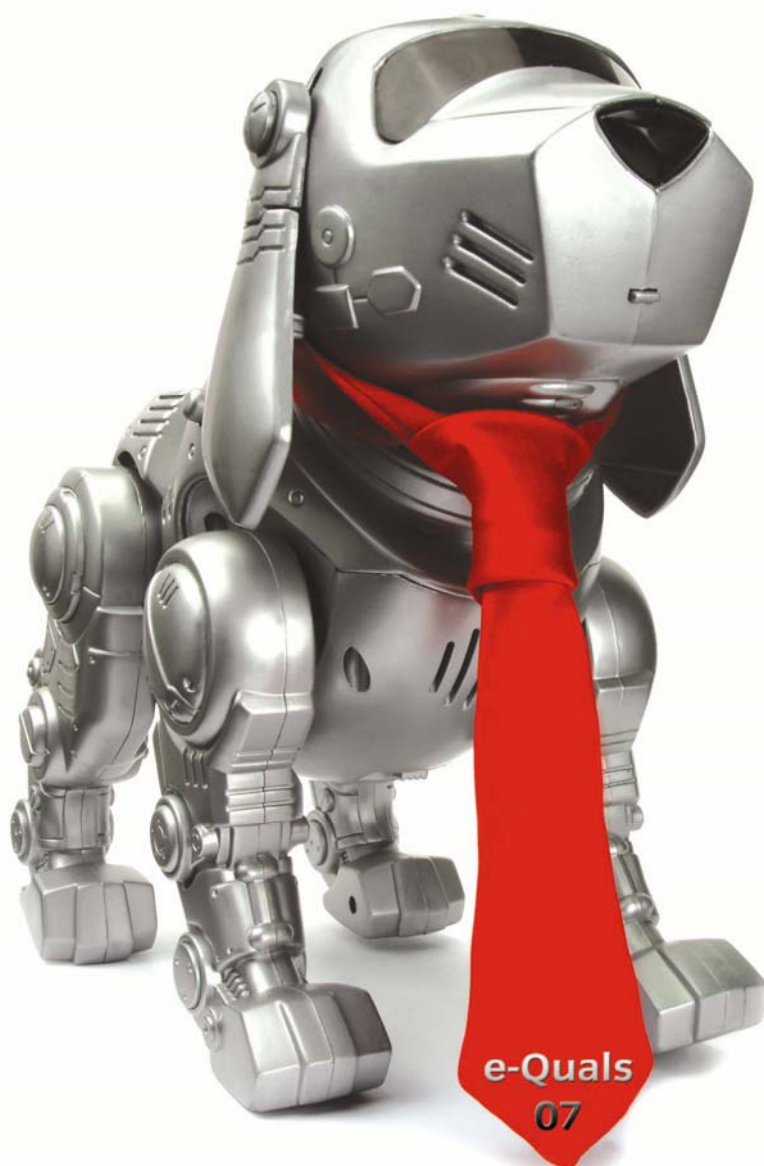


# e-Quals Unit Syllabus

Level 2 Technology and electronic components  
(7267-422)



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### Rationale

This unit concerns the introduction to a.c. circuits, reactive components, assembly and testing techniques.

### Learning outcomes

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

- electromagnetic devices and capacitors
- alternating current and voltage
- a.c. mains supply safety and distribution.

### Assessment and grading

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

## Unit 422

## Technology and electronic components

### Outcome 1

Demonstrate an understanding of electromagnetic devices and capacitors and apply this knowledge safely in a practical situation

#### Practical activities

The candidate will be able to:

- 1 carry out practical tests on electromagnetic devices
- 2 carry out the assembly of capacitor and resistor-capacitor networks
- 3 test capacitors and networks

#### Underpinning knowledge

The candidate will be able to:

- 1 identify the behaviour of magnets and electromagnets and can
  - a define magnetic poles
  - b draw field patterns for simple permanent magnets and electromagnets
  - c describe the effect of magnetic and non magnetic materials on the field of a permanent magnet
  - d describe the effect of a magnetic material in the core of an electromagnet with applications
    - i solenoid
    - ii relay magnetic circuit
  - e describe the force on a current-carrying conductor in a magnetic field with applications
    - i permanent magnet motor
    - ii moving coil meter
  - f describe electromagnetic induction with applications
    - i simple generator
    - ii inductor
    - iii transformer
    - iv constructional features of coils and transformers
    - v unit of inductance
    - vi range of values for typical components
    - vii inductor and transformer circuit symbols

- 2 identify the property of capacitance and can
- a define
    - i positive and negative charges
    - ii the unit of charge
    - iii the symbol for quantity of charge
    - iv capacitance as the ability to store charge
    - v unit of capacitance
  - b state the relationship between
    - i charge (Q)
    - ii capacitance (C)
    - iii voltage (V)
  - c perform simple calculations and transformations based on  $Q=CV$
  - d state the elements of a capacitor and their effect on capacitance
    - i plate area (quantitatively)
    - ii dielectric thickness (quantitatively)
    - iii nature of dielectric (qualitatively)
    - iv circuit symbols for capacitors
    - v perform calculations based on the relationship in d) i) and ii)
  - e recognise common capacitor types and applications
    - i film foil polymer dielectric
    - ii metallised polymer film dielectric
    - iii disc ceramic
    - iv multilayer ceramic
    - v variable air dielectric
    - vi single turn trimmer
    - vii aluminium electrolytic
    - viii tantalum electrolytic
  - f explain practical aspects of capacitor applications
    - i tolerance
    - ii coding of capacitor values
    - iii importance of voltage rating
    - iv distinction between axial and radial leads
    - v connection of polarised electrolytics
  - g solve capacitive circuit calculations limited to two capacitors in parallel and two capacitors in series (using product over sum method)
    - i perform transpositions based on the formulae
    - ii total capacitance
    - iii charge
    - iv voltage

- h describe procedures for practical measurements and electronic assembly
  - i selection and care of instruments for circuit testing
  - ii insulation, continuity and resistance measurements on PM motors and generators, coils and transformers
  - iii solder terminations
  - iv identification and care of tools needed for assembly tasks
  - v handling and mounting precautions for components
  - vi assembly (on strip board and/or prepared PCB) of capacitor networks
  - vii continuity and resistance measurements on assembled network
  - vii use of capacitance meter to check individual and network values
  - ix health and safety aspects of the assembly processes.

## Unit 422

## Technology, components and circuits

### Outcome 2

Demonstrate an understanding of alternating current and voltage and apply this knowledge safely in a practical situation

#### Practical activities

The candidate will be able to:

- 1 use electronic instruments to make measurements in a.c. circuits
- 2 carry out the assembly of CR and LR circuits

#### Underpinning knowledge

The candidate will be able to:

- 1 identify fundamentals of alternating current and voltage and can
  - a define for a sinusoidal waveform
    - i cycle
    - ii periodic time
    - iii frequency
    - iv peak value
    - v peak-to-peak value
    - vi root mean square value
  - b state typical frequencies for
    - i power distribution
    - ii speech and music
    - iii communications
  - c describe the use of graphs
    - i axes
    - ii scales
  - d use waveforms of voltage or current to define
    - i in phase
    - ii antiphase
    - iii 90 deg phase shift
  - e solve power calculations for resistance only a.c. circuits using rms values
  - f describe capacitor function in a circuit
    - i block to d.c.
    - ii path for a.c.
  - g describe inductor function in a circuit
    - i restricts a.c.
    - ii path for d.c.



- h describe parallel LC circuit function
- i outline applications of the foregoing
- j describe procedures for practical measurements and electronic assembly
  - i selection and care of instruments for circuit testing
  - ii use of multimeter a.c. ranges
  - iii function of oscilloscope controls
  - iv use of oscilloscope to display a.c. waveforms
  - v function of signal generator controls
  - vi identification and care of tools needed for assembly tasks
  - vii handling and mounting precautions for components
  - viii assembly (on strip board and/or prepared PCB) of CR and LR networks
  - ix use of instruments to observe network waveforms
  - x health and safety aspects of the assembly processes.

## Unit 422

### Outcome 3

## Technology, components and circuits

Demonstrate an understanding of a.c. mains supply, safety and distribution and apply this knowledge safely in a practical situation

### Practical activities

The candidate will be able to:

- 1 carry out safe procedures for resetting safety devices
- 2 renew and rewire domestic fuses
- 3 test continuity of fuses
- 4 draw a diagram of power distribution within the workshop including forms of protection used and ratings

### Underpinning knowledge

The candidate will be able to:

- 1 identify the working principles of the a.c. mains supply and can
  - a identify on a diagram
    - i connection from local substation for single phase supply
    - ii consumer's circuit, main fuse, energy meter, consumer unit, lighting and power circuits
  - b explain why equipment is earthed
  - c state the purpose of mains fuses in a consumer unit
    - i fuse ratings
    - ii renewal procedure
  - d state MCB principle of operation and application in a consumer unit
    - i MCB ratings
    - ii reset procedure
  - e state RCD principle of operation and application in a consumer unit
    - i tripping current
    - ii rated contact current
    - iii reset procedure
  - f state the principles of double insulation in equipment
    - i applications
    - ii flexible wiring arrangement

- g describe procedures for practical measurements and repair
  - i health and safety aspects of reset and repair processes
  - ii identification and care of tools needed for repair tasks
  - iii selection and care of instruments for circuit testing
  - iv fuse continuity test
  - v rewiring a fuse
- 2 identify electrical safety for workshop and field service and can
  - a give reasons for compliance with BS 7671 Code of practice (IEE Wiring Regulations, current edition)
  - b explain the danger of electric shock from the use of electrical equipment
  - c state how risks may be reduced by observing codes of practice, standards and legislation
  - d state the need to avoid working on live equipment
  - e list measures to ensure safety
    - i circuit isolation
    - ii verification and securing
    - iii circuit identification by notices and labelling
  - f describe how to inspect and check cables, leads and plugs for safety
  - g describe portable equipment hazards (Electricity at Work Regulations 1989)
- 3 hazards and first aid treatment for workshop and field service and can
  - a describe the human body as part of an electrical circuit
  - b state how to isolate a casualty from a live circuit
  - c explain methods of resuscitation
  - d describe burn injuries from high energy electrical faults
  - e describe appropriate first aid treatment for burn injuries.

# 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 electromagnetic devices and capacitors and apply this knowledge safely in a practical situation	<input type="checkbox"/>	
2 Demonstrate an understanding of alternating current and voltage and apply this knowledge safely in a practical situation	<input type="checkbox"/>	
3 Demonstrate an understanding of a.c. mains supply, safety and distribution 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 .....

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Centre Number .....

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