

# e-Equals Unit Syllabus

Level 2 Digital electronics 2  
(7267-425)



## About City & Guilds

City & Guilds is the UK's leading provider of vocational qualifications, offering over 500 awards across a wide range of industries, and progressing from entry level to the highest levels of professional achievement. With over 8500 centres in 100 countries, City & Guilds is recognised by employers worldwide for providing qualifications that offer proof of the skills they need to get the job done.

## City & Guilds Group

The City & Guilds Group includes City & Guilds, ILM (the Institute of Leadership & Management) which provides management qualifications, learning materials and membership services, NPTC which offers land-based qualifications and membership services, and HAB (the Hospitality Awarding Body). City & Guilds also manages the Engineering Council Examinations on behalf of the Engineering Council.

## Equal opportunities

City & Guilds fully supports the principle of equal opportunities and we are committed to satisfying this principle in all our activities and published material. A copy of our equal opportunities policy statement *Access to assessment and qualifications* is available on the City & Guilds website.

## Copyright

The content of this document is, unless otherwise indicated, © The City and Guilds of London Institute 2010 and may not be copied, reproduced or distributed without prior written consent.

However, approved City & Guilds centres and learners studying for City & Guilds qualifications may photocopy this document free of charge and/or include a locked PDF version of it on centre intranets on the following conditions:

- centre staff may copy the material only for the purpose of teaching learners working towards a City & Guilds qualification, or for internal administration purposes
- learners may copy the material only for their own use when working towards a City & Guilds qualification
- the *Standard Copying Conditions* on the City & Guilds website.

Please note: National Occupational Standards are not © The City and Guilds of London Institute. Please check the conditions upon which they may be copied with the relevant Sector Skills Council.

## Publications

City & Guilds publications are available on the City & Guilds website or from our Publications Sales department at the address below or by telephoning +44 (0)20 7294 2850 or faxing +44 (0)20 7294 3387.

Every effort has been made to ensure that the information contained in this publication is true and correct at the time of going to press. However, City & Guilds' products and services are subject to continuous development and improvement and the right is reserved to change products and services from time to time. City & Guilds cannot accept liability for loss or damage arising from the use of information in this publication.

## City & Guilds

**1 Giltspur Street**

**London EC1A 9DD**

**T +44 (0)20 7294 2800**

**F +44 (0)20 7294 2400**

**[www.cityandguilds.com](http://www.cityandguilds.com)**

**[enquiry@cityandguilds.com](mailto:enquiry@cityandguilds.com)**

# Contents

<b>Unit 425</b>	<b>Digital electronics 2</b>	<b>2</b>
Outcome 1	Demonstrate an understanding of combinational logic circuits and apply this knowledge safely in a practical situation	3
Outcome 2	Demonstrate an understanding of multivibrators, timers and logic systems and apply this knowledge safely in a practical situation	5
Outcome 3	Demonstrate an understanding of input signals and output displays in digital systems and apply this knowledge safely in a practical situation	7
<b>Unit record sheet</b>		<b>9</b>

### Rationale

This unit concerns the introduction to digital logic devices and applications, also testing techniques and fault finding on prepared circuit boards.

### Learning outcomes

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

- combinational logic circuits
- multivibrators, timers and logic systems
- input signals and output displays in digital systems.

### Assessment and grading

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

## Unit 425

## Digital electronics 2

### Outcome 1

Demonstrate an understanding of combinational logic circuits and apply this knowledge safely in a practical situation

#### Practical activities

The candidate will be able to:

- 1 assemble circuits on prototype boards using logic gates.
- 2 carry out test/fault-finding procedures on prepared combinational logic circuit boards.

#### Underpinning knowledge

The candidate will be able to:

- 1 identify the structure of number systems and can
  - a define
    - i denary system
    - ii binary system
  - b undertake calculations using binary arithmetic
  - c make conversions between systems
  - d explain binary coded decimal representation
- 2 identify the working principles of combinational logic elements and can
  - a explain how AND OR logic functions may be represented by switches
  - b describe positive and negative logic conventions
  - c define logic terms NOT NAND NOR
  - d draw symbols for logic gates to BS3939 and US Milspec
  - e set out truth tables for functions in c)
  - f recognise common digital integrated circuits and power requirements
    - i standard 74 series TTL
    - ii standard 4000 series CMOS
    - iii importance of correct d.c. supply voltage
    - iv setting up power supplies
    - v simple methods for over voltage and reverse voltage protection
  - g explain the convergence between TTL and CMOS in later versions of digital integrated circuits
  - h describe simple combinational systems based on multiple NAND gates
    - i NOT from NAND
    - ii OR from NAND
    - iii NOR from NAND
    - iv AND from NAND

- i describe procedures for practical measurements and fault-finding
  - i selection and care of instruments for circuit testing
  - ii assembly exercises using prototype board of combinational logic circuits
  - iii use of multimeter, logic probe and logic pulser to observe circuit behaviour
  - iv testing logic circuits on a prepared circuit board
  - v simple fault-finding to gate level.

## Unit 425

## Digital electronics 2

### Outcome 2

Demonstrate an understanding of multivibrators, timers and logic systems and apply this knowledge safely in a practical situation

#### Practical activities

The candidate will be able to:

- 1 assemble and testing circuits using integrated circuit multivibrators, timers and logic systems on prototype boards
- 2 carry out test and fault-finding procedures on prepared circuit boards

#### Underpinning knowledge

The candidate will be able to:

- 1 identify multivibrators and timer integrated circuits and can
  - a define the family of multivibrator circuits
    - i astable
    - ii monostable
    - iii bistable
  - b describe an astable logic gate oscillator
    - i conversion to crystal control
    - ii function of a clock oscillator
  - c set out the truth table for an RS bistable
  - d recognise single and multiple forms of integrated circuit RS bistable
  - e describe procedures for using a 555 IC timer as
    - i astable
    - ii monostable
- 2 identify logic systems and can
  - a recognise a binary counter (asynchronous) as a system
    - i input and outputs
    - ii timing diagram
  - b state the function of a register and modes of operation
    - i SIPO
    - ii SISO
    - iii PIPO
    - iv PISO
  - c state the purpose of a display decoder/driver

- d describe A-D and D-A converters as system blocks
  - i input and output specification
  - ii applications
- e describe procedures for practical measurements and fault finding
  - i selection and care of instruments for circuit testing
  - ii assembly exercises on prototype board of multivibrators, timers and logic systems
  - iii use of multimeter, logic probe, logic pulser and oscilloscope to observe circuit behaviour
  - iv fault-finding to module level on prepared circuit boards.



## Unit 425

## Digital electronics 2

### Outcome 3

Demonstrate an understanding of input signals and output displays in digital systems and apply this knowledge safely in a practical situation

#### Practical activities

The candidate will be able to:

- 1 assemble debounced switches and LED devices on prototype board
- 2 carry out practical measurements.
- 3 carry out test and fault-finding procedures on prepared circuit boards

#### Underpinning knowledge

The candidate will be able to:

- 1 identify input signals suitable for digital systems and can
  - a describe logic levels derived from switches
  - b outline methods for debouncing
    - i simple CR network
    - ii use of RS bistable
    - iii Schmitt comparator
- 2 identify output indicators and displays for use with digital systems and can
  - a recognise LED devices
    - i range of colours
    - ii operating currents and voltages
    - iii calculation of limiting resistor value
  - b recognise forms of LED display
    - i numeric and alphanumeric displays
    - ii 5 x 7 dot matrix display
    - iii 7 segment display
    - iv starburst display
    - v bargraph display
  - c recognise LCD reflective and transfective displays
    - i operating currents and voltages
    - ii calculation of power requirements
    - iii 7-segment version
    - iv 5 x 7 dot matrix version

- d describe procedures for practical measurements and fault finding
  - i selection and care of instruments for circuit testing
  - ii assembly exercises using prototype board of debounced switches and LED devices
  - iii use of instruments to observe circuit behaviour
  - iv fault-finding to module level on prepared circuit boards
- 3 identify personal behaviour leading to workplace accidents and can
  - a identify personal factors
    - i carelessness
    - ii unsuitable behaviour
    - iii unsuitable dress
    - iv fatigue
    - v drug and alcohol abuse
  - b identify shortcomings
    - i lack of training
    - ii lack of supervision
    - iii lack of experience
- 4 identify personal preventative measures to be taken in the workplace and can
  - a state the need for personal hygiene
    - i skin care and protection
    - ii ear and eye care
  - b explain the hazards of moving machinery with regard to
    - i hair
    - ii loose clothing
    - iii means of avoidance
  - c state the requirements for and use of protective clothing
  - d describe the use of protective equipment (Personal Protective Equipment Regulations 1992, Regulation 10 Employee's Responsibility).

# 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 combinational logic circuits and apply this knowledge safely in a practical situation	<input type="checkbox"/>	
2 Demonstrate an understanding of multivibrators, timers and logic systems and apply this knowledge safely in a practical situation	<input type="checkbox"/>	
3 Demonstrate an understanding of input signals and output displays in digital systems 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**

**[www.cityandguilds.com](http://www.cityandguilds.com)**

**[www.cityandguilds.com/e-quals07](http://www.cityandguilds.com/e-quals07)**

**City & Guilds is a registered charity  
established to promote education and  
training**