

Statistics

200.1 Conduct a survey and record data by means of a tally chart and produce the results in the form of a frequency table.

200.2 Represent the information contained in the frequency table in pictorial form.
Pictorial form: pie charts, bar charts and line graphs

200.3 Define arithmetic mean, the mode and the median and calculate their values from the distribution obtained.

Knowledge requirements

Instructors must ensure that candidates are able to:

Number systems

200.4 Express denary numbers in binary forms and binary numbers in denary forms.

200.5 Perform simple calculations involving addition, subtraction, multiplication and division of binary numbers.

Indices

200.6 Perform calculations applying rules of indices where m and n are positive integers.

Rules: $a^m a^n = a^{m+n}$, $\frac{a^m}{a^n} = a^{m-n}$, $(a^m)^n = a^{mn}$

200.7 State that $a^\circ = 1$ for all values of a.

200.8 Apply the rules where m and n are negative integers.
Rules: $a^m a^n = a^{m+n}$, $a^m/a^n = a^{m-n}$, $(a^m)^n = a^{mn}$

200.9 Apply the rules for fractional indices where n and m are positive integers, and recognise that $a^{1/n} = \sqrt[n]{a}$ and that $a^{m/n} = \sqrt[n]{a^m}$

200.10 Evaluate expressions which combine positive, negative and fractional indices.

Algebra

200.11 Factorise expressions by grouping and extraction of common factors.

200.12 Distinguish between an algebraic expression, an equation and an identity.

200.13 Maintain the equality of a given equation whilst applying any arithmetic operation.

200.14 Solve linear equations in one unknown including those involving brackets and fractions.

200.15 Form and solve linear equations.

200.16 Solve a pair of simultaneous linear equations in two unknowns by both substitution and elimination.

200.17 Evaluate formulae required in this and parallel units by substitution of given data.

200.18 Transpose simple formulae in which the subject is equal to an expression whose terms are connected by + or –

200.19 Transpose simple formulae in which the subject is equal to an expression composed of two or more factors.

200.20 Transpose formulae which contain a root or power.

200.21 Transpose formulae in which the subject appears in more than one term.

200.22 Transpose formulae and evaluate using given data.

Geometry and trigonometry

200.23 Use given formulae to calculate areas and perimeters of plane figures.
Plane figures: triangle, square, rectangle, parallelogram, circle, semi-circle

200.24 Use given formulae to calculate the surface area and volume of common solids.
Common solids: cubes, prisms, cylinders, pyramid, cone, sphere

200.25 Demonstrate by suitable examples that the ratio of the areas of similar shapes is equal to the square of the ratio of the corresponding linear dimensions.

200.26 Demonstrate by suitable examples that the ratio of the volumes of similar solids is equal to the cube of the ratio of corresponding linear dimensions.

200.27 State the angle sum of a triangle.

200.28 Identify the types of triangle.
Types: acute-angled, right-angled, obtuse-angled, equilateral, isosceles

200.29 Identify complementary angles.

200.30 Calculate the length of any third side of a right-angled triangle, given the length of the other two sides, using the theorem of Pythagoras.

200.31 Demonstrate, by suitable examples, that any triangle whose sides are in the ratios 3:4:5 forms a right-angled triangle.

200.32 Compare two triangles for similarity or congruency.

200.33 Determine an unknown side or an angle of a second triangle applying principles demonstrated in 200.32.

200.34 Define trigonometrical ratios and solve problems involving right angled triangles.
Ratios: sine, cosine, tangent

200.35 Identify components of a circle.
Components: radius, diameter, circumference, chord, tangent, secant, sector, segment, arc

200.36 Solve simple problems relating to circumference, radius and diameter of circles.

200.37 State that the angle between a tangent and the radius of a circle at the point of contact is a right-angle.

200.38 State the relationships between the internal angles formed by two radii and the tangents at the points of contact with the circumference of a circle.

200.39 Define the radian in terms of π

200.40 Convert degree measure to radians and vice versa.

Graphs

200.41 Choose suitable scales and plot graphs from experimental data.

200.42 Plot graphs of equations by forming a data table and plotting the points.
Equations: $y = mx + c$, $y = {}^1/x$, $y = x^2$

200.43 Read values from graphs and interpolate intermedial values between points.

200.44 Determine the intercept of a straight line on the y – axis by extrapolation.

200.45 Determine the gradient of a straight line graph.

200.46 Evaluate the law of a straight line graph in the form of y = mx + c

200.47 Determine the roots of a quadratic equation from the intersections of the graph with the x – axis.

200.48 Solve graphically a pair of simultaneous equations in two unknowns.

Science

Practical competences

The candidate must be able to do the following:

Dynamics

200.49 Construct distance/time graphs from measured data, and interpret slopes as speed or velocity.

200.50 Construct velocity/time graphs from measured data and interpret slopes as acceleration.

Electricity

200.51 Use a tungsten filament lamp, ammeter, voltmeter and variable resistors to demonstrate the effect of temperature on resistance.

Heat

200.52 Use a calorimeter to determine the specific heat capacity of a liquid.

Knowledge requirements

Instructors must ensure that candidates are able to:

SI Units and symbols

200.53 Identify basic SI units.
SI units: metre(m), kilogram(kg), second(s), ampere(A), kelvin(K)

200.54 Identify names and symbols for preferred SI prefixes.
Names and symbols: giga(G), mega(M), kilo(k), micro(μ), nano(n) and pico(p)

Dynamics

200.55 Define speed, velocity and acceleration.

200.56 Describe waves and wave motion.
Waves: sound waves, electromagnetic waves

200.57 Define amplitude, wavelength(λ), frequency(f) and the unit of frequency (hertz).

200.58 State the relationship velocity = frequency x wavelength ($v = f\lambda$).

200.59 Define momentum and state Newton's laws of motion.

200.60 State the relationship between force (f), mass (m) and acceleration (a).

200.61 Define the unit of force as the newton (N) and explain the relationship between weight and mass.

200.62 Solve problems involving Newton's laws of motion.

200.63 Define work and power and the units used.
Units: Joule (J), Watt (W)

200.64 Explain the relationship between work and energy.

200.65 Explain efficiency and solve problems involving work done by a constant force, power and efficiency.

200.66 Identify forms of energy.
Forms: mechanical (potential and kinetic), heat, chemical, electrical

200.67 Explain the principle of conservation of energy and energy conversion.
Energy conversion: electrical to heat, electrical to chemical, electrical to mechanical, mechanical to electrical, mechanical to heat

Statics

200.68 Represent force as a vector.

200.69 Explain the concept of equilibrium.

200.70 Explain the triangle of forces theorem and solve graphically problems using the triangle of forces theorem.

200.71 Explain the parallelogram of forces theorem and solve graphically problems involving the resultant and equilibrium of two inclined forces.

200.72 Define the moment of a force about a point.

200.73 Explain the principle of moments and solve problems involving straight and bell crank levers.

200.74 Define the centre of gravity and identify the position of the centre of gravity of symmetrically- shaped solids.

200.75 Define pressure and its units (N/m^2 or Pa).

200.76 Explain the distinction between absolute and gauge pressure.

200.77 Calculate pressure in engineering situations.

Heat

200.78 Explain the difference between heat and temperature.

200.79 Describe the methods of heat transfer.
Methods: conduction, convection, radiation

200.80 Describe the Celsius scale of temperature and explain the relationship between degrees Celsius (C) and Kelvin (K).

200.81 Define specific heat capacity and its units.

200.82 Calculate heat transfer in mixtures of hot and cold substances, involving their mass, specific heat capacity and temperature changes.

200.83 Describe with the aid of a temperature time graph the phase changes that occur when superheated steam is formed from ice by the uniform supply of heat energy.

200.84 Define specific latent heats of fusion and vapourisation and solve problems involving phase changes.

200.85 Define the coefficient of linear expansion and its units and solve problems involving the expansion and contraction of engineering components.

Electricity

200.86 Describe the effects of an electric current.
Effects: heating, chemical, magnetic

200.87 Describe the basic concept of a flow of electric current.

200.88 Define the coulomb, ampere, ohm and volt.

200.89 State Ohm's law and use the law to solve simple electrical circuit problems.

200.90 Identify the formula for power in a resistive electric circuit (power = voltage x current).

200.91 Identify the formula for energy in a resistive electric circuit (energy = power x time).

200.92 Explain the concept of a magnetic field.

200.93 Explain the principle of operation of electromagnet devices.
Electromagnetic devices: lifting magnet, relay and electric bell

200.94 Explain the concept of an electric field.

Drawing

All drawings should comply with BS308 or equivalent ISO standards. Electrical and electronic drawings should comply with BS3939 or equivalent ISO standards.

Practical competences

The candidates must be able to do the following:

Isometric drawing, oblique drawing and freehand sketching

200.95 Interpret isometric and oblique views.

200.96 Use an appropriate method to draw an isometric circle.

200.97 Produce isometric drawings (without the use of isometric scales) and oblique drawings from given orthographic drawings of simple mechanical and electrical components.

200.98 Produce freehand orthographic and pictorial sketches of simple mechanical and electrical components using square grid paper.

Orthographic working drawings

200.99 Produce detail drawings in first or third angle projection of simple mechanical and electrical components, from given isometric or oblique drawings.
Detail drawings: hidden detail, sectional views, dimensions, title block

200.100 Produce assembly drawings in first or third angle projection of simple mechanical and electrical assemblies from given assembly instructions and detail drawings of parts.
Assembly drawings: fastenings, bearings, sectional views, item (balloon) referencing, parts list, title block

Engineering fastenings

200.101 Use an approximate construction for drawing a standard hexagon nut and bolt.

Basic geometric constructions

200.102 Produce basic geometric constructions used in the preparation of orthographic working drawings.
Constructions: bisection of a straight line and an angle, division of a line into an equal number of parts, hexagon, tangency (tangent at a point on the circumference of a circle, common tangent to two circles, curve in a right angle)

Electrical and electronic circuit diagrams

200.103 Interpret simple electrical and electronic circuit diagrams identifying standard symbols for common components.
Common components: resistors, capacitors, inductors, ac and dc supplies, active devices, transformers

Knowledge requirements

Instructors must ensure that candidates are able to:

200.104 Identify instruments and equipment used for the production of good quality drawings.

200.105 Identify isometric and oblique forms of projection and distinguish between isometric and oblique views.

200.106 Explain the need for various types of drawings.
Types: detail, assembly, sub-assembly, combined

200.107 List the basic information required in a title block of a drawing.
Information: name of company, drawing number, descriptive title of depicted part or assembly, date, signatures, original scale, projection symbol, unit of measurement, revision number and issue number

200.108 List the main items of supplementary information to be included in the title block of a detail drawing.
Information: material, treatment, finish, general tolerances

200.109 List the headings required for a parts list on an assembly drawing.
Headings: item, description, number required, material

200.110 Identify orthographic first and third angle forms of projection in standard terms.
Terms: principal planes, points, lines, areas, simple three-dimensional objects

200.111 Identify the correct use of line for use when constructing drawings.
Use of line: centre line, outline, hidden detail, dimension, cutting plane, hatching

200.112 Identify and explain the recommendations made in the current edition of BS308, Part 1 on general principles or the equivalent ISO standard.
General principles: scales, lines, lettering, projection, symbols, sections, simple sectional views, symbols and abbreviations, conventional representations (eg threaded parts, bearings, knurling)

200.113 Interpret functional and non-functional dimensions from given working drawings.

200.114 Identify screw threads and ISO metric and square thread forms.

200.115 Identify a range of common types of fastening and locking devices used in engineering assembly drawings.
Fastening and locking devices: standard hexagonal nuts and bolts, lock nuts, studs, solid and hollow rivets, washers, threaded fasteners, pins, internal and external circlips, keys, splines

200.116 Identify the conventional representation of common electrical and electronic components in circuit and system diagrams in accordance with BS3939 or other approved international standards.
Common components: resistors, capacitors, inductors, ac and dc supplies, active devices, transformers

200.117 Identify the standard symbols for welded joints in accordance with BS499, Part 2 or the equivalent ISO specifications.
Types: butt, fillet, spot, seam

200.118 Explain the need for bearings

200.119 Identify types of journal bearing.
Types: plain (direct lined, solid inserts), ball, roller

Materials

Practical competences

The candidates must be able to do the following:

200.120 Select in terms of properties, ease of handling, availability, form of supply (eg round, square, sheet, plate) and cost, suitable materials for given mechanical and electrical components, using appropriate data sources.
Sources: text books, catalogues, standards (BS/ISO), data sheets, computer database

Knowledge requirements

Instructors must ensure that candidates are able to:

200.121 Identify a range of common materials and their uses.
Materials: plain carbon steel, stainless steel, cast iron, aluminium, aluminium alloys, brass, copper, bronze, thermoplastic and thermosetting polymers, glass fibre reinforced plastic (GFRP), carbon fibre reinforced plastic (CFRP) composites

200.122 Explain the terms ferrous, non-ferrous, metallic, non-metallic.

200.123 State the forms of supply in which a range of materials are commonly available.
Forms: rolled bar, extruded sections, strip, wire, sheet, plate, castings, forgings, woven cloth and pre-impregnated lay-up materials
Materials: metals, plastics

200.124 Identify and describe properties of materials.
Properties: tensile strength, shear strength, hardness, ductility, malleability, toughness, machinability, castability, corrosion resistance, thermal expansion and conductivity, electrical conductivity

200.125 Explain the purpose of heat treatment processes used to modify the properties of plain carbon steels.
Processes: annealing, hardening and tempering, case hardening

200.126 Explain the need for corrosion protection and state methods of surface protection.
Methods: painting, electroplating, plastic coating, chemical coating, galvanising

200.127 State the types of solder and flux used in electrical and electronic assembly.
Types: solder paste, resin cored solder, typical gauge and lead/tin ratio

200.128 Recognise the abbreviations commonly used on engineering drawings to represent materials.

Introduction to Computer Technology

An introduction to databases, spreadsheets and word processing.

Practical competences

The candidate must be able to do the following:

Load, save and print

200.129 Select a suitable software application for a given task.
Software: word processing, database, spreadsheet

200.130 Load applications software.

200.131 Load a data file.

200.132 Save a data file with an appropriate filename.

200.133 Print out all or part of a data file.

200.134 Exit application software to return to the operating system or graphical user interface (GUI).

Word processing

200.136 Open a new file and enter text.

200.137 Edit the contents of a document.
Edit: correct errors, insert word(s), delete word(s), insert paragraph breaks, delete paragraph breaks

200.138 Improve the appearance of a document.
Improve the appearance: bold, centre

Editing a database

200.139 Edit data into an existing database file.
Edit: add, delete, amend data

200.140 Define and execute a single condition search using appropriate operators.
Numerical operators: less than (<), greater than (>), equal to (=)

200.141 Sort a data file into numerical or alphabetical order.

Editing a spreadsheet

200.142 Identify and move the cell pointer to any row, column and cell within a spreadsheet using cursor keys or mouse control.
Cursor keys: up, down, left, right
Mouse control: point and click, use of scroll bars

200.143 Edit the contents of a cell in an existing spreadsheet file.
Edit: amend, replace, delete

200.144 Insert and delete columns and rows in a spreadsheet.

200.145 Insert formulae, containing cell addresses and numbers, to add, subtract, multiply and divide.

200.146 Use the sum function in spreadsheets to sum rows and columns.

200.147 Replicate a formulae in a row or a column.

Knowledge requirements

Instructors must ensure that candidates are able to:

Hardware and software

200.148 Identify the four main components of a computer system.
Main components: main processor, input, output, storage

200.149 Describe the components of a microcomputer system.
Components: keyboard, mouse, CPU, monitor (VDU), disk drive, printer

200.150 Explain that software is a set of instructions that enables the computer to carry out operations.

200.151 Identify the main functions of commonly used software applications packages.
Packages/functions: spreadsheet (numerical analysis and manipulation), word processing (document production), database (file creation, updating, searching and sorting), computer aided design (line drawings used for architecture and engineering)

Data input and output

200.152 Describe different methods for inputting data and their applications.
Methods: direct entry (keyboard), OCR, OMR, scanner, bar code reader, electronic file, remote data logger, electronic sensor (transducer)

200.153 Describe devices used to output data.
Devices: screen, printer, control devices, audio systems

200.154 Compare printers for output in terms of speed and cost.
Printers: ink-jet printer, laser printer, impact (dot matrix, daisy wheel)

Data storage

200.155 Describe typical media for storing data and programs.
Media: floppy disk, hard disk, CD-Rom, tape streamers, cassettes

200.156 State that computer memory (RAM) is volatile and that any data not stored will be lost.

200.157 State why floppy disk must be formatted before use and the effect on previously recorded data of formatting a disk.

Health and Safety

It is recommended that candidates undertake a basic first aid course and have various types of fire extinguisher demonstrated to them.

Practical competences

The candidate must be able to do the following:

Practical safety in the workplace

200.158 Identify hazards and safety facilities in a workshop.

Knowledge requirements

Instructors must ensure that candidates are able to:

Safety in the workplace

200.159 Describe the general requirements for the observance of safe practice.
General requirements: alertness to danger, maintaining personal hygiene, general tidiness, protecting self and others, a knowledge of emergency and hazard reporting procedures

200.160 Describe the human and environmental factors that may lead to an accident.
Factors: tiredness, carelessness, improper behaviour, lack of training, unguarded or faulty tools and machinery, unsuitable clothing, lack of adequate ventilation

200.161 Explain the dangers associated with the following materials.
Materials: compressed gases, cryogenic materials, noxious fumes and liquids, explosives, combustible materials, salt baths

200.162 State the need for eye protection in relation to sparks, dust, chippings, liquid splashes.

200.163 State special precautions to be observed when working with hazardous substances.
Hazardous substances: industrial chemicals, poisons, toxic gases, petro-chemicals

200.164 State the types of fire extinguisher generally available in an industrial environment and their suitability for different types of fire.
Fire extinguisher: water, foam, dry powder, carbon dioxide
Types of fire: dry materials, oil and petrol, electrical

200.165 Describe the first aid procedures required in the event of an industrial accident.
First aid procedures: dealing with electric shock, administering mouth to mouth resuscitation, dealing with eye and other types of physical injury

200.166 Describe the sources of electrical danger and the methods of protection.
Methods of protection: insulation, earthing, circuit breakers, fuses, residual current devices (RCD)

200.167 State the essential procedures for the safe handling and storage of materials.

200.168 State the correct procedures for lifting bulky or heavy loads including manual lifting and the safe use of lifting equipment.

Test specification for written paper Engineering Fundamentals 1 (8030-21-200)

This is a written examination paper lasting one and a half hours and comprising sixty multiple choice questions. Candidates must answer **all** 60 questions.

The examination paper will cover the knowledge specifications:

Topic	Approximate % examination weighting
Mathematics	27
Science	27
Drawing	16
Materials	10
Introduction to Computer Technology	10
Health and Safety	10

Practical assignment 201/1: Carry out a Statistical Survey

1 Objective references

200.1, 200.2, 200.3

2 Preparation

2.1 **Location of test**
Training centre and appropriate locations for the collection of data.

2.2 **Requirements**
Plain paper, graph paper, ruler, compass, pencil, pen

2.3 **Instructor notes**
Instructors must provide guidance to candidates in the selection of an appropriate assignment. Candidates must conduct a survey and produce the results in a frequency table and in pictorial form.

Candidates should be able to collect at least 50 items of data.

3 Candidates' instructions

3.1 You need to agree the assignment that you are doing with your instructor before starting the assignment.

3.2 Conduct a survey and collect at least 50 items of data.

3.3 Present the results of the survey in the form of a frequency table.

3.4 Produce a bar chart or pie chart to represent this information.

3.5 Produce a line graph to represent this information.

3.6 From the distribution obtained calculate:

3.6.1 the mean

3.6.2 the mode

3.6.3 the median

3.7 Ensure that you put your name on all your work and hand it in to the instructor.

4 Marking

4.1	Assignment agreed with the instructor.	[ ]
4.2	A survey conducted with at least 50 items of data.	[ ]
4.3	The results of the survey presented in the form of a frequency table.	[ ]
4.4	A bar chart or pie chart produced to represent this information.	( )
4.5	A line graph produced to represent this information.	( )
4.6	From the distribution obtained	
	4.6.1 the mean	( )
	4.6.2 the mode	( )
	4.6.3 the median are calculated	( )
4.7	All materials produced are handed in.	[ ]

5 Assignment completion

The candidate will have satisfactorily completed this assignment if successful in all items marked with a [ ] and at least 4 of the items marked with a ( ).

A period of seven days must elapse before an unsuccessful candidate may retake this assignment.

Practical assignment 201/2: Construct Distance/Time Graphs from Measured Data

1 Objective references

200.49, 200.50

2 Preparation

2.1 **Location of test**
The training centre or other venue where supervision and appropriate working conditions will be provided.

2.2 **Requirements**
Ticker-timer with 12V ac supply

Ticker-timer tape

'Model (toy) car' whose velocity is to be measured (could be hand-made)

Wooden plank to act as runway

1m ruler to measure distances

2.3 **Instructor notes**
Candidates may undertake assignments in pairs, provided results analysis is undertaken independently by each candidate.

In this experiment a ticker-timer is used to investigate motion. The timer prints dots on a paper tape at regular intervals (eg one dot every 0.02 s). The tape passes through the ticker-timer and is attached to the model car which is placed on top of a slope. The timer is started and the car is allowed to run down the slope.

The candidate should take the tape chart and measure the distance travelled at regular intervals, eg 0.2s. A plot of 'Displacement' against 'Time' can then be used to calculate Velocity at any instance.

It may be useful for the instructor to undertake a dummy run demonstration of the procedures before allowing the candidates to proceed.

The writing up of this assignment may be done outside the 2½ hour practical session.

Alternative apparatus/equipment for this experiment may be used, eg air track, Fletcher's trolley.

3 Candidates' instructions

3.1 The time allowed for this assignment is 2½ hours. You are advised to read all the instructions before commencing work. If you do not understand all the instructions then please ask you instructor.

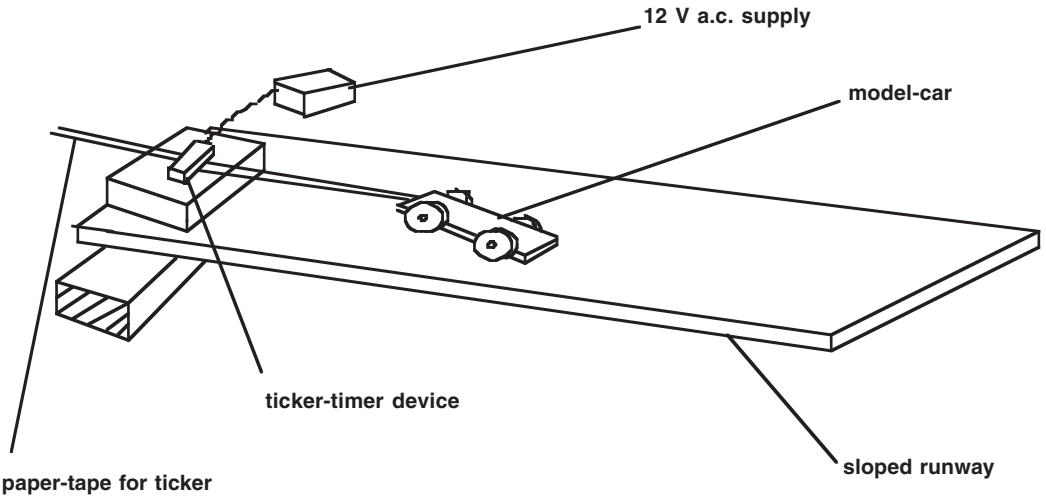


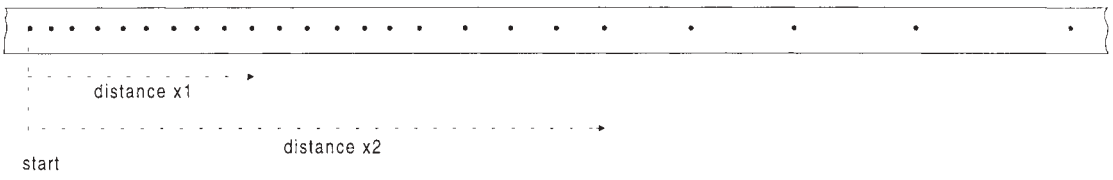
Fig. 1

3.2 You are provided with a 'ticker-timer' device which makes marks on a paper tape at regular intervals. Your instructor will advise you the rate at which the marks are produced by the ticker-timer. Pass a roll of paper tape through the ticker-timer machine. Attach the free end of the tape to a model car and place the car on a slope, at the top, as shown in Fig.1.

3.3 Start the ticker-timer device and allow the model car to run down the slope and come to a natural stop. Reduce the slope of the runway if the car moves too quickly.

3.4 Collect the ticker-tape and mark out the distance every ten dots. Measure the distance from the first dot to every ten consecutive dots as shown in the Fig.2.

Fig.2



3.5 Calculate time taken to travel distance x1, x2, x3 etc knowing that the time taken to strike each dot is 'y' seconds (as given by your instructor).

3.6 Plot a graph of distance travelled (displacement) against time taken.

3.7 The velocity of the model car is given by the gradient of the distance/time graph at any point. Calculate the velocity of the model car at five points on the graph and state the velocities in correct units.

3.8 Plot a graph of velocity against time taken.

3.9 The acceleration of the model car is given by the gradient of the velocity/time graph. Calculate the acceleration of the model car at 2 points on the graph and state the acceleration in the correct units.

3.10 Describe using the graphs the motion of the model car from the start until it stops.

3.11 Write your name on your work and hand it in to your instructor.

4 Marking

4.1	Assignment completed in 21/2 hours (excluding write up).	( )
4.2	Experiment set up correctly.	[ ]
4.4	Distances x1, x2, x3 etc measured and recorded.	[ ]
4.5	Time elapsed to travel distances x1, x2, x3 etc. calculated and recorded.	[ ]
4.6	Graph of distance travelled versus time elapsed plotted.	[ ]
4.7	Velocity determined at five points on the graph.	[ ]
4.8	Graph of velocity against time plotted.	[ ]
4.9	Acceleration determined at two points on the graph.	[ ]
4.10	Motion of model car described from start to finish.	[ ]
4.11	Work handed in to the instructor.	[ ]

5 Assignment completion

The candidate will have satisfactorily completed this assignment if successful in all items marked with a [ ].

A period of seven days must elapse before an unsuccessful candidate may retake this assignment.

Practical assignment 201/3: Measuring the Specific Heat Capacity of a Liquid

1 Objective references

200.52

2 Preparation

2.1 **Location of test**
The training centre or other venue where supervision and appropriate working conditions will be provided.

2.2 **Requirements**
Thermometer (°C)

One 500 ml beaker

One 1 litre beaker

Polystyrene insulation (beads or broken pieces of styrene block)

Liquid whose specific heat capacity is to be measured

Rheostat and electrical connections

Voltmeter

Ammeter

Stop clock

Electrical immersion heater

Stirrer

Insulating lid for 500 ml beaker with holes for thermometer, stirrer, and connections for electrical heater

Power supply

Weighing scales in grams

2.3 **Instructor notes**
Candidates should be familiar with basic electrical circuits involving power sources, voltmeter, ammeter and rheostat and know the function of each of these devices. Candidates should also be familiar with the equation: Electrical Energy (Q) supplied over a period of time = IVt, (where I is the current in amps, V is the voltage and t is time)

Health and safety should be carefully considered when using live electrical circuits and liquids such as water.

The instructor is advised to carry out a dummy run demonstration for candidates prior to letting them use the equipment.

The write up for the experiment can be carried out outside of the 2 hour practical time.

3 Candidates' instructions

3.1 The time allowed for this assignment is 2 hours. You are advised to read all the instructions before commencing work. If you do not understand all the instructions then please ask your instructor.

3.2 You are provided with electrical wire connections, an ammeter, a voltmeter, a power pack and a rheostat. Connect these to the electrical heater device as shown in Fig. 1. **Do not switch the circuit on until your instructor has seen that your set-up is correct.**

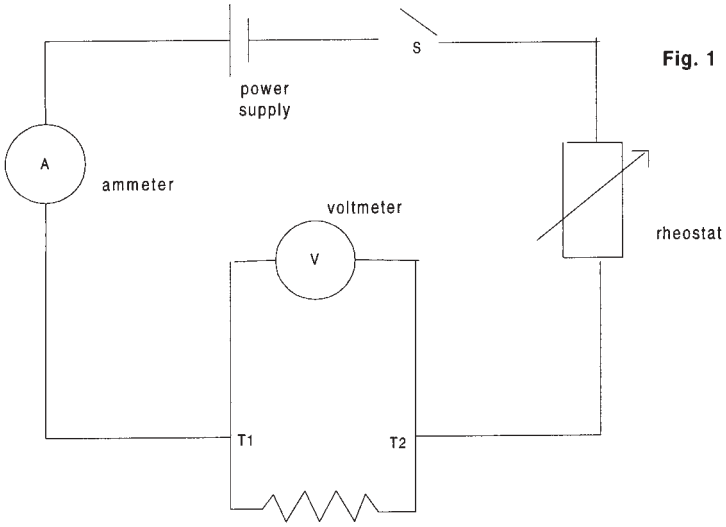


Fig. 1

3.3 Use the weighing scales to find the weight (mass, m) of the 500 ml beaker which will act as the calorimeter.

3.4 Place the liquid whose specific heat capacity is to be measured in the beaker and weigh the beaker again. Hence determine the mass 'm' of the liquid.

3.5 Set up the calorimeter as in Fig. 2.

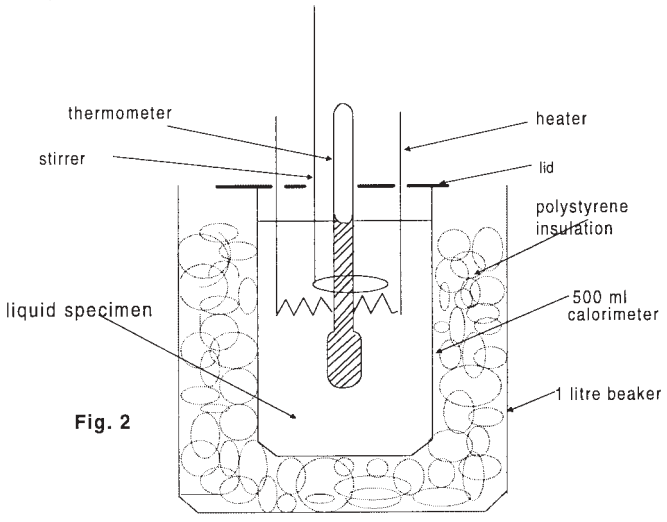


Fig. 2

3.6 Record the initial temperature of the liquid: θ_1

3.7 Switch the current through the heater and start the stop-clock.

3.8 Heat the liquid for say ten minutes (to obtain a measurable rise in temperature).

Read the voltage and current supplied.

3.9 Stop the heater and stop clock.

3.10 Measure the final temperature: θ_2

3.11 Calculate the heat energy supplied to the liquid (in Joules), using the formulae:

Energy supplied = IVt where I is current in amperes
V is voltage in volts
t is time in seconds

3.12 Assume that all the heat supplied is transferred to the liquid and none is lost (because we insulated the glass calorimeter).

Also assume that the specific heat capacity of the glass calorimeter is negligible and heat transferred to the glass is minimal.

Hence,

Heat supplied by heater = heat absorbed by liquid

Heat absorbed by liquid = mc $(\theta_2 - \theta_1)$

Where m = mass of liquid in kilograms

c = specific heat capacity of liquid in J/kg K

Hence, knowing the value of 'm' and '$(\theta_2 - \theta_1)$', calculate the specific heat capacity.

3.13 Write up this assignment, ensure your name is on your work and hand it in to your instructor.

4 Marking

4.1 Assignment completed in 2 hours (excluding write up). ( )

4.2 Electrical circuit set up correctly. [ ]

4.3/4.4 Mass of liquid determined in kilograms. [ ]

4.5 Calorimeter set up correctly. [ ]

4.6 Initial temperature of liquid measured. [ ]

4.10 Final temperature of liquid measured. [ ]

4.11 Voltage and current supplied is measured and heat energy supplied to liquid is calculated. [ ]

4.12 Specific heat capacity of liquid is correctly calculated using correct units. [ ]

4.13 Work handed in to the instructor. [ ]

5 Assignment completion

The candidate will have satisfactorily completed this assignment if successful in all the items marked with a [ ].

A period of seven days must elapse before an unsuccessful candidate may retake this assignment. An alternative liquid should be used for analysis.

Practical assignment 201/4: Demonstrate the Effect of Heat on the Resistance of a Conductor

1 Objective references

200.51

2 Preparation

2.1 **Location of test**
The training centre or other venue where supervision and appropriate working conditions will be provided.

2.2 **Requirements**
Power pack or battery of several cells

Ammeter with ranges of 0-10A and 0-1A

Voltmeter with a range of 0-5 V

2x Variable resistors (rheostats): one with 20 ohm maximum resistance and another with 10 ohm maximum resistance

Electrical circuit connectors

Filament lamp (tungsten) 2.5 V

2.3 **Instructor notes**
Candidates may undertake assignments in pairs, provided results analysis is undertaken independently by each candidate.

Candidates must be familiar with Ohm's law, electrical circuits and the functions of resistors, ammeters and variable resistors.

Health and safety issues must be explained to candidates in the context of use of electric currents. It may be useful for the instructor to undertake a dummy run demonstration of the procedures before allowing the candidates to proceed. It is particularly useful to check that the filament lamp will display non-ohmic relationship at reasonable voltage values.

The writing up of this assignment may be done outside the two hour practical session.

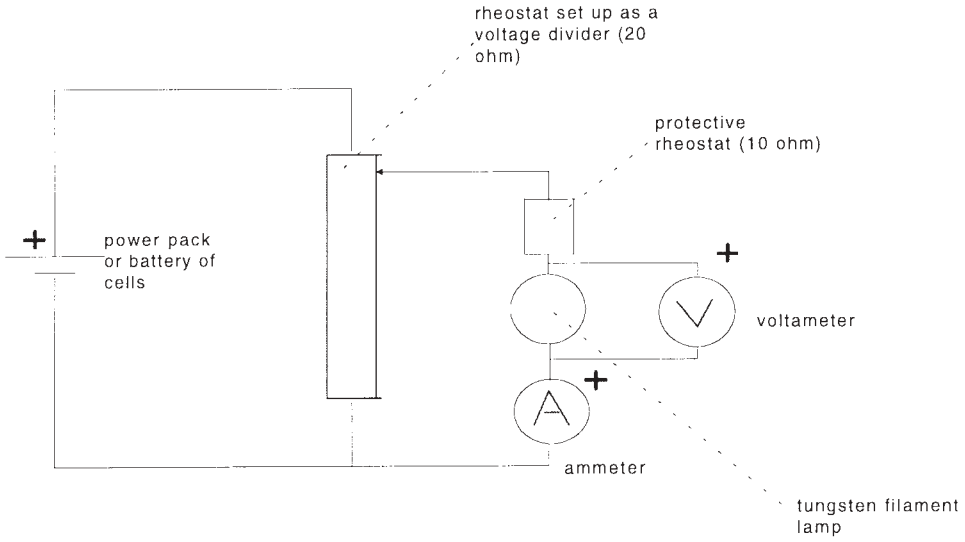
3 Candidates' instructions

3.1 The time allowed for this assignment is 2 hours. You are advised to read all the instructions before commencing work. If you do not understand all the instructions then please ask you instructor.

3.2 In this experiment you will investigate the electrical conduction characteristics of a conductor device (eg a filament lamp). You will use a variable resistor as a 'voltage divider' to give a smooth increase in voltage from zero to positive values.

Set up the electrical circuit as shown in Fig. 1. But DO NOT switch on the circuit until your instructor has had a chance to see that it is correctly set up.

Fig.1



3.3 Set up the ammeter to read at the higher range of 0-10A. Switch on the circuit. If the current reading is too small then change to the 0-1A setting. The reason for carrying out this procedure is that ammeters are sensitive devices which can be damaged by high through put of current.

3.4 Adjust the voltage divider so that a range of voltage readings are produced, eg 0, 0.5V, 1.0V, 1.5V, 2.0V, 2.5V, 3.0V, 3.5V, 4.0V, 4.5V, 5.0V

For each voltage reading, record the current in amperes.

3.5 Plot the change in current with voltage.

3.6 Describe the relationship between the voltage and current for the conductor (filament lamp) eg is it a straight line relationship or does the graph begin to curve at the higher voltage levels?

3.7 Refer to a textbook to identify why the filament lamp behaves in a way that does not follow Ohm's law at higher voltage values.

3.8 Look up textbooks (or obtain information from your instructor) on how other types of conductors which do not obey Ohm's law have application in circuit design.

3.9 Write up this assignment, ensure that your name is on your work and hand it in to the instructor.

4 Marking

4.1	Assignment completed in 2 hours (excluding write up).	( )
4.2	Electrical circuit set up as advised.	[ ]
4.4	A range of voltage and current readings taken.	[ ]
4.5	Graph of current against voltage plotted.	[ ]
4.6	Relationship between current and voltage for the conductor correctly described.	[ ]
4.7	Relationship correctly identified as non-ohmic and due to Increase in resistance due to heating effects.	[ ]
4.8	Application of non-ohmic properties in other conductor devices in use in electrical circuits appreciated in a very general way.	( )
4.9	Work handed in to the instructor.	[ ]

5 Assignment completion

The candidate will have satisfactorily completed this assignment if successful in all items marked with a [ ] and at least 1 of the items marked with a ( ).

A period of seven days must elapse before an unsuccessful candidate may retake this assignment.

Practical assignment 201/5: Interpret Isometric and Oblique Views

1 Objective references

200.95, 200.96

2 Preparation

2.1 **Location of test**
The training centre or other venue where supervision and appropriate working conditions will be provided.

2.2 **Requirements**
Drafting machine or drawing board and Tee square, drawing instruments and A3 drawing paper.

Copy of section 6

2.3 **Instructor notes**
Candidates are required to construct two isometric drawings and two oblique
drawings of simple shapes which include flat surfaces, angular surfaces,
curved surfaces and cylindrical shapes. The time allowed for this assignment is 3 hours.

3 Candidates' instructions

3.1 In Section 6, figure 1 shows four simple engineering components. Figure 1a and figure 1b are drawn in isometric projection and figure 1c and figure 1d are drawn in oblique projection. You must redraw the isometric components in oblique projection and the oblique components must be redrawn in isometric projection.

You have 3 hours to complete this assignment.

3.2 Produce a drawing sheet with appropriate layout and title.

3.3 Draw full size the two isometric projections figures 1a and 1b in oblique projection:

3.3.1 Figure 1a in oblique projection.

3.3.2 Figure 1b in oblique projection.

3.4 Draw full size the two oblique projections figures 1c and 1d in isometric projection:

3.4.1 Figure 1c in isometric projection.

3.4.2 Figure 1d in isometric projection.

3.5 Ensure the drawing:

3.1.1 represents the component correctly.

3.1.2 represents the drawing accurately.

3.1.3 interprets the views correctly.

3.1.4 meets BS308 or ISO standards.

3.6 Ensure your name is on your work and hand in to the instructor.

4 Marking

4.1 Assignment completed in 3 hours. ( )

4.2 A drawing sheet with appropriate layout and title produced. ( )

4.3 The two isometric projections figures 1a and 1b in oblique projection drawn full size:

4.3.1 Figure 1a in oblique projection. ( )

4.3.2 Figure 1b in oblique projection. [ ]

4.4 The two oblique projections figures 1c and 1d in isometric projection drawn full size:

4.4.1 Figure 1c in isometric projection. ( )

4.4.2 Figure 1d in isometric projection. [ ]

4.5 The drawings produced:

4.5.1 represents the component correctly. [ ]

4.5.2 represents the drawing accurately. [ ]

4.5.3 interprets the views correctly. [ ]

4.5.4 meets BS308 or ISO standards. ( )

4.6 Work handed in to the instructor. [ ]

5 Assignment completion

The candidate will have satisfactorily completed this assignment if successful in all items marked with a [ ] and at least three of the items marked with a ( ) for each drawing.

Candidates may retake this assignment or use alternative data produced by the instructor.

6 Assignment documentation

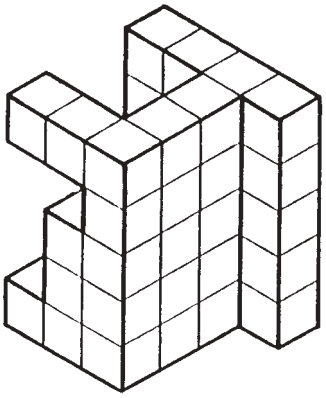


Figure 1a

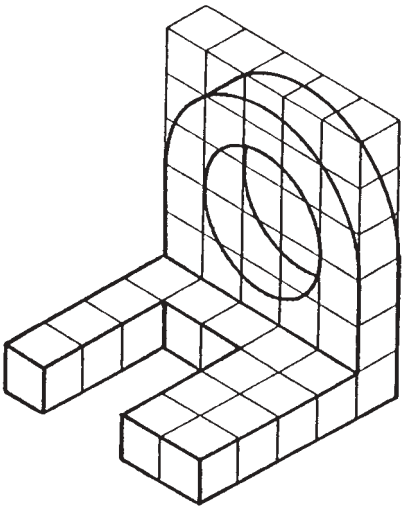


Figure 1b

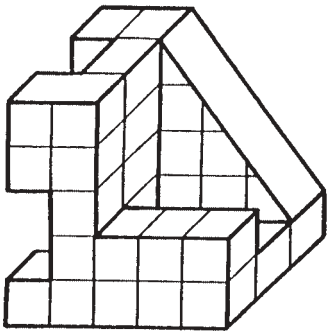


Figure 1c

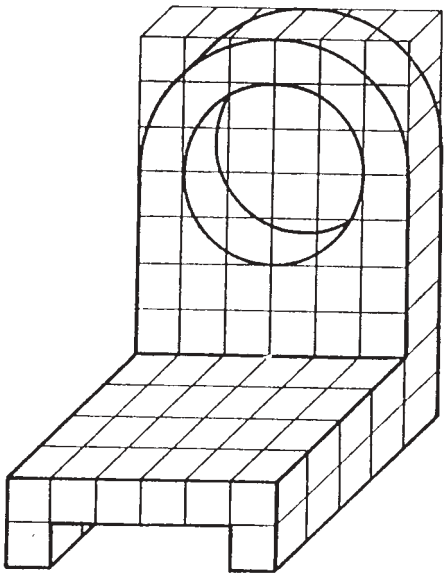


Figure 1d

Figure 1
Each square represents a 10mm measurement

Practical assignment 201/6: Produce a Detail Drawing of a 'V' Block

1 Objective references

200.99

2 Preparation

2.1 **Location of test**
The training centre or other venue where supervision and appropriate working conditions will be provided.

2.2 **Requirements**
Drafting machine or drawing board and Tee square, drawing instruments and A3 drawing paper.

Access to BS308 or equivalent ISO standards.

Copy of section 6.

2.3 **Instructor notes**
Candidates are required to construct a standard view of a detail drawing in 1st or 3rd angle projection of the 'V' block shown in section 6. The detail drawing must be fully dimensioned and must include a title block. Time allowed for the assignment is 2 hours.

3 Candidates' instructions

3.1 The time allowed for this assignment is 2 hours. In this assignment you are required to produce a full size detail drawing in 1st or 3rd angle projection of the 'V' block shown in see Section 6. The detail drawing must be fully dimensioned and must include a title block.

You are advised to read all the instructions before commencing work. If you do not understand all the instruction then ask the instructor.

3.2 Produce a drawing sheet with appropriate layout and title block.

3.3 Draw full size the following views of the 'V' block in 1st or 3rd angle projection. The drawings should be positioned symmetrically on the paper.

3.3.1 Front.

3.3.2 End.

3.3.3 Plan.

3.4 Dimension the detail drawing in accordance with BS308 or equivalent ISO standard.

3.5 Ensure that the drawing contains your name, title, scale, projection symbol, material, unit of measurement and date.

3.6 Hand the drawing in to your instructor.

4 Marking

4.1	Assignment completed in 2 hours.	( )
4.2	A drawing sheet with appropriate layout and title block produced.	( )
4.3	A full size detail drawing in 1st or 3rd angle projection showing the following views:	
	4.3.1 Front	[ ]
	4.3.2 End	[ ]
	4.3.3 Plan	( )
4.4	The detail drawing dimensioned in accordance with BS308 or equivalent ISO standard.	[ ]
4.5	Your name, title, scale, projection symbol, material unit of measurement and date written on the drawing.	[ ]
4.6	Drawing handed in to your instructor.	[ ]

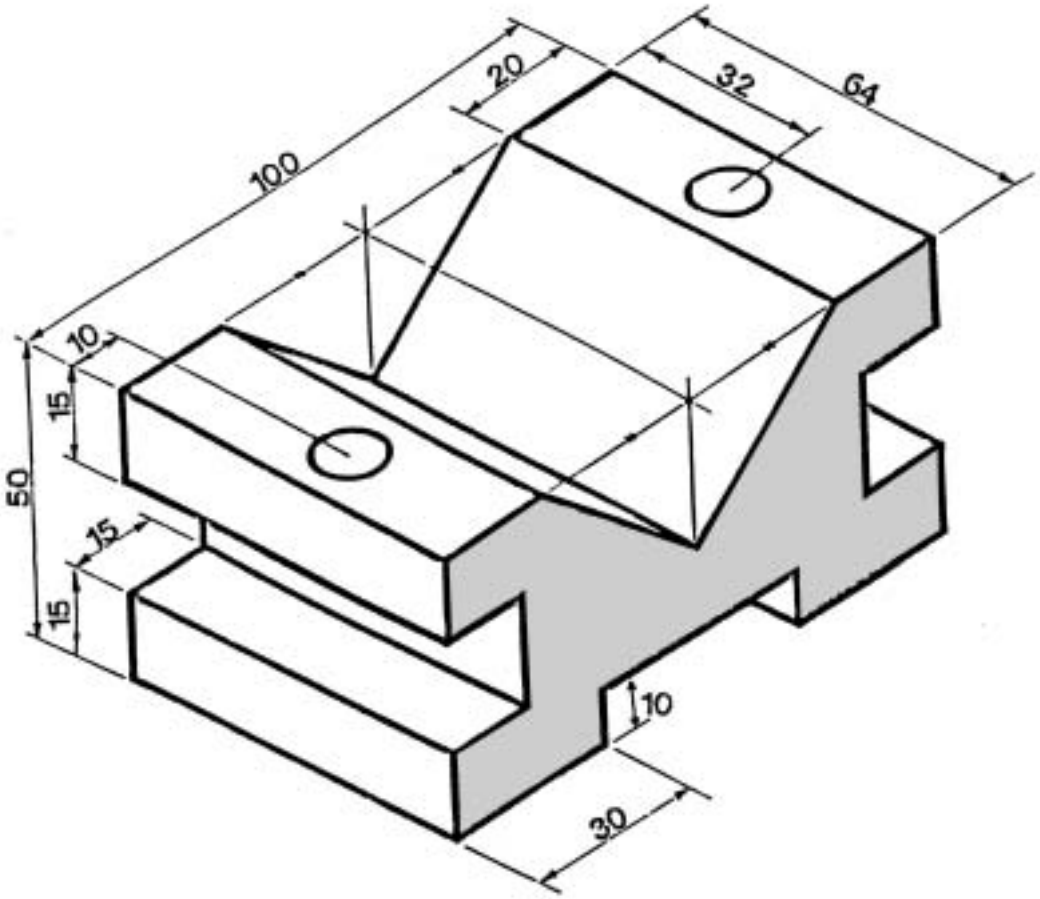
5 Assignment completion

The candidate will have satisfactorily completed this assignment if successful in all items marked with a [ ] and 1 item marked with a ( ).

A period of seven days must elapse before an unsuccessful candidate may retake this assignment.

6 Assignment documentation

6.1 Reproduce a machine 'V' block diagram in 1st or 3rd angle projection to full size. Fully dimension diagram.



Note: all dimensions are in millimetres. Holes are 10mm diameter.

Practical assignment 201/7: Produce a Detail Drawing of a Transistor Heat Sink

1 Objective references

200.99

2 Preparation

2.1 **Location of test**
The training centre or other venue where supervision and appropriate working conditions will be provided.

2.2 **Requirements**
Drafting machine or drawing board and Tee square, drawing instruments and A3 drawing paper.

Access to BS308 or equivalent ISO standards.

Copy of section 6.

2.3 **Instructor notes**
Candidates are required to construct a standard view of a detail drawing in 1st or 3rd angle projection of the Heat Sink shown in section 6. The detail drawing must be fully dimensioned and must include a title block. Time allowed for the assignment is 2 hours.

3 Candidates' instructions

3.1 The time allowed for this assignment is 2 hours. In this assignment you are required to produce a detail drawing in 1st or 3rd angle projection of the Heat Sink shown in Section 6. You must select a suitable scale for this drawing in accordance with BS308 or equivalent standards. The detail drawing must be fully dimensioned and must include a title block.

You are advised to read all the instructions before commencing work. If you do not understand all the instructions then ask the instructor.

3.2 Produce a drawing sheet with appropriate layout and title block.

3.3 Using a suitable scale, draw the following views of the Heat Sink in 1st or 3rd angle projection. The drawings should be positioned symmetrically on the paper.

3.3.1 Front.

3.3.2 End.

3.3.3 Plan.

3.4 Dimension the drawing in accordance with BS308 or equivalent ISO standard.

3.5 Ensure that the drawing contains your name, title, scale, projection symbol, material, unit of measurement and date.

3.6 Hand the drawing in to your instructor.

4 Marking

4.1 Assignment completed in 2 hours. ( )

4.2 A drawing sheet with appropriate layout and title block produced. ( )

4.3 A Heat Sink drawn to a suitable scale in 1st or 3rd angle projection:

4.3.1 Front [ ]

4.3.2 End [ ]

4.3.3 Plan. ( )

4.4 The drawing dimensioned in accordance with BS308 or equivalent ISO standard. [ ]

4.5 Your name, title, scale, projection symbol, material, unit of measurement and date on the drawing. [ ]

4.6 Drawing handed in to your instructor. [ ]

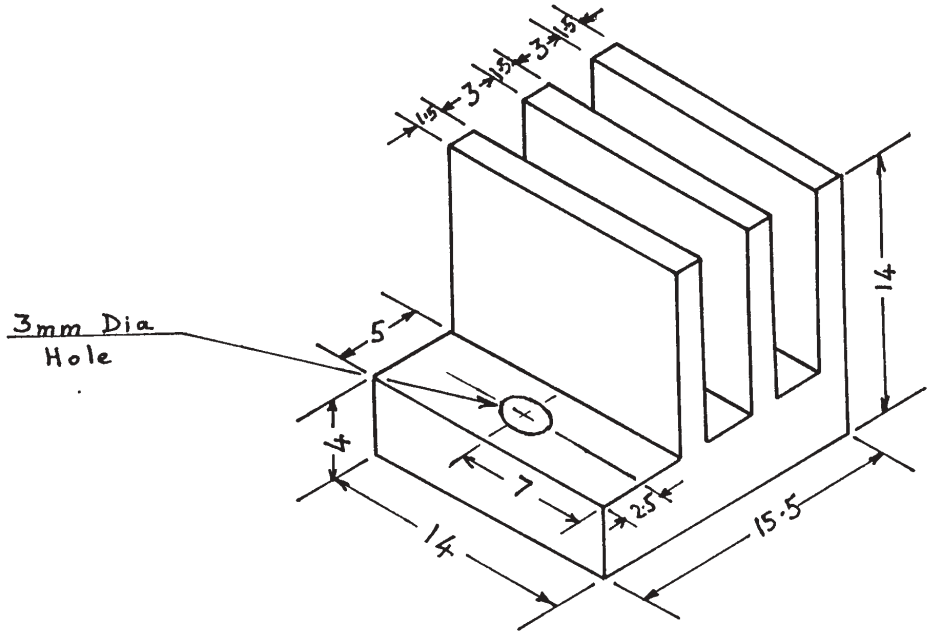
5 Assignment completion

The candidate will have satisfactorily completed this assignment if successful in all items marked with a [ ] and 1 other marked with a ( ).

A period of seven days must elapse before an unsuccessful candidate may retake this assignment.

6 Assignment documentation

6.1 Heat Sink



Transistor Heat Sink
Material – Aluminium
Finish – Matt Black

Practical assignment 201/8: Assembly Drawing of a Pulley and Support Bracket

1 Objective references

200.100

2 Preparation

2.1 **Location of test**
The training centre or other venue where supervision and appropriate working conditions will be provided.

2.2 **Requirements**
Drafting machine or drawing board and Tee square, drawing instruments and A3 drawing paper.

Access to BS308 or equivalent standards.

Copy of section 6.

2.3 **Instructor notes**
Candidates are required to draw three views of an assembly drawing in first or third angle projection shown in Section 6, figure 1. The drawing must be drawn to BS308 or equivalent ISO standard and must include an appropriate title block and a parts list.

The time allowed for this assessment is 6 hours.

3 CANDIDATES' INSTRUCTIONS

3.1 The time allowed for this assignment is 6 hours. You are advised to read all the instructions before starting work. The dimensions shown in section 6 are in mm.

In section 6, figure 1 shows components of a pulley unit in first angle projection. The bush is located on the top face of the bracket with the large diameter of the bush adjacent to the face. A hexagonal nut and washer (not shown in figure 1) is used to hold the spindle in the bracket. The nut and washer must be drawn. Hidden details or dimensions are not required.

3.2 Produce a drawing sheet with appropriate layout and title.

3.3 Draw full size in either first or third angle projection the following views of the pulley and support bracket assembly:

3.3.1 A sectional front view on plane AA.

3.3.2 An end view.

3.3.3 A plan view.

3.4 Balloon (item) reference the assembly.

3.5 Draw up a parts list to include a suitable material for each component.

3.6 Ensure the drawing takes the following aspects into account:

3.6.1 The correct assembly.

3.6.2 The accuracy of the drawing.

3.6.3 The correct projection interpretation of the two views.

3.6.4 The quality of the drawing.

3.7 Ensure your name is on your work and hand it in to your instructor.

4 Marking

4.1 Assignment completed in 6 hours. ( )

4.2 Drawing sheet with appropriate layout and title produced. ( )

4.3 Either first or third angle projection of the following views of the assembly drawn in full size.

- 4.3.1 A sectional front view on plane AA [ ]
- 4.3.2 An end view [ ]
- 4.3.3 A plan view ( )

4.4 The assembly balloon referenced. ( )

4.5 A parts list to include a suitable material for each component drawn up. ( )

4.6 The drawing produced taking the following aspects into account:

- 4.6.1 The correct assembly. [ ]
- 4.6.2 The accuracy of the drawing. [ ]
- 4.6.3 The correct projection interpretation of the two views. [ ]
- 4.6.4 The quality of the drawing. [ ]

4.7 Work handed in to the instructor. [ ]

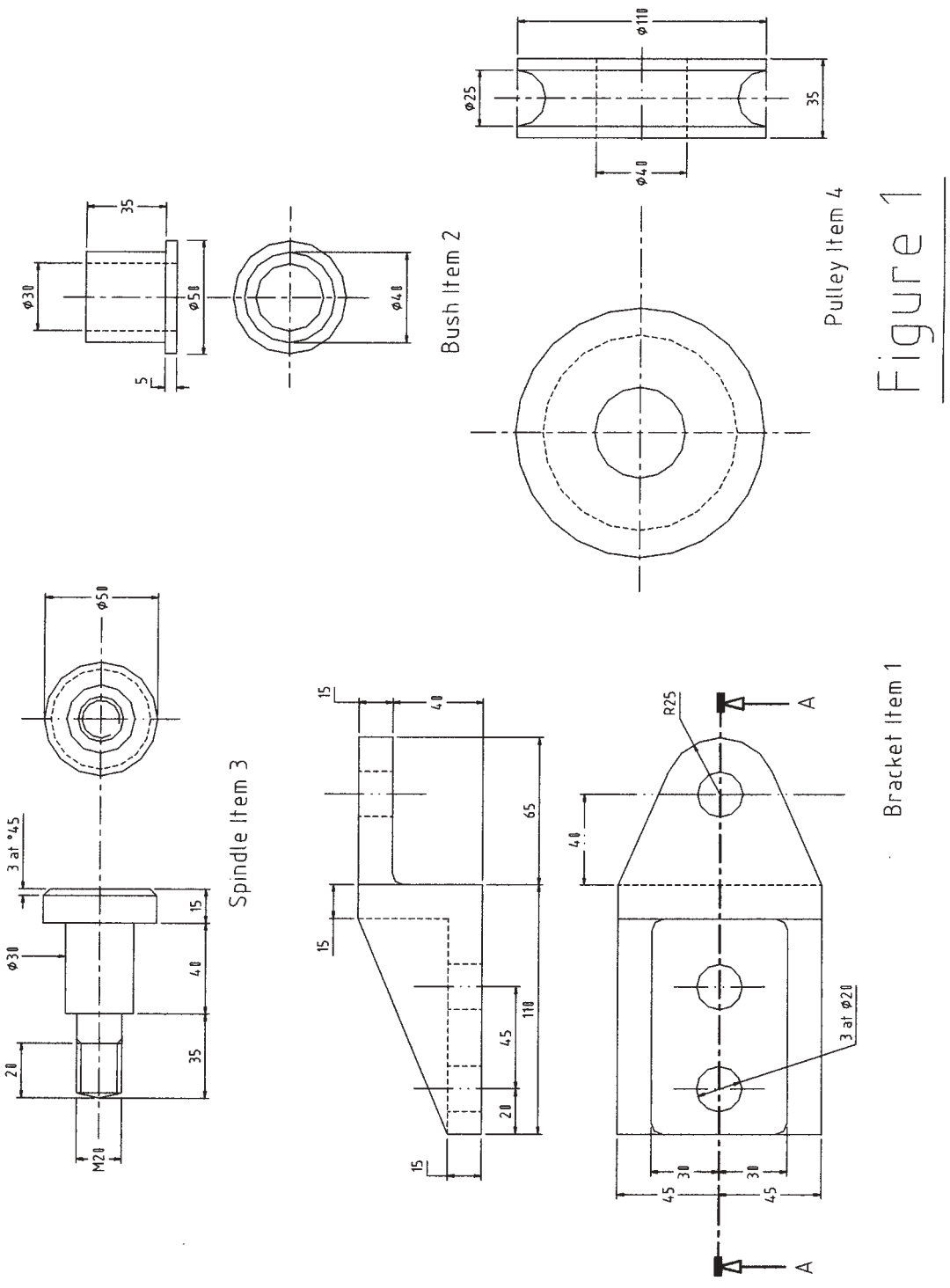
5 Assignment completion

The candidate will have satisfactorily completed this assignment if successful in all items marked with a [ ] and at least three of the items marked with a ( ).

Candidates may retake this assignment or an alternative assignment produced by the instructor.

6 Assignment documentation

6.1 Assembly drawing of a pulley and support bracket.



Practical assignment 201/9: Logic Controlled Power Switch

1 Objective references

200.103

2 Preparation

2.1 **Location of test**
The training centre or other venue where supervision and appropriate working conditions will be provided.

2.2 **Requirements**
Copy of section 6.

2.3 **Instructor notes**
Using the logic controlled power switch chart in section 6, candidates are required to identify the component type and briefly describe its function. Time allowed for the assignment is 2 hours.

3 Candidates' instructions

3.1 The time allowed for this assignment is 2 hours. In this assignment you are required to use section 6.1 – the logic controlled power switch chart and identify the component type and briefly describe its function. You should enter your answers on the sheet in section 6.2. Time allowed for the assignment is 2 hours.

You are advised to read all the instructions before commencing work. If you do not understand all the instruction then ask the instructor.

3.2 Identify the component types.

3.3 Describe the function of each component.

3.4 Write your name on the answer sheet and hand it in to your instructor.

4 Marking

4.1	Assignment completed in 2 hours.	( )
4.2	The component types identified.	( )
4.3	The function of each component described.	( )
4.4	Answer sheet handed in to the instructor.	( )

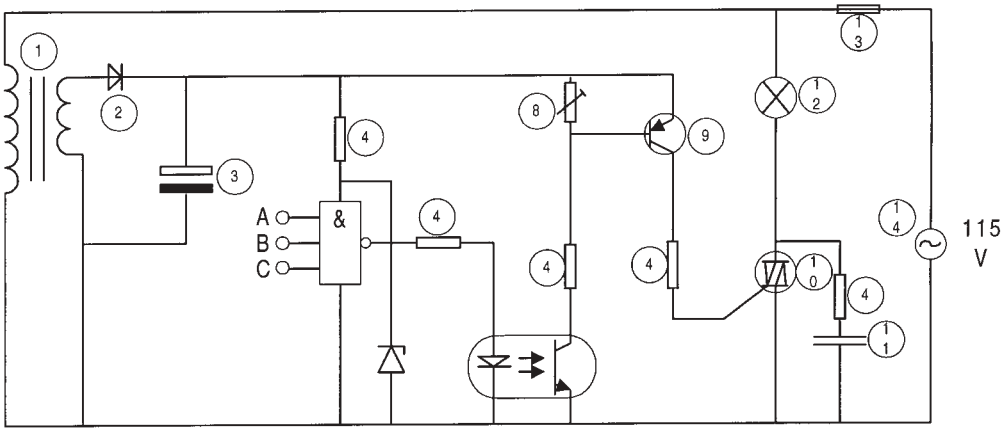
5 Assignment completion

The candidate will have satisfactorily completed this assignment if 10 out of 14 components are identified and described correctly.

A period of seven days must elapse before an unsuccessful candidate may retake this assignment.

6 Assignment documentation

6.1 Logic controlled power switch.



6.2. Answer sheet

Name

Component ref	Component type	Function
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		

Practical assignment 201/10: Selecting Materials for Product Applications

1 Objective references

200.120

2 Preparation

2.1 **Location of test**
The training centre or other venue where supervision and appropriate working conditions will be provided.

2.2 **Requirements**
Copy of section 6 – Database of Materials

An every day simple electronic or mechanical product which consists of several different materials (eg a hand-held battery torch or an electrical plug).

2.3 **Instructor notes**
Instructors may prepare their own database of materials for use in this assignment. Time allowed for this assignment is 1 hour.

3 Candidates' instructions

3.1 The time allowed for this assignment is 1 hour. You are advised to read all the instructions before commencing work. If you do not understand all the instructions then please ask you instructor.

3.2 You are provided with a database of materials and an item which is of everyday use, eg a battery torch.

Analyse the item to identify the different types of materials which are used in the construction of the product. Your instructor will advise you on whether you can dismantle the item to carry out your analysis.

Analyse the materials used in the item and for each material consider the following:

i Does the material need to be light or heavy?
ii Does the material need to be strong?
iii Is the material used for its flexibility or stiffness properties?
iv Is the material used for its moulding properties?
v Is the material used for its electrical conduction properties?
vi Is the material used for its thermal (heat) conduction ability?
vii Is the material used for its insulation properties?
viii Consider the cost of the material and decide if alternative cheaper material could be used in its place.

You may find it useful to create a table to record your findings.

3.3 Write up this assignment, ensure your name is on your work and hand it in to your instructor.

4 Marking

4.1 Assignment completed in 1 hour (excluding write up). ( )

4.2 i Light/heavy qualities of materials considered ( )

ii Strength quality of material considered ( )

iii Flexibility/stiffness properties of materials considered ( )

iv Moulding properties of materials considered ( )

v Electrical conduction properties of materials considered ( )

vi Thermal conduction properties of materials considered ( )

vii Insulation properties of materials considered ( )

viii Cost factors and alternative materials considered. ( )

4.3 Assignment written up and handed in to the instructor. [ ]

5 Assignment completion

The candidate will have satisfactorily completed this assignment if successful in the item marked with a [ ] and at least 7 of the items marked with a ( ).

A period of seven days must elapse before an unsuccessful candidate may retake this assignment. An alternative product should be used for analysis.

6 Assignment documentation

6.1 Database of Materials

Metals

Material	Melting point (°C)	Composition	Properties	Uses	Approximate cost ($ per tonne)
Aluminium	650	Pure metal	light, soft, ductile, good heat and electricity conductor	aircraft, boats, kitchen utensils, drink cans, engine components	1625
Copper	1100	Pure metal	very malleable, ductile, highly heat and electrical conductivity, corrosion resistant, easily soldered	electrical wires, water pipes, printed circuit boards	2600
Brass	980	65% copper 35% zinc	good conductor, easily soldered, highly corrosion resistant, easily mould-cast, easily machined into shapes	electrical contacts, cast-metal objects and decorative items	2150
Mild steel	1400	Iron plus less than 0.3% carbon	high strength, ductile, tough, fairly, malleable. Cannot be hardened and tempered. Low costs	general purpose construction work, nuts, bolts, washers, and screws. Tubular furniture	1600
High carbon steel	1400	Iron plus 0.7% to 1.4% carbon	hardest of the carbon steels, but less ductile and malleable. Can be hardened and tempered	cutting tools such as drills, files, plane and chisel blades. Wood and plastic cutting saws	1800
Soft solder	250	60% tin 40% lead	soft low melting point, joins to other metals easily	joining copper joints, tin plates and all electrical soldering	3500

Plastics

Name	Chemical name	Properties	Uses	Approximate cost cost ($ per tonne)
Low density polythene	low density polyethylene	wide range of colours, good insulator, good chemical resistance, flexible, soft, working temperature up to 60°C	squeezy bottles, toys, TV aerial lead insulation, plastic sacks and sheets	500
High density polythene	high density polyethylene	wide range of colours, stiff and hard, can be sterilised, fades in light unless stabilised, easily injected and blown (moulding)	buckets, bowls and other household wares, milk crates, boxes, barrels, some machine parts	700
Rigid PVC	rigid polychloroethane	wide range of colours, tough at room temperature, can be used outdoors, stiff & hard, good for fabricating	plumbing fittings, pipes and gutters, curtain rails, roofing and constructional sheets	800
Acrylic	polymethyl methacrylate	stiff, hard, clear or opaque, many colours available, very durable, can be polished easily, good electrical insulator, ten times more impact resistant than glass, safe when in contact with food, can be bent and formed easily at about 160 °C	signs for shops, aircraft canopies, double glazing, baths, furniture, caravan windows	400
Nylon	polyamide	hard, tough, wear resistant, self lubricating, high melting point	bearings, gear wheels, clothing, packaging	500

Practical assignment 201/11: Creating and Editing a Document

1 Objective references

200.129, 200.138

2 Preparation

2.1 **Location of test**
The training centre or other venue where supervisor and appropriate working conditions will be provided.

2.2 **Requirements**
Computer system providing access to word processing, database and spreadsheet software connected together and switched on.

Software user manuals.

Printer with paper loaded.

Formatted floppy disk and disk labels (work may be saved onto candidate's area of the network).

Copy of section 6.

Pen, pencil.

2.3 **Instructor notes**
For simplicity, this assignment is written for use with floppy disks to save electronic files for marking. Time allowed for this assignment is 11/2 hours.

3 Candidates' instructions

3.1 The time allowed for this assignment is 1 hour and 30 minutes. In this assignment you are required to create a business letter and amend it.

You are advised to read all of the instructions before commencing work. Ensure that you understand all the instructions and follow them precisely. If you are in any doubt ask the instructor.

Unless otherwise instructed by your instructor, all files are to be saved on the floppy disk provided.

3.2 On your computer system you have word processing, database, graphics and spreadsheet software available. Access the appropriate software for this task.

3.3 You are required to create a new document which should be typed exactly as shown in section 6.1.

3.4 Save the document as LETTER on the floppy disk provided and print a copy.

3.5 You are now going to make the following changes to the letter:

3.5.1 Centre justify the first 5 lines (the address).

3.5.2 Centre justify the line containing 'Order number CC145' and make the text bold.

3.5.3 In the first paragraph of the letter, delete the word 'old'.

3.5.4 In the last paragraph of the letter, insert the words 'latest' before the word 'model'.

3.5.5 Insert 4 more blank lines between 'Yours sincerely' and 'G Marlow'.

3.5.6 Enter your own name in the document next to 'copy to'.

3.6 Save the file with the filename LETTER1 on your floppy disk and print a copy.

3.7 Exit the software to return to your usual operating environment.

3.8 Write your name, the date and the number of this assignment on the print-outs of the letter and hand them together with the floppy disk to your instructor.

4 Marking

4.1 Assignment completed in 1 hour and 30 minutes. ( )

4.2 Word processing software accessed. [ ]

4.3 Text typed as given in section 6.1 (3 errors allowed). [ ]

4.4 Copy of LETTER saved and printed. [ ]

4.5.1 First 5 lines centred. ( )

4.5.2 'Order number CC145' centred and bold. ( )

4.5.3 Word deleted as specified. ( )

4.5.4 Word inserted as specified. ( )

4.5.5 Blank lines inserted as specified. ( )

4.5.6 Candidate name entered. ( )

4.6 Copy of LETTER1 saved and printed. [ ]

4.7 Document processing software exited correctly. ( )

4.8 Disk and print-outs handed in. [ ]

5 Assignment completion

The candidate will have satisfactorily completed this assignment if successful in all items marked with a [ ] and at least 4 of the items marked with a ( ).

A period of seven days must elapse before an unsuccessful candidate may retake this assignment.

6 Assignment documentation

Note to candidate: you should use the set default values for margins and fonts. If your default margins and font are different from those used in this document then your text may wrap around at different points to those presented below.

6.1 Document to be entered by candidates

Mr D Green
Carlton Computers Plc
14 Milton Road
BISHOPS STORTFORD
Hertfordshire BS8 1UR

23 April 1998

Dear Mr Green

Order no. CC145

With reference to your order number CC145 received today, I am writing to inform you that this old printer has been replaced with the model NR-90.

Please contact me if you are interested and I can arrange for our salesperson to call and demonstrate this model to you.

Yours sincerely

G Marlow
Sales Manager

Copy to (candidate's own name)

Practical assignment 201/12: Editing a Database

1 Objective references

200.129 – 200.134, 200.139 – 200.141

2 Preparation

2.1 **Location of test**
The training centre or other venue where supervision and appropriate working conditions will be provided.

2.2 **Requirements**
Computer system providing access to database software, connected together and switched on.

Database software user manual.

Printer with paper loaded.

Floppy disk containing the database file STORES (see 3.2 below).

Copy of section 6.

Pen, pencil, paper.

2.3 **Instructor notes**
For simplicity, this assignment is written for use with floppy disks to save electronic files for marking. Candidates may, however, work in the user area of the network.

You are required to create a new database to hold the data for candidates to use in the assignments. You should set up the database as follows:

Field name	Data type	Field length
Component	text	14
Cost	number	5 (2 decimal places)
Recorder	number	3
Quantity	number	4

Enter all the data below into the file. Save the file with the filename STORES.

Component	Cost per item	Minimum re-order level	Order quantity per item
bolts	0.50	400	2000
nuts	0.20	400	2000
washers	0.10	400	2000
base plates	5.00	50	200
covers	3.00	50	250
electric motor	10.00	10	50
handles	2.50	25	150
levers	1.50	40	200
gear wheels	2.00	40	200

Copy the file STORES to candidates' disks or to the user areas of the network.

3 Candidates' instructions

3.1 The time allowed for this assignment is 1 hour 30 minutes. In this assignment you are required to edit and search a database.

You are advised to read all of the instructions before commencing work. Ensure that you understand all the instructions and follow them precisely. If you are in any doubt ask the instructor.

Unless otherwise instructed by your instructor, all files are to be saved on the floppy disk.

3.2 Access the database software.

3.3 Load the data file STORES

3.4 Sort the file so that the components are in alphabetical order and print out the file.

3.5 Search the file for minimum re-order level = 400 and print out a list of all these records.

3.6 The following changes need to be made to the data:

3.6.1 The cost of levers has gone up from 1.50 to 1.90. Change the cost.

3.6.2 Delete the record containing covers.

3.6.3 Add the following component to the file:

Component	Cost per item	Minimum re-order level	Order quantity per item
Locknuts	0.80	300	1500

3.7 Print out a copy of the amended database.

3.8 Save the database with the name STORES2

3.9 Exit the database software to return to your usual operating environment.

3.10 Ensure your name, the date and the number of this assignment are on all print-outs and the floppy disk and hand them to your instructor.

4 Marking

4.1	Assignment completed in 1 hour 30 minutes.	( )
4.2	Database software accessed.	[ ]
4.3	Database file stores loaded.	[ ]
4.4	Table sorted alphabetically and printed out.	[ ]
4.5	File searched as specified and selected records printed.	[ ]
4.6.1	Cost amended as specified.	( )
4.6.2	Record deleted as specified.	( )
4.6.3	New record added as specified.	( )
4.7	Amended file printed.	[ ]
4.8	STORES2 files saved on disk.	[ ]
4.9	Database software exited correctly.	( )
4.10	Disk and print-outs handed in.	[ ]

5 Assignment completion

The candidate will have satisfactorily completed this assignment if successful in all items marked with a [ ] and at least 2 of the items marked with a ( ).

A period of seven days must elapse before an unsuccessful candidate may retake this assignment.

Practical assignment 201/13: Spreadsheet

1 Objective references

200.129 – 200.134, 200.142 – 200.147

2 Preparation

2.1 **Location of test**
The training centre or other venue where supervision and appropriate working conditions will be provided.

2.2 **Requirements**
Computer system providing access to spreadsheet software, connected together and switched on.

Spreadsheet software user manual.

Printer with paper loaded.

Floppy disk containing the data file LABOUR (see 2.3 below).

Pen, pencil, paper, calculator.

2.3 **Instructor notes**
For simplicity, this assignment is written for use with floppy disks to save electronic files for marking. Candidates may, however, work in the user area of the network. You are required to create a spreadsheet for the candidates as specified below. Save the file under LABOUR and copy it to candidate disks or user network area.

	A	B	C	D	E	F	G
1	LABOUR UTILISATION – *Candidate name*						
2	Month	JAN	FEB	MAR	APRIL	MAY	TOTAL
3	Work days/month	21	20	21	20	23	
4	No. of operators	70	65	68	73	71	
5	Max days for production	91					

3 Candidates' instructions

3.1 The time allowed for this assignment is 1 hour 30 minutes. In this assignment you are required to edit and carry out calculations on a small spreadsheet. You are advised to read all of the instructions before commencing work. Ensure that you understand all the instructions and follow them precisely. If you are in any doubt ask the instructor.

Unless otherwise instructed by your instructor, all files are to be saved on the floppy disk provided.

3.2 Access the spreadsheet software.

3.3 Load the data file LABOUR

3.4 Enter your name in the spreadsheet where it says 'Candidate Name'.

3.5 Insert a column before the TOTAL column and enter the following data.

June
22
68

3.6 You are required to make further amendments to your spreadsheet as specified below:

3.6.1 Change the value in cell F4 from 71 to 73.

3.6.2 Replace the value in cell D3 with 40.

3.6.3 Delete the contents of cell B5.

3.7 Use the sum function in cell H3 to calculate the total number of work days.

3.8 Use the Sum function in all H4 to calculate the total number of operators.

3.9 To calculate the maximum days for production insert the formulae B3 x B4 in cell B5.

3.10 Copy this formula across the spreadsheet to the other months (Column C to G).

3.11 Save the amended spreadsheet with the filename LABOUR1. Print a copy of the whole spreadsheet on a single sheet of paper. Write your name, the date and the details of this assignment on a disk label and put the label on your floppy disk.

3.12 Exit the spreadsheet software to return to your usual operating environment.

4 Marking

4.1 Assignment completed in 1 hour and 30 minutes. ( )

4.2 Spreadsheet software accessed. [ ]

4.3 Data file loaded. [ ]

4.4 Name entered in correct position. [ ]

4.5 Column inserted correctly. [ ]
New data entered

4.6.1 Cell content amended as specified. ( )

4.6.2 Cell content replaced as specified. ( )

4.6.3 Cell content deleted as specified. ( )

4.7 Sum function entered correctly. ( )

4.8 Sum function entered correctly. ( )

4.9 Sum function entered correctly. ( )

4.10 Sum function copied across the spreadsheet. ( )

4.11 Amended spreadsheet printed and saved as LABOUR1. [ ]

4.12 Spreadsheet software exited correctly. ( )

4.13 Disk and print-outs handed in. [ ]

5 Assignment completion

The candidate will have satisfactorily completed this assignment if successful in all items marked with a [ ] and at least 3 of the items marked with a ( ).

A period of seven days must elapse before an unsuccessful candidate may retake this assignment.

Practical assignment 201/14: Safety in The Workshop

1 Objective references

200.158

2 Preparation

2.1 **Location of the test**
The training centre workshop or other venue where supervision and appropriate workshop equipment is available.

2.2 **Requirements**
Standard workshop equipment relevant to the syllabus, eg turning machines, milling machines, drilling machines, grinding machines, work benches and associated tools and equipment.

2.3 **Instructor notes**
This assignment is conducted in two parts.

Part 1: The instructor tours the workshop with the candidates indicating where the health and safety facilities are located and giving instructions on their correct use. The tour should include the following facilities: emergency fire exits, fire extinguishers, electricity emergency 'stop' buttons, first aid facilities and procedures, use of protective clothing and equipment, clearways throughout the workshop, ventilation provision, location of cleaning facilities, etc.

During the tour the instructor should highlight potential hazards which are associated with each type of machine tool or bench operation. Please note that all machinery must be isolated during the undertaking of the assignment.

Part 2: The candidates prepare a report relating to the tour of the workshop. The candidates are allowed to revisit the workshop, under supervision, to make further observations. The report, which should include a labelled drawing (not drawn to scale), must list the potential hazards associated with each machine tool and typical bench operations.

In Section 3.4.4 instructors may substitute alternative machines/equipment and delete those that are not appropriate.

3 Candidates' instructions

3.1 The time allowed for writing this assignment is 2 hours.

Part 1
Ensure that you understand all the requirements of the assignment and follow them precisely. If you are in any doubt ask the instructor.

3.2 The instructor will show you around the workshop pointing out a) the location of the safety facilities and b) the potential hazards related to workshop machinery and equipment.

3.3 Take notes and make sketches during the tour of the workshop.

Part 2

3.4 Produce a short report with the title 'Safety in the workshop'. The report should include:

3.4.1 A labelled diagram (not to scale) of the workshop.

3.4.2 Location of the safety facilities.

3.4.3 Correct use of the safety facilities.

3.4.4 Hazards associated with typical workshop machinery, equipment and the work environment, for example:

General layout of the workshop.
Safe working practices.
Drilling machines.
Bench operations (Soldering and assembly).
Portable equipment.

3.5 Make sure that your name is clearly shown on your work and hand the work to the instructor.

4 Marking

4.1	The assignment completed in 2 hours.	( )
4.2	Tour of workshop with instructor undertaken	[ ]
4.3	Notes and sketches produced.	( )
4.4	Report produced including:	
4.4.1	Location of the safety facilities.	[ ]
4.4.2	Correct use of the safety facilities.	[ ]
4.4.3	Hazards associated with:	
	General layout of the workshop	[ ]
	Safe working practices	[ ]
	Drilling machines	( )
	Bench operations (Soldering and assembly)	[ ]
	Portable equipment.	[ ]
4.5	Report handed to the instructor.	[ ]

5 Assignment completion

The candidate will have satisfactorily completed this assignment if successful in all items marked with a [ ] and at least three of the items marked with a ( ).

A period of seven days must elapse before an unsuccessful candidate may retake this assignment.

202 Electrical and Electronic Applications

The aim of this unit is to provide candidates with the knowledge and skills to identify and select a range of electrical and electronic components and cables and to wire and test simple electrical and electronic circuits.

Practical competences

The candidate must be able to do the following:

202.1 Identify and select electronic components.

202.2 Plan practical electronic circuit component and wiring layouts.

202.3 Solder electronic components and wiring to a circuit board.

202.4 Measure electronic circuit voltages.

202.5 Use a signal generator and oscilloscope to measure amplifier gain and monitor the level of distortion on the amplified output.

202.6 Mount electrical components and wiring on an appropriate surface (eg circuit board).

202.7 Assemble electrical isolation and protective devices, (eg switches and miniature circuit breakers) into distribution unit.

202.8 Wire radial circuits using appropriate type and size of electrical cable.

202.9 Carry out tests on completed electrical circuit.
Tests: polarity, continuity, insulation resistance, earth-loop impedance, overall functional test

Knowledge requirements

Instructors must ensure that candidates are able to:

Electrical supplies and electronic signals

202.10 State the operating voltages normally available in electrical installations and distribution systems.
Three phase distribution voltages: 132kV, 33kV, 11kV, 400/415V
Single phase voltages: 230/240V, 110V

202.11 Explain the following types of supply.
Types of supply: direct current (dc), alternating current (ac), three phase

202.12 State the applications of each type of supply.
Type of supply: direct current (dc), alternating current (ac), three phase

202.13 State the types of signal in common use in electronics.
Types of signal: continuous dc, interrupted dc or digital/pulsed waveforms, variable amplitude ac (amplitude modulated), constant amplitude ac (frequency modulated)

202.14 Sketch graphs of amplitude/time to illustrate the nature of different types of signal.
Types of signal: continuous dc, interrupted dc or digital/pulsed waveforms, variable amplitude ac (amplitude modulated), constant amplitude ac (frequency modulated)

202.15 Explain that the function of electronic systems is to process input signals in order to provide a different level or type of output.

202.16 Describe typical examples of the applications of signals in common use.
Examples: voltage and power amplifiers, computers and logic systems, am and fm radio and television, industrial control processes, electronic control in motor vehicles
Signals: continuous dc, interrupted dc or digital/pulsed waveforms, variable amplitude ac (amplitude modulated), constant amplitude ac (phase modulated)

Resistors and dc circuits

202.17 Explain the terms.
Terms: tolerance, power rating, stability, colour and numerical coding and preferred value ranges

202.18 Describe the system of numerical and both four and five band colour coding used to identify the ohmic value and tolerance of resistors.

202.19 List the preferred values of resistance forming the 10% range.

202.20 Identify series and parallel connections of resistors and in each case derive the equivalent resistance formula.

202.21 Explain Ohm's law and solve simple problems involving resistors in series and/or parallel connected in a dc circuit.

202.22 Explain the function and describe the construction of typical variable resistors used for panel mounting and circuit board assemblies.
Variable resistors: continuously variable, preset types

202.23 Explain the function and describe the construction of non-linear resistive devices.
Non-linear resistive devices: thermistor (temperature dependent resistors), light dependent resistors (LDR)

202.24 Draw the internationally accepted circuit symbols for fixed resistors, preset and variable resistors, thermistors and light dependent resistors.

Capacitors

202.25 State that the function of a capacitor is to store a small amount of electrical energy in an electric field set up between its plates.

202.26 State that capacitance is measured in Farads(F) and explain the use of sub units.
Sub units: mF, μF, nF and pF.

202.27 State the types of capacitor in general use in electronics.
Types of capacitor: silvered mica, polyester, polystyrene, mylar, tantalum and electrolytic

202.29 Explain the need for observing the correct voltage polarity when connecting electrolytic capacitors.

202.29 Describe the system of numerical coding used to identify the capacitance and tolerance of capacitors.

202.30 Identify series and parallel connections of capacitors and for each connection state the formula for the equivalent capacitance of the combination.

202.31 Draw the internationally accepted circuit symbols for types of capacitors.
Capacitors: non-polarised, electrolytic, variable, pre-set

Inductors and transformers

202.32 State that the function of an inductor is to store small amounts of electrical energy in a magnetic field surrounding the windings.

202.33 State examples of the uses of inductors in electrical circuits.
Uses of inductors: mains transformers, power supplies, fluorescent lighting fittings

202.34 Explain the function and describe the operation of an iron cored transformer.

202.35 State the qualities of an ideal transformer.
Ideal transformer: zero winding resistance, infinite primary and secondary inductance, perfect coupling between primary and secondary windings, zero capacitance between turns

202.36 State the relationship between primary and secondary voltages (Vp and Vs), currents (Ip and Is) and turns-ratio(Np and Ns) for an ideal transformer (Vp/Vs = Is/Ip = Np/Ns) and perform simple calculations of voltage, current and turns-ratio to illustrate the relationship.

Diodes

202.37 State that the function of an ideal diode is to allow current to pass in one direction only.

202.39 Define p-type and n-type semi-conductor material and explain a flow of current in terms of the movement of positive and negative charge carriers.

202.39 State that a diode is constructed when a pn junction is formed and the direction of current through the junction, when it is forward biased, is from the p to n. The connections to the diode are termed anode(p) and cathode(n) respectively.

202.40 State that large, slower acting diodes are termed rectifier diodes and small, fast acting diodes are termed signal diodes.

202.41 Describe the practical polarity markings for indicating the cathode connection of a diode.
Polarity markings: + sign or a band

202.42 Explain that pn junction diodes will conduct in the reverse direction when a critical voltage level is reached determined by the level of doping of the p and n regions. Diodes designed to operate in this manner are termed Zener or voltage reference diodes.

Transistors

202.43 State there are two types of junction (bipolar) transistor.
Types: npn, pnp

202.44 Draw the internationally agreed circuit symbols for npn and pnp transistors.

202.45 Describe the three main functions of a transistor.
Functions: to amplify ac or dc signals, to act as a switch, to act as an electronically controlled variable resistor

202.46 State that a transistor has three electrodes.
Electrodes: emitter, base, collector

202.47 Describe the conditions required for a transistor to conduct.
Conditions: emitter-base junction forward biased, base collector junction reverse biased

202.48 State that the voltage across the emitter-base junction when the transistor is conducting normally is approximately 0.6V for a silicon transistor.

202.49 Draw circuit diagrams and explain the operation of a common emitter amplifier with simple and stabilised biasing.

202.50 Explain the terms 'input resistance' and 'current gain' and state that the symbols used to denote these two characteristics are 'h_{ie}' and 'h_{fe}' respectively for a common emitter connected transistor.

202.51 Sketch graphs of transistor base current against base voltage (input characteristic) and transistor collector current against base current (transfer characteristic) and show that the slopes of these characteristics represent the input resistance and current gain respectively.

202.52 Explain that a common emitter connected transistor acts as a switch when the forward bias on the base emitter junction causes sufficient collector current to flow through the collector load to reduce the collector voltage to the saturation voltage Vsat, which is less than the base emitter voltage.

202.53 State typical applications of transistor switching circuits.
Applications: relay control, LED control, pulse squaring circuits

202.54 State there are two basic types of field-effect transistor (FET), junction type (JFET) and metal oxide semiconductor type (MOSFET).

202.55 Draw the internationally agreed circuit symbols for JFET and MOSFET transistors.

202.56 State that FETs have three electrodes.
Three electrodes: source, gate, drain

202.57 State that both JFETs and MOSFETs are constructed having either p or n channels.

202.58 Describe the conditions required for n-channel FETs to operate as an amplifier.
Conditions: drain voltage positive with respect to source, gate voltage negative with respect to source

202.59 Sketch a graph of drain current I_d against V_{gs} and show that the slope of the graph represents the forward transfer conductance (g_{fs}) of the FET.

202.60 Draw a circuit diagram and explain the operation of a common source FET amplifier with source biasing.

Power supplies

202.61 Draw a circuit and explain the operation of half-wave rectifier circuits with reservoir capacitor.

202.62 Draw circuits of full wave rectifiers with centre tapped transformers and bridge connections and explain their operation.

202.63 Explain the need for regulating or stabilising the output voltage of a power supply.

Electrical cables

202.64 Describe the applications and reasons for the use of different types of cable in electrical engineering.
Types of cable: single and multi-strand conductors, single-cored and multi-cored cables and armoured cables
Applications: distribution and supply, domestic and industrial applications and the use of flexible leads

202.65 State the colours used for the cable insulation to identify their applications.
Colours: red, yellow, blue, brown, black, green/yellow
Applications: three phase lines, single phase wiring, flexible leads and earthing or circuit protection conductors

202.66 Using tables published in the relevant wiring regulations (Institute of Electrical Engineers [IEE]) or other internationally acceptable regulations, identify the suitability, current ratings and sizes of cables for various applications.
Applications: distribution and supply, domestic, industrial applications, the use of flexible leads

202.67 Using tables published in the relevant wiring regulations (IEE) or other internationally acceptable regulations, calculate the voltage drop in cables from data specifying the volts/metre/amp given the length of cable and the current being carried.

Isolation and protection in electrical circuits.

202.68 Describe the need for both isolation and overload protection equipment in electrical circuits.

202.69 Explain why it is important that the isolation and overload devices are connected in the live phase of the supply and operate within a stated time period from the commencement of the overload.

202.70 Explain the operation of current overload devices.
Devices: rewirable fuses, cartridge fuses, circuit breakers, residual current devices (RCD)

202.71 Explain the need to use residual current devices for protection in non-earthed situations with portable appliances.

Circuits and wiring

202.72 Draw circuit and wiring diagrams of domestic lighting circuits and power circuits.
Lighting circuits: single-way, two-way, intermediate switching
Power circuits: radial supplies, ring mains, spurs

202.73 Identify and explain the recommendations stated in the IEE or other internationally recognised regulations relating to the wiring systems and circuits.
Power circuits: radial supplies, ring mains, spurs
Lighting circuits: single-way, two-way, intermediate switching

Electrical circuit testing

202.74 Describe the use of insulation and continuity testers to test the insulation resistance, polarity and continuity of the circuits.
Power circuits: radial supplies, ring mains, spurs
Lighting circuits: single-way, two-way, intermediate switching

202.75 Describe the use of earth loop testers to test the impedance of the earthing protection system.

202.76 Identify from the regulations (IEE or other internationally recognised regulations) the limiting values for the tests listed in 202.74 and 202.75 above.

Electric motors

202.77 Describe the construction and explain the operation of different types of electric motor.
Types of motors: dc commutator motor, dc brushless motor, three-phase induction motor, single-phase ac motor

202.78 State typical applications of the types of motors.
Types of motors: dc commutator motor, dc brushless motor, three-phase induction motor, single-phase ac motor

Use of soldered connections

202.79 Identify the types of soldering iron, voltages and power rating suitable for use in electrical work.

202.80 State the type and gauges of cored solder used in electrical work and explain the purposes of the use of a suitable flux.

Integrated circuits

202.81 Explain that an integrated circuit is a silicon device with resistors, diodes and transistors formed in a single chip to provide an active circuit device providing either linear or switching/logic operations.

202.82 Explain that an operational amplifier (Op-Amp) is a high gain, differential amplifier in the form of a linear integrated circuit with provision to control its voltage gain by means of externally connected resistors.

202.83 Draw a circuit and explain the operation of an inverting amplifier based on an op-amp with negative feedback and show that the voltage gain is controlled by the ratio of the feedback to input resistors.

202.84 Draw a circuit and explain the operation of a non-inverting amplifier based on an op-amp with negative feedback and show that the voltage gain is {1 + (the ratio of the feedback resistors)}.

202.85 Explain that digital integrated circuits consist of a silicon chip processed to form a number of logic circuits interconnect to provide a wide range of logic functions.

202.86 State there are two groups of logic integrated circuit, transistor-transistor logic (TTL) and complementary metal oxide semiconductors (CMOS).

202.87 Explain that CMOS circuits are based on insulated gate field-effect devices (MOSFETs)
and consume considerably less power than TTL types.

Test specification for written paper Electrical and Electronic Applications (8030-21-202)

This is a written examination paper lasting one hour and comprising forty multiple choice questions. Candidates must answer **all** 40 questions.

The examination paper will cover the knowledge specifications:

Topic	Approximate % examination weighting
Electrical supplies and electronic signals	10%
Resistors and dc circuits	10%
Capacitors	10%
Inductors and transformers	8%
Diodes	8%
Transistors	15%
Power supplies	5%
Electrical cables	5%
Isolation and protection in electrical circuits	5%
Circuits and wiring	5%
Electrical circuit testing	5%
Electric motors	3%
Use of soldered connections	3%
Integrated circuits	8%

Practical assignment 203/1: Power Supply

1 Objective references

202.1 – 202.4

2 Preparation

2.1 **Location of test**
The training centre or other venue where supervision and appropriate working conditions will be provided.

2.2 **Requirements**
Copy of section 6.

Graph or squared paper, pen, pencil, ruler.

Soldering equipment, components as required on circuit diagram, printed circuit board or strip board or matrix 75 X 30 mm, single sided pins.

Component (parts) list

Name	No required
Zener or voltage reference diode 9V	1
Transistor silicon p-n-p	1
Rectifier 126	4
Capacitor electrolytic sub miniature 100µF	2
Resistor 470 Ω 1/4 W	1
Printed Circuit board, strip board 0.06 mm, matrix 75 X 30 mm	1

Note the circuit board may be modified to suit local availability of components.

2.3 **Instructor notes**
In this assignment candidates are required to identify the components (see circuit diagram section 6) and solder components to matrix board to the layout in the circuit diagram and test. The time allowed for the assignment is 6 hours.

3 Candidates' instructions

3.1 The time allowed for this assignment is 6 hours. You are advised to read all the instructions before commencing work. If you do not understand all the instructions then please ask you instructor.

In this assignment you are required to identify the components (see circuit diagram section 6) and solder components to matrix board to the layout in the circuit diagram and test.

3.2 From component (parts) list, identify the components in the circuit diagram (section 6).

3.3 Plan the layout on graph (squared) paper) and ensure the layout is economical.

3.4 Check the layout is correct with your instructor.

3.5 Remove copper track at hole E11.

3.6 Solder wire links C5-E5, B13-E13 and D16-G16 on reverse side of strip board.

3.7 Position components on reverse side of strip board clipping wire ends to protrude about 12 mm from the printed circuit. Bend wires over to secure the components.

3.8 Solder components to the board using a heat sink where necessary to protect the components.

3.9 Measure dc levels and record the values.

3.10 Put your name on your work and hand it in to your instructor.

4 Marking

4.1 Assignment completed in 6 hours. ( )

4.2 The components correctly listed. [ ]

4.3 The layout correctly and economically planned on graph (squared) paper. [ ]

4.4 The layout checked by the instructor. [ ]

4.5 Copper track at hole E11 removed. [ ]

4.6 Wire links C5-E5, B13-E13 and D16-G16 soldered on reverse side of strip board. [ ]

4.7 Components positioned on reverse side of strip board, wire ends clipped to protrude about 12 mm from the printed circuit, wires bent over to secure the components. [ ]

4.8 Components soldered to the board using a heat sink where necessary to protect the components. [ ]

4.9 dc levels measured and the values recorded. [ ]

4.10 Work handed in to your instructor. [ ]

5 Assignment completion

The candidate will have satisfactorily completed this assignment if successful in all the items marked with [ ].

A period of seven days must elapse before an unsuccessful candidate may retake this assignment. An alternative circuit design should be used.

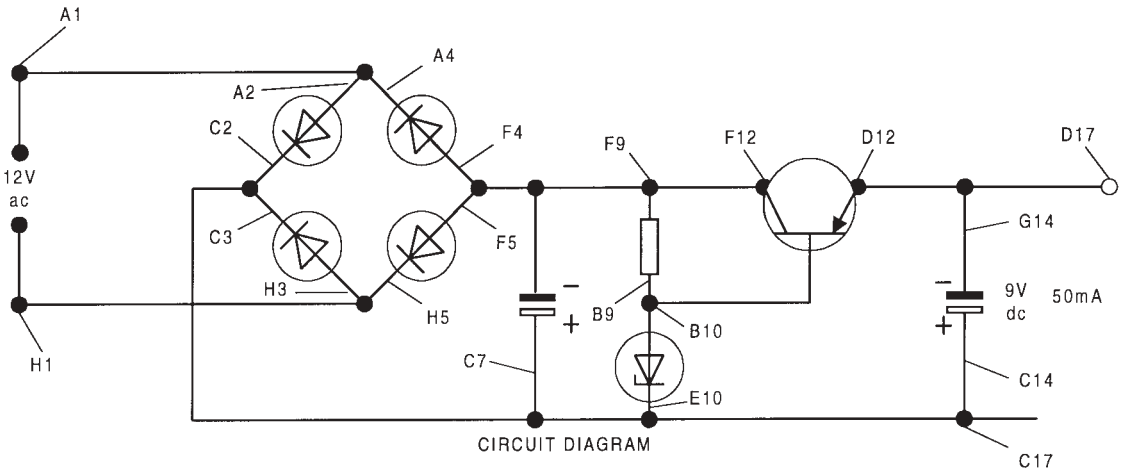
6 Assignment documentation

6.1 Component (parts) list

Name	No required
Zener or voltage reference diode 9V	1
Transistor p-n-p	1
Rectifier 126	4
Capacitor electrolytic sub miniature 100μF	2
Resistor 470 Ω 1/4 W	1
Printed circuit board, strip board 0.06 mm, matrix 75 X 30 mm	1

6 Assignment documentation

6.2 Circuit Diagram



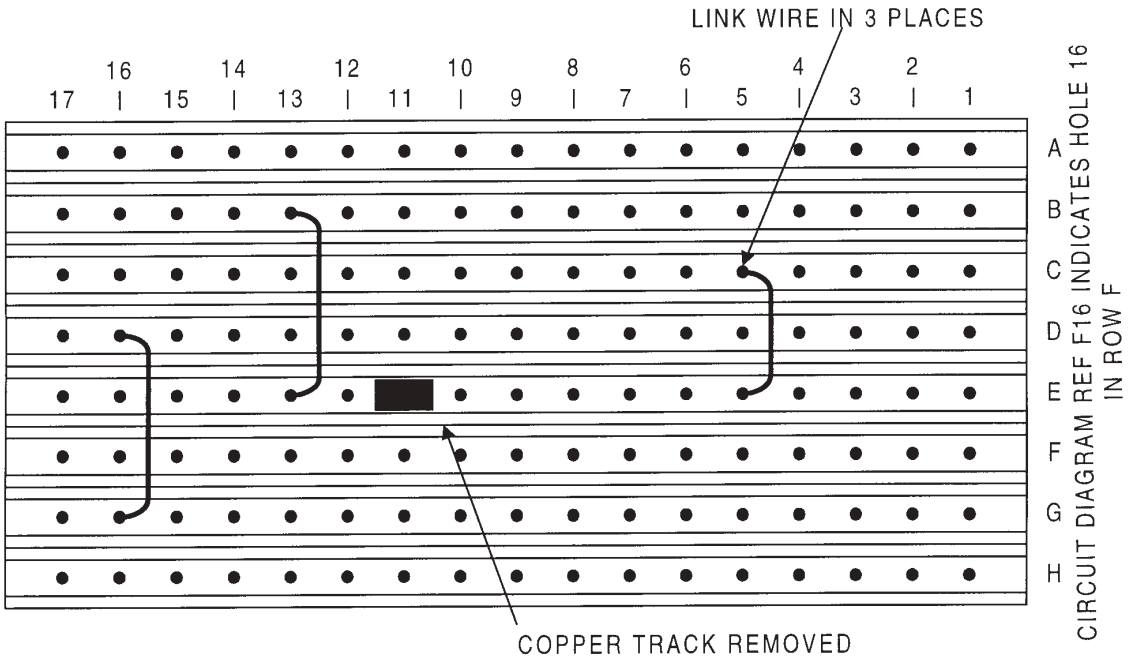
NOTE:

1 ANY SUITABLE PRINTED CIRCUIT BOARD MAY BE USED

2 RECTIFIER CIRCUIT MAY BE MODIFIED TO SUIT COLLEGE REQUIREMENTS

6 Assignment documentation

6.3 Printed Circuit Board



Practical assignment 203/2: Positive Voltage Regulator Circuit

1 Objective references

202.1 – 202.4

2 Preparation

2.1 **Location of test**
The training centre or other venue where supervision and appropriate working conditions will be provided.

2.2 **Requirements**
Circuit diagram shown in section 6.

Graph or squared paper, pen, pencil, ruler.

Soldering equipment, components as required on circuit diagram, 0.1in (2.54 mm) pitch matrix board (SRBP) 50 X 100 mm, single sided pins.

Note the circuit board may be modified to suit local availability of components.

2.3 **Instructor notes**
In this assignment candidates are required to identify the components (see circuit diagram section 6) and solder components to matrix board to the layout in the circuit diagram. The time allowed for this assignment is 6 hours.

3 Candidates' instructions

3.1 The time allowed for this assignment is 6 hours. You are advised to read all the instructions before commencing work. If you do not understand all the instructions then please ask you instructor.

In this assignment you are required to identify the components (see circuit diagram section 6) and solder components to matrix board to the layout in the circuit diagram.

3.2 List the components required from the diagram (section 6).

3.3 Plan the component layout on graph (squared) paper) and ensure the layout is economical.

3.4 Check the layout is correct with your instructor.

3.5 Insert the components in the strip board and insert pins in appropriate holes in the board to anchor the components.

3.6 Solder the components to the pins to form the power supply circuit shown.

3.7 Power up circuit using 12 volt ac power supply unit (or suitable mains transformer).

3.8 Measure dc levels throughout circuit and record the values.

3.9 Connect to load (eg 4 K 7) and check that the output voltage remains constant.

3.10 Put your name on your work and hand it in to your instructor.

4 Marking

4.1	Assignment completed in 6 hours.	( )
4.2	The components correctly listed.	[ ]
4.3	The layout correctly and economically planned on graph (squared) paper.	[ ]
4.4	The layout checked by the instructor.	[ ]
4.5	The components inserted in the strip board and pins inserted in appropriate holes in the board to anchor the components.	[ ]
4.6	The components soldered to the pins to form the amplifier circuit shown.	[ ]
4.7	Circuit powered up using 12 volt ac power supply unit (or mains transformer).	[ ]
4.8	dc levels measured throughout circuit and the values recorded.	[ ]
4.9	Connected to load and output voltage remained constant.	[ ]
4.10	Work handed in to your instructor.	[ ]

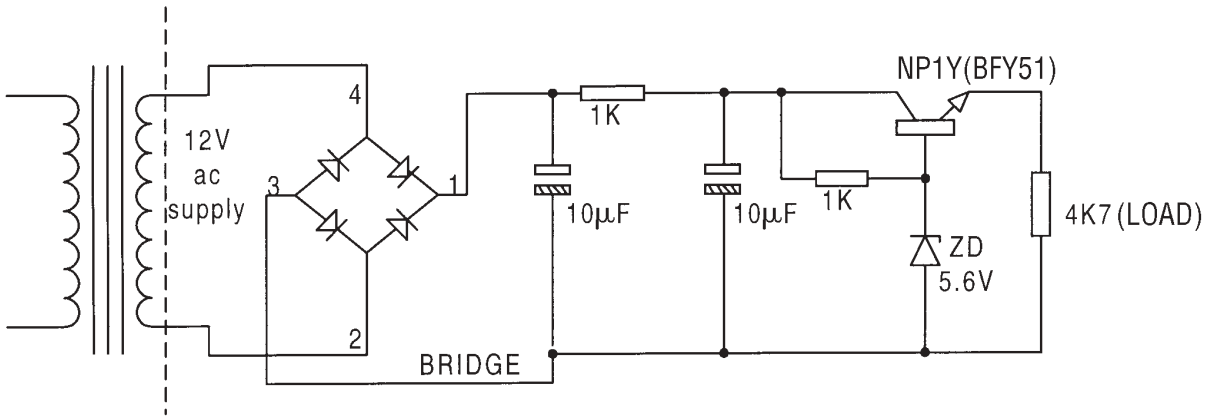
5 Assignment completion

The candidate will have satisfactorily completed this assignment if successful in all the items marked with [ ].

A period of seven days must elapse before an unsuccessful candidate may retake this assignment. An alternative circuit design should be used.

6 Assignment documentation

6.1 Power Supply



Practical assignment 203/3: Amplifier

1 Objective references

202.1 – 202.5

2 Preparation

2.1 **Location of test**
The training centre or other venue where supervision and appropriate working conditions will be provided.

2.2 **Requirements**
Circuit diagram shown in section 6.

Graph or squared paper, pen, pencil, ruler.

Soldering equipment, components as required on circuit diagram, 0.1in (2.54 mm) pitch matrix board (SRBP) 50 X 100 mm, single sided pins.

Note the circuit board may be modified to suit local availability of components.

2.3 **Instructor notes**
In this assignment candidates are required to identify the components (see circuit diagram section 6) and solder the components to the matrix board to the layout in the circuit diagram. Time allowed for this assignment 6 hours.

3 Candidates' instructions

3.1 The time allowed for this assignment is 6 hours. You are advised to read all the instructions before commencing work. If you do not understand all the instructions then please ask you instructor.

In this assignment you are required to identify the components (see circuit diagram section 6), solder components to matrix board to the layout in the circuit diagram.

3.2 List the components required from the diagram (section 6).

3.3 Plan the layout on graph (squared) paper and ensure the layout is economical.

3.4 Check the layout is correct with your instructor.

3.5 Insert the components in the strip board and insert pins in appropriate holes in the board to anchor the components.

3.6 Solder the components to the pins to form the amplifier circuit shown.

3.7 Power up circuit using 9 volt power supply unit (or battery).

3.8 Check dc levels throughout circuit and record the values.

3.9 Input 1 kHz signal from signal generator and display input and output on an oscilloscope. Adjust input amplitude to avoid any distortion.

3.10 Draw the input signal and the output signal and measure the amplitudes.

3.11 Calculate the voltage gain of the amplifier from the results obtained in 3.10.

3.12 Increase the input amplitude to a maximum value without causing significant distortion and record the value.

3.13 Put your name on your work and hand it in to your instructor.

4 Marking

4.1	Assignment completed in 6 hours.	( )
4.2	The components correctly listed.	[ ]
4.3	The layout correctly and economically planned on graph (squared) paper.	[ ]
4.4	The layout checked by the instructor.	[ ]
4.5	The components inserted in the strip board and pins inserted in appropriate holes in the board to anchor the components.	[ ]
4.6	The components soldered to the pins to form the amplifier circuit shown.	[ ]
4.7	Circuit powered up using 9 volt power supply unit (or battery).	[ ]
4.8	dc levels checked throughout circuit and the values recorded.	[ ]
4.9	Input 1 KHz signal input from signal generator and input and output signal displayed on an oscilloscope. Input amplitude adjusted to avoid any distortion.	[ ]
4.10	The input signal and the output signal drawn and the amplitudes measured.	[ ]
4.11	The voltage gain of the amplifier calculated from the results obtained in 4.10.	[ ]
4.12	The input amplitude increased to a maximum value without causing significant distortion and the value recorded.	[ ]
4.13	Work handed in to the instructor.	[ ]

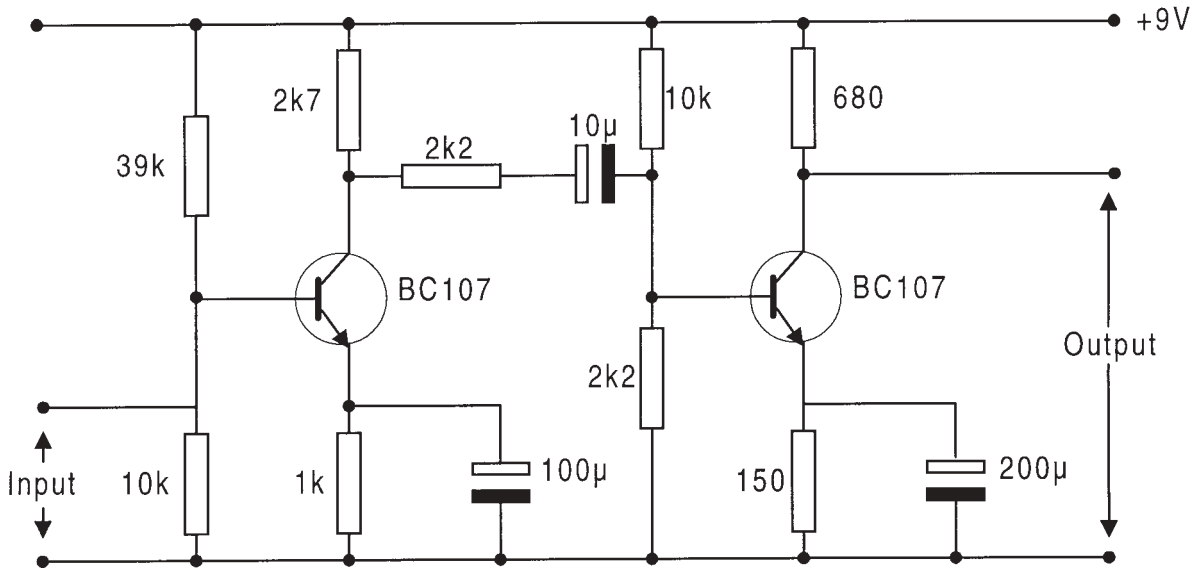
5 Assignment completion

The candidate will have satisfactorily completed this assignment if successful in all the items marked with [ ].

A period of seven days must elapse before an unsuccessful candidate may retake this assignment. An alternative circuit design should be used.

6 Assignment documentation

6.1 Circuit Diagram



Practical assignment 203/4: Lighting Circuit

1 Objective references

202.6 – 202.9

2 Preparation

2.1 **Location of test**
The training centre or other venue where supervision and appropriate working conditions will be provided.

2.2 **Requirements**
Components (Parts) List

Name	No. required	Remarks
1.5mm^2 3-core flexible cord	1m	
1.5mm^2 single core cable	1m	
1.5mm^2 T and E PVC cable	1.5m	clips to suit
SPDT switch	2	
Square surface box	2	
Batten lampholder	1	
5-terminal junction box	3	

Copy of section 6.

2.3 **Instructor notes**
Candidates are required to construct a two-way lighting circuit. The time allowed for this assignment is 4 hours.

3 Candidates' instructions

3.1 The time allowed for this assignment is 4 hours. You are advised to read all the instructions before commencing work. If you do not understand all the instructions then please ask you instructor.

You are required to construct a two-way lighting circuit. A diagram of the circuit and a component (parts) list is in section 6.

3.2 Assemble accessories on board.

3.3 Wire the circuit as shown in the diagram using 1.5mm^2 cable.

3.4 Connect flexible cord to the input junction box for use as a test lead.

3.5 Test

3.5.1 polarities

3.5.2 continuity

3.5.3 insulation resistances.

3.6 Test for correct operation of circuit.

3.7 Identify the regulations associated with the circuit (IEE or equivalent).

3.8 Put your name on your work and hand it to the instructor.

4 Marking

4.1	Assignment completed in 4 hours.	( )
4.2	Accessories assembled on board.	[ ]
4.3	Circuit diagram wired as shown in the diagram.	[ ]
4.4	Flexible cord connected to the input function box for use as a test lead.	
	4.4.1 polarity tested	[ ]
	4.4.2 earthing tested	[ ]
	4.4.3 insulation resistance tested.	[ ]
4.5	Correct operation of circuit tested.	[ ]
4.6	Regulations identified with the IEE or equivalent.	[ ]
4.7	Work handed in.	[ ]

5 Assignment completion

The candidate will have satisfactorily completed this assignment if successful in all the items marked with [ ].

A period of seven days must elapse before an unsuccessful candidate may retake this assignment. An alternative circuit diagram should be used.

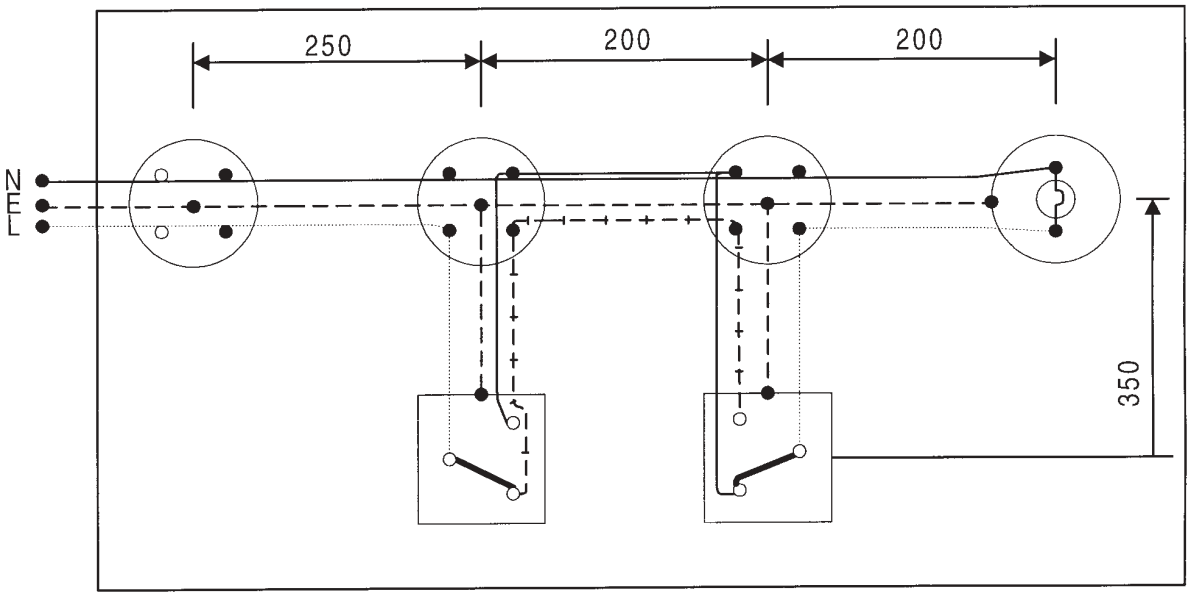
6 Assignment documentation

6.1 Components (parts) list.

Name	No. required	Remarks
1.5mm^2 3-core flexible cord	1m	
1.5mm^2 single core cable	1m	
1.5mm^2 T and E PVC cable	1.5m	clips to suit
SPDT switch	2	
Square surface box	2	
Batten lampholder	1	
5-terminal junction box	3	

6 Assignment documentation

6.2 Circuit diagram.



Practical assignment 203/5: Radial Circuit Wiring

1 Objective references

202.6 – 202.9

2 Preparation

2.1 **Location of test**
The training centre or other venue where supervision and appropriate working conditions will be provided.

2.2 **Requirements**
Components (Parts) List

Name	No. required	Remarks
PVC cable 2.5mm^2 T and E PVC 6mm^2 T and E	2m	clips to suit
13A switched socket outlet	2	with surface boxes
30 amp cooker socket	1	with surface box
Distribution	1	with 15A and 30A mcb

Copy of section 6.

2.3 **Instructor notes**
Candidates are required to construct a two-outlet radial circuit and a fixed cooker appliance using PVC surface wiring. Time allowed for this assignment is 4 hours.

3 Candidates' instructions

3.1 The time allowed for this assignment is 4 hours. You are advised to read all the instructions before commencing work. If you do not understand all the instructions then please ask you instructor.

You are required to construct a two-outlet radial circuit and a fixed cooker appliance using PVC surface wiring. The diagram of the circuits and the component (parts) list is in section 6.

3.2 Assemble distribution box and switched socket outlets on board.

3.3 Construct radial power circuit in 2.5mm2 twin and earth PVC insulated and sheathed cable.

3.4 Construct fixed cooker output point in 6mm2 twin and earth PVC insulated and sheathed cable.

3.5 Assemble 15A mcb and 30A mcb to protect the circuits in the distribution unit.

3.6 Test polarity, continuity, insulation resistance and earth loop impedance.

3.7 Test for satisfactory operation of circuit.

3.8 Put your name on your work and hand it to your instructor.

4 Marking

4.1	Assignment completed in 4 hours.	( )
4.2	Distribution box assembled.	[ ]
4.3	Radial power circuit constructed.	[ ]
4.4	Cooker output point constructed.	[ ]
4.5	15A mcb and 30A mcb circuit constructed in the distribution unit.	[ ]
4.6	Polarity, continuity and insulation tested.	[ ]
4.7	Circuit operating satisfactorily.	[ ]
4.8	Work handed in to instructor.	[ ]

5 Assignment completion

The candidate will have satisfactorily completed this assignment if successful in all the items marked with [ ].

A period of seven days must elapse before an unsuccessful candidate may retake this assignment. An alternative circuit diagram should be used.

6 Assignment documentation

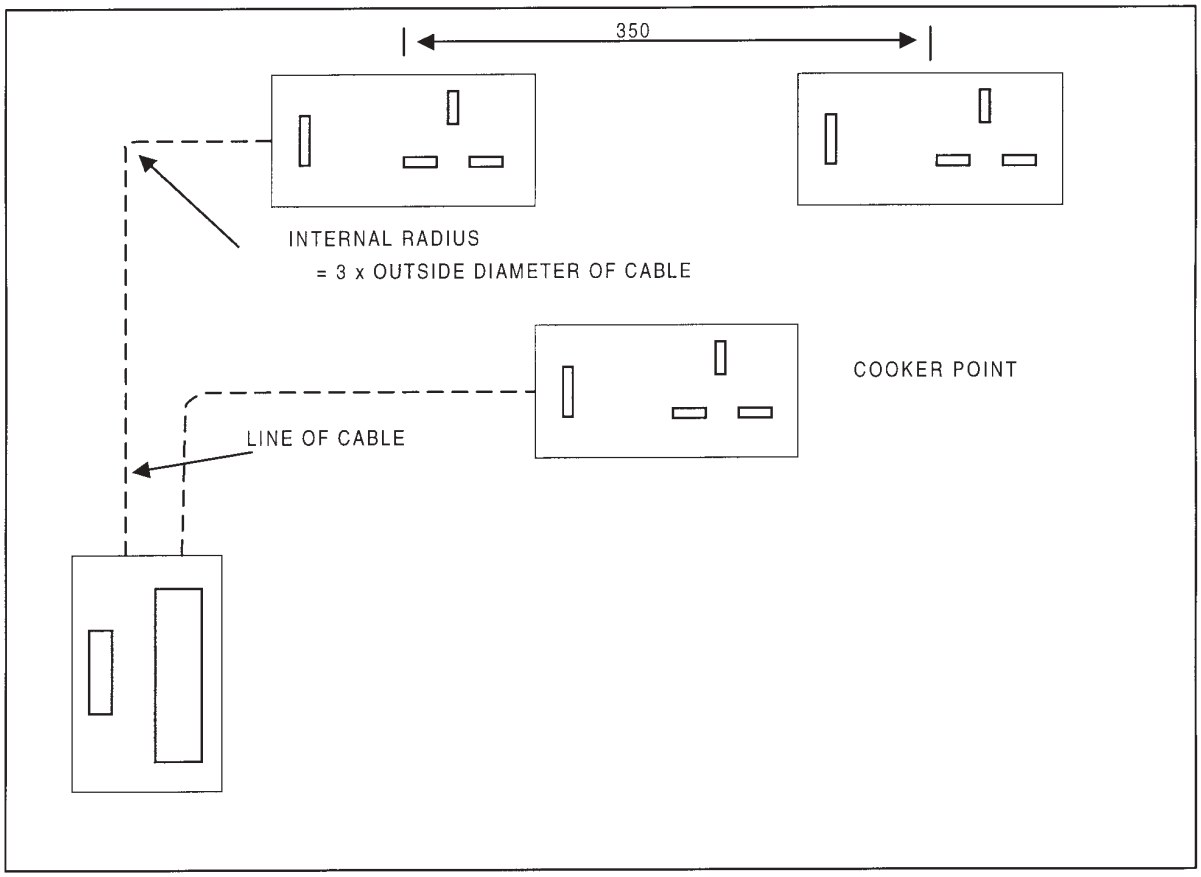
6.1 Copy of components (parts) list

Name	No. required	Remarks
PVC cable 2.5mm^2 T and E PVC 6mm^2 T and E	2m	clips to suit
13A switched socket outlet	2	with surface boxes
30 amp cooker socket	1	with surface box
Distribution	1	with 15A and 30A mcb

Components (parts) list

6 ASSIGNMENT DOCUMENTATION

6.2 Circuit Diagram



Appendix A
Entry Level Mathematics

Introduction

The aim of this module is to provide the entry level of mathematics required by candidates wishing to take the assessments for the Technician Certificate Awards in Engineering.

Knowledge requirements

Instructors must ensure that candidates are able to:

Numeracy

1 Perform calculations involving the four operations of addition, subtraction, multiplication and division applied to whole and decimal numbers.

2 Perform calculations involving the four arithmetic operations applied to positive and negative numbers, using the rules relating to directed numbers.

3 Perform calculations to convert decimal fractions to a percentage and a percentage to a fraction.

4 Perform calculations to express one quantity as a percentage of another.

5 Perform calculations to divide various amounts into given ratios.

6 Perform calculations involving two quantities in direct proportion to each other.

7 Perform calculations involving two quantities in inverse proportion to each other.

8 Deduce estimated solutions to arithmetic calculations, expressing the results to both a given number of significant figures and to a given number of decimal places.

9 Express denary numbers in binary form and binary numbers in denary form.

10 Define the terms base, index, power, reciprocal and square root.

11 Perform calculations applying the rules $a^m \times a^n = a^{(m+n)}$; $a^m/a^n = a^{(m-n)}$; $(a^m)^n = a^{mn}$ where m and n are positive indices; m and n are negative indices; m and n are fractional indices.

Algebra

12 Represent quantities by symbols and translate phrases involving quantities into algebraic expressions.

13 Simplify algebraic expressions involving symbols and numbers using a range of methods.
Methods: collect like terms using addition and subtraction; multiply and divide using the rules for directed numbers where applicable; remove brackets where applicable; apply the priority order precedence rules relating to arithmetic operations

14 Factorise expressions by extracting common factors, eg $ax + ay = a(x + y)$ and grouping, $ax - ay + bx - by = (a + b)(x - y)$

15 Construct and solve simple linear equations using appropriate data.

16 Evaluate formulae by substituting appropriate data.

Geometry

17 Identify a range of plane figures.
Plane figures: square, rectangle, triangle and circle

18 Calculate the perimeter and area of the plane figures.
Plane figures: square, rectangle, triangle and circle

19 Construct triangles from given information.
Given information: the lengths of three sides, the lengths of two sides and the magnitude of the included angle, the length of one side and the magnitudes of two angles

20 Identify the Theorem of Pythagoras and apply it to determine the length of the unknown side of a right-angled triangle given the length of the other two sides.

Graphs

21 Identify the point of origin for horizontal and vertical axes including positive and negative co-ordinates.

22 Determine suitable scales to be applied to the axes to enable given data to be plotted.

23 Plot graphs from given data.

24 Read values of y for given values of x and values of x for given values of y from a graph and interpolate intermediate values between points.

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Appendix B
Practical assignments

Two assessment methods are used in the 8030 Technician Awards in Engineering programme – written questions and practical assignments.

Practical assignments
Each unit or component in the Certificate level of this programme has a related practical assignment or assignments. These assignments may call on skills covered in other sections but reference is only made to the objectives covered by the marking criteria. Wherever relevant the option is given for you to use local names, local currencies, alternative measurements and paper sizes, or to design an alternative assessment. Where this option is taken **the assignment must be of a comparable standard** to ensure consistency between centres using this programme. The assignment must be documented and available for the visiting verifier. ALL assignments must be successfully completed.

The assignments may be administered at any time convenient to the instructor and to the candidate.

The practical assignments in this publication are intended to be photocopied.

Instructor notes
It is essential that you read these before attempting to administer the practical assignment. Practical assignments usually require you to prepare material for the assignment.

Candidate instructions
Make sure every candidate has a copy of these before beginning the practical assignment.

Marking
The marking is based on performance criteria or outcomes related to the practical assignment, to which the answer will always be either 'yes – the candidate achieved this' or 'no – the candidate did not achieve this'. Credit is given for those performance objectives for which the answer is 'yes – the candidate achieved this'.

Supervision
All assignments require supervision and you must make sure that the results reflect only the individual candidate's own work. You must keep all assessment documentation and material in a file for each candidate until the results have been agreed by the visiting verifier and until confirmation of result has been received from City & Guilds.

Records, results and certification
Successful completion of the related practical assignments for each unit needs to be recorded and then sent to City & Guilds. We suggest that you keep a record of each individual's achievements which may then be transferred to the entry forms. A model is given at the end of this section but you may use any form of record keeping that is convenient and accessible.

In order to gain certification, results for successfully completed practical assignments must be sent to City & Guilds. Results for practical assignments are entered onto Form S which is then countersigned by the visiting verifier and sent to us.

An advantage of this programme is that candidates who successfully complete the practical assignments for a single unit may, if they wish, claim a Certificate of Unit Credit. This may be beneficial for those candidates who only wish to complete part of this programme. Send these claims to us at any time provided the visiting verifier has countersigned the Form S.

Candidates wishing to gain the full award (Certificate, Diploma or Advanced Diploma) must successfully complete all the relevant practical assignments. We recommend that their practical results are sent at the time of, or shortly before the date of the written examinations.

Visiting verifier
The operation of this programme requires the appointment of a visiting verifier. **The visiting verifier must countersign the results of the practical assignments on Form S.** The visiting verifier should also be able to inspect records and candidates' work to verify the results before submission.

Technician Certificate in Applied Electrical and Electronic Engineering
Candidate assessment record

***Candidates must complete these assignments**

Candidate's name and number

Centre name and number

Assessment reference		Date completed	Instructor signature	Instructor name
201/8	Assembly drawing*			
201/10	Selecting materials*			
201/14	Safety in the workshop*			
203/3	Amplifier*			
201/1	Carry out statistical survey			
201/2	Construct distance/time graphs			
201/3	Specific heat capacity			
201/4	Demonstrate the effect of heat			
201/5	Isometric views			
201/6	'V' block			
201/7	Heat sink			
201/9	Logic controlled power switch			
201/11	Creating and editing a document			
201/12	Editing a database			
201/13	Spreadsheet			
203/1	Power supply			

Assessment reference	Date completed	Instructor signature	Instructor name
203/2 Regulator circuit			
203/4 Lighting circuit			
203/5 Radial wiring circuit			

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