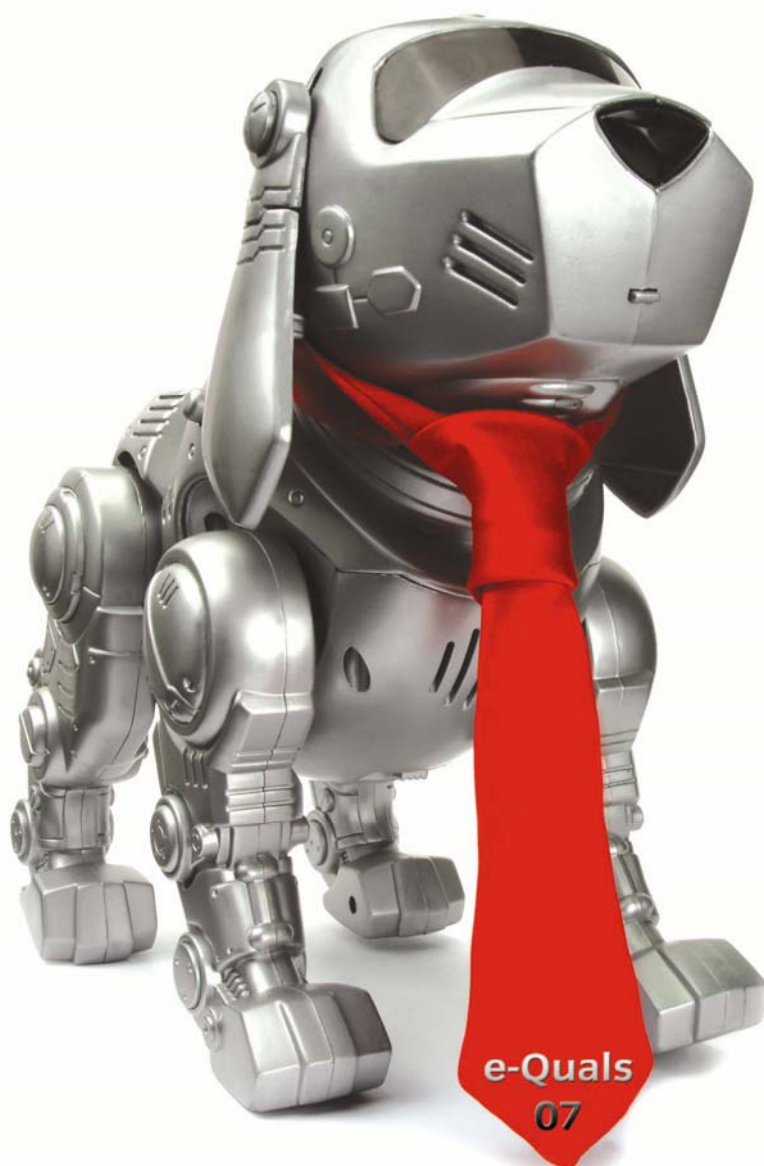


e-Quals Unit Syllabus

Level 2 Technology, components and circuits
(7267-421)



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City & Guilds

1 Giltspur Street

London EC1A 9DD

T +44 (0)20 7294 2800

F +44 (0)20 7294 2400

www.cityandguilds.com

enquiry@cityandguilds.com

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Rationale

This unit concerns the introduction to d.c. circuits, fundamental passive components, assembly and testing techniques.

Learning outcomes

There are **four** outcomes to this unit. The candidate will be able to demonstrate an understanding of:

- electrical units, primary cells and secondary cells
- cables, connectors, lamps and fuses
- resistors and potentiometers
- health and safety in the training and work environment.

Assessment and grading

Assessment will be by means of a **set assignment** covering both practical activities and underpinning knowledge.

Unit 421

Technology, components and circuits

Outcome 1

Demonstrate an understanding of electrical units, primary cells and secondary cells and apply this knowledge safely in a practical situation

Practical activities

The candidate will be able to:

- 1 carry out practical calculations involving electrical formulae and units
- 2 use a voltmeter to measure cell and battery terminal voltages

Underpinning knowledge

The candidate will be able to:

- 1 identify electrical units and properties of electrical circuits and trace the path of current in a circuit
 - a trace the path of current in a circuit
 - i conventional current for the majority of circuits
 - ii electron flow for some solid state devices and the CRT
 - b interpret a circuit diagram with relevant BS symbols consisting of
 - i supply
 - ii fuse
 - iii switch
 - iv conductor
 - v load
 - c state the effects of an electric current and their applications
 - i heating effect
 - ii magnetic effect
 - iii chemical effect
 - d define electrical units and state symbols
 - i volt
 - ii ampere
 - iii ohm
 - iv joule
 - e explain powers of ten and express numerical values for units in standard form for multiples and submultiples

- f explain the use of SI prefixes with electrical units
 - i mega
 - ii kilo
 - iii milli
 - iv micro
 - v nano
 - vi pico
 - g state the relationships between quantities
 - i $V=IR$
 - ii $P=IV$ etc
 - iii $W=Pt$
 - h explain decimal places, significant figures, squares, ratios, and averages
 - i perform transpositions and calculations based on the formulae in g)
- 2 identify primary and secondary cells and can
- a recognise the following types with applications
 - i zinc carbon
 - ii zinc chloride
 - iii alkaline
 - iv silver oxide
 - v lithium
 - vi nickel-cadmium
 - vii lead acid
 - b give reasons for series and parallel connection
 - c describe the relationship between A-h capacity and physical size
 - d state the effect of load current on terminal voltage
 - e describe procedures for practical measurements
 - i selection and care of instruments for testing
 - ii use of d.c. voltage ranges of multimeters
 - iii measurement of cell and battery terminal voltage.

Unit 421

Technology, components and circuits

Outcome 2

Demonstrate an understanding of cables, connectors, lamps and fuses and apply this knowledge safely in a practical situation

Practical activities

The candidate will be able to:

- 1 assemble electrical connectors
- 2 carry out continuity and insulation tests on connectors and cables
- 3 make continuity tests on fuses and lamps

Underpinning knowledge

The candidate will be able to:

- 1 identify the properties of conductors and insulators and can
 - a give examples of each
 - b describe the factors which affect resistance
 - i length (quantitatively)
 - ii cross sectional area (quantitatively)
 - iii resistivity (qualitatively)
 - c explain the importance of copper for cable conductors and printed circuit board tracks
 - d perform calculations based on the relationships in b) i) and ii)
 - e describe flexible mains cables for equipment
 - i rating
 - ii cross sectional area
 - iii colour codes for flexible cables brown, blue, green/yellow and red, black, green for older cables
 - f recognise current ratings of mains plugs
 - i BS1363 13A type
 - ii IEC 6/10A types
 - g state current ratings for multiple outlet distribution units and calculate inlet and outlet currents
 - h describe the use of a mains test connector (Test-block)
 - i describe preventive maintenance for flexible mains cables
 - j explain the need for earthing and screening signal cables

- k describe procedures for practical measurements and assembly
 - i selection and care of instruments for circuit testing
 - ii use of multimeter resistance ranges
 - iii identification and care of tools for assembly tasks
 - iv screw and solder terminations
 - v wiring a mains plug and socket
 - vi wiring a coaxial plug
 - vii wiring multicore cable to a multi point pin connector
 - viii continuity and insulation tests on assembled plugs, cables and fuses
- 2 identify the effects of heat in devices and can
 - a describe the effects of temperature change and give examples for
 - i solids
 - ii liquids
 - iii gases
 - b explain methods of heat transfer
 - i conduction
 - ii convection
 - iii radiation
 - c outline the operation of heat sinks with examples
 - i transistor types
 - ii types for plastic packaged devices
 - iii high power types
 - d define fuse rating and recognise common fuses
 - i anti-surge types
 - ii quick blow fuse
 - iii thermal fuse
 - e recognise mains fuses and applications
 - i fused plug
 - ii IEC fused socket
 - iii colour coding for mains fuses
 - iv procedure for fuse replacement

- f recognise incandescent panel lamps, applications and symbols
 - i MES
 - ii MCC
 - iii MBC
 - iv flanged
 - v bi-pin
 - vi wedge
 - vii typical operating voltages and currents
 - viii circuit symbols for panel lamps
 - ix calculations based on $P=IV$ for lamps
- g describe procedures for practical measurements
 - i selection and care of instruments for circuit testing
 - ii continuity tests on fuses and lamps.

Unit 421

Outcome 3

Technology, components and circuits

Demonstrate an understanding of resistors and potentiometers and apply this knowledge safely in a practical situation

Practical activities

The candidate will be able to:

- 1 carry out assembly of resistor networks
- 2 test resistors and potentiometers

Underpinning knowledge

The candidate will be able to:

- 1 identify resistors, potentiometers and simple networks and can
 - a explain percentage and tolerance
 - b recognise common types of resistor together with
 - i circuit symbols
 - ii coding
 - iii applications
 - c describe qualitatively the effect of temperature on resistance of common
 - i elementary metallic conductors
 - ii insulating materials
 - d explain power dissipation in components
 - e recognise thermistors and applications
 - i PTC
 - ii NTC
 - f solve resistive circuit calculations limited to two resistors in series and two resistors in parallel (using product over sum method)
 - i perform transpositions based on the formulae
 - ii total resistance
 - iii voltages
 - iv currents
 - v power

- g describe the voltage divider principle (unloaded) with applications and recognise the following controls
 - i potentiometer
 - ii rotary single turn pot.
 - iii trimmer pot.
 - iv multi-turn preset pot.
 - v slider pot.
 - vi linear and log law for variable potentiometers
 - vii variable resistor (rheostat) connection
 - viii joystick configuration
- h describe procedures for practical measurements and electronic assembly
 - i selection and care of instruments for circuit testing
 - ii use of multimeter d.c. current, voltage and resistance ranges
 - iii measurement of resistor and potentiometer current, voltage and resistance
 - iv solder terminations
 - v identification and care of tools needed for assembly tasks
 - vi handling and mounting precautions for components
 - vii assembly (on strip board and/or prepared PCB) of resistor networks
 - viii measurement of network currents, voltages and resistance.

Unit 421

Technology, components and circuits

Outcome 4

Demonstrate an understanding of health and safety in the training and work environment and apply this knowledge safely in a practical situation

Practical activities

The candidate will be able to:

- 1 investigate provisions for fire safety in the training or work environment

Underpinning knowledge

The candidate will be able to:

- 1 identify the need for health and safety at work and can
 - a refer to the legal background routine
 - i HASAWA 1974
 - ii Electricity at Work Regulations 1989
 - iii Safety Reps. and Committees 1977
 - iv Noise at Work Act 1989
 - v Reporting of Injuries (RIDDOR) 1995
 - vi Management of Health and Safety Regulations 1992 (Regulation 12 Employees Responsibility)
 - vii Personal Protective Equipment Regulations 1992 (Regulation 10 Employees Responsibility)
 - b describe personal attitudes to safety in the workshop and field service
 - i the need to act safely and responsibly
 - ii the need to work safely and responsibly
 - iii the need for awareness of the safety of others
 - c describe fire prevention and equipment
 - i conditions required for combustion
 - ii causes and spread of fire
 - iii fire prevention
 - iv fire fighting equipment for different types of fire
 - v fire drill
 - d describe evacuation procedures
 - i alarms and signals
 - ii signs
 - iii exits
 - iv emergency evacuation procedures for fire, explosion, toxic atmosphere, terrorist activity
 - v evacuation drill.

Unit record sheet

Use this form to track your progress through this unit.

Tick the boxes when you have covered each outcome. When they are all ticked, you are ready to be assessed.

Outcome	✓	Date
1 Demonstrate an understanding of electrical units, primary cells and secondary cells and apply this knowledge safely in a practical situation	<input type="checkbox"/>	
2 Demonstrate an understanding of cables, connectors, lamps and fuses and apply this knowledge safely in a practical situation	<input type="checkbox"/>	
3 Demonstrate an understanding of resistors and potentiometers and apply this knowledge safely in a practical situation	<input type="checkbox"/>	
4 Demonstrate an understanding of health and safety in the training and work environment and apply this knowledge safely in a practical situation	<input type="checkbox"/>	

Candidate Signature

Date

City & Guilds
Registration Number

Quality nominee
(if sampled)

Date

Assessor Signature

Date

External Verifier
Signature (if sampled)

Date

Centre Name

Centre Number

Published by City & Guilds

1 Giltspur Street

London

EC1A 9DD

T +44 (0)20 7294 2468

F +44 (0)20 7294 2400

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