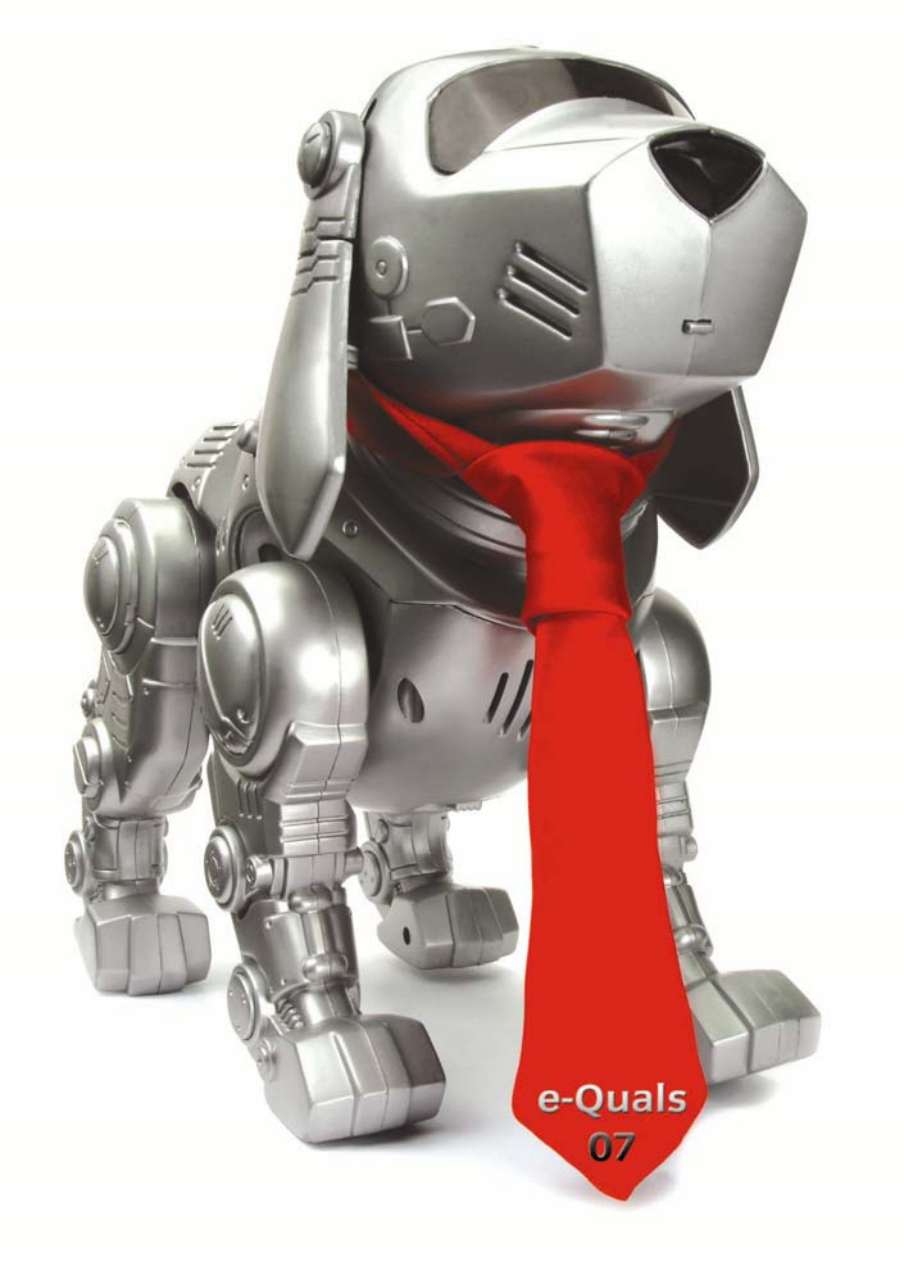
e-Quals Unit Syllabus

Level 3 Analogue Electronics (7267-525)

www.cityandguilds.com/ivqit
January 2010
Version 1.0



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, © City & Guilds Limited 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 © City & Guilds Limited. 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 2885
F +44 (0)20 7294 2405
www.cityandguilds.com
centresupport@cityandguilds.com

Contents

Unit 525	**Analogue Electronics**	**2**
Outcome 1	Demonstrate an understanding of power supplies, to component level	3
Outcome 2	Demonstrate an understanding of amplifiers, to component level and apply this knowledge safely in a practical situation	5
Outcome 3	Demonstrate an understanding of oscillators, multivibrators and waveform generator circuits, to component level	7
Unit record sheet		**8**

Unit 525 Analogue Electronics

Rationale

This unit concerns d.c. power supply units, amplifiers and oscillators; also faultfinding techniques on these circuits to component level.

Learning outcomes

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

- d.c. power supplies, to component level
- low frequency amplifiers, power amplifiers and operational amplifiers, to component level
- oscillators, multivibrators and waveform generator circuits, to component level.

Assessment and grading

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

Unit 525 Analogue Electronics

Outcome 1 Demonstrate an understanding of power supplies, to component level

Practical activities

The candidate will be able to:

1 use electronic instruments to test electronic circuit functions

2 fault find to component level

Underpinning knowledge

The candidate will be able to:

1 a select appropriate d.c. power supplies for a given application

b explain the operation of series and shunt regulator circuits

c explain the use of feedback and reference levels, to provide stabilisation due to circuit load changes

d explain the operation of a voltage doubler circuit

2 a outline the principles of switch mode power supplies (SMPS)

b state the advantages and disadvantages of SMPS over conventional voltage and current regulators

c describe the operation from a block diagram for

i. power switching

ii. chopper control

iii. start-up

iv. feedback

v. over-voltage and over-current protection

vi. d.c. outputs

d state expected waveforms and voltages at relevant points on a circuit diagram

e state, with reasons, the expected changes in waveforms and voltages for given fault conditions

f describe typical symptoms for given fault conditions

g describe methods of applying a dummy load to SMPS output

h describe typical adjustment procedures

i explain the principles of inverter power supplies

j explain the principles of voltage polarity inverters

k explain the principles of dc-dc converters

3 a describe the principles of voltage control by controlled rectification

b describe a.c. pulsed gating signals applied to a silicon controlled rectifier (SCR)

	c	describe applications of controlled rectification feeding a resistive load
4	a	explain the importance of safety-critical components
	b	explain the need for radio frequency suppression in power supplies
	c	explain the need for transient suppression in power supplies

Unit 525 Analogue Electronics

Outcome 2 Demonstrate an understanding of amplifiers, to component level and apply this knowledge safely in a practical situation

Practical activities

The candidate will be able to:

1 use electronic instruments to test electronic circuit functions

2 fault find to component level

Underpinning knowledge

The candidate will be able to:

1 a describe the operation of single and multi-stage transistor voltage amplifiers

b use frequency response plots to determine bandwidth for voltage amplifiers

c state typical values of components

d explain the effect of varying the collector load resistor on a transistor voltage amplifier

e describe from the output characteristics how distortion is produced

f identify characteristics of amplifier Class A, AB, B, C operation

g explain the effects of

i. d.c. negative feedback

ii. a.c. negative feedback

2 a explain the need for power amplifiers

b describe the operation of bipolar junction transistor (BJT) and MOSFET amplifiers

c describe the operation of transformer-less push-pull amplifiers

d explain why a.c. and/or d.c. feedback may be employed in power amplifiers

e state the input and output requirements of an IC power amplifier

3 a describe the operation of operational amplifiers

b state the requirements of an ideal operational amplifier

c describe the existence of a 'virtual earth' at the input when feedback is applied

d explain the terms 'drift' and 'offset'

e identify the following operational amplifier circuits and state a simple application of

i. an inverting amplifier

ii. a non-inverting amplifier

iii. integrator

iv. differentiator

v. differential amplifier

vi. comparator

vii. Schmitt trigger

viii. high pass and low pass active filters

f calculate the gain and time constant, where applicable, for the circuits in drift and offset.

Unit 525 Analogue Electronics

Outcome 3 Demonstrate an understanding of oscillators, multivibrators and waveform generator circuits, to component level

Practical activities

The candidate will be able to:

1 use electronic instruments to test electronic circuit functions

2 fault find to component level

Underpinning knowledge

The candidate will be able to:

1 a state the effects of positive feedback on amplifier gain and stability

b state the conditions for oscillation

2 a describe the operation of the following oscillators using

i. crystal

ii. ceramic resonator

iii. oscillator with divider chain

iv. Wien bridge network

v. LC network

b draw typical time related waveforms for the above circuits

3 a identify the components responsible for timing control in a 555 timer operating as

i. astable

ii. monostable

b show how the basic astable circuit can be modified to produce a sawtooth waveform

4 describe the operation of a voltage-controlled oscillator (VCO) and its application in a phase locked loop (PLL) using a block diagram.

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 power supplies, to component level	☐	
2 Demonstrate an understanding of amplifiers, to component level and apply this knowledge safely in a practical situation	☐	
3 Demonstrate an understanding of oscillators, multivibrators and waveform generator circuits, to component level	☐	
	☐	
	☐	
	☐	

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
www.cityandguilds.com/ivqit

City & Guilds is a company registered in England and Wales (company number 16513878)