OCR
Oxford Cambridge and RSA

Unit Title: **Telecommunication principles**

OCR unit number: 21

Unit reference number: J/601/3295

Level: 2

Credit value: 7

Guided learning hours: 60

Unit aim

The aim of this unit is that learners will:

- Understand the electromagnetic spectrum as applied to telecommunications

- Know the relationship between telecommunication circuits and transmission lines and their effect on a digital signal

- Know how binary information is transmitted as a digital signal

- Understand how an analogue signal is converted to a digital signal

- Demonstrate an understanding of signal multiplexing

Learning Outcomes	Assessment Criteria	Knowledge, understanding and skills
The Learner will: 1 Understand the electromagnetic spectrum as applied to telecommunications	**The Learner can:** 1.1 Describe the physical properties of electromagnetic radiation and the relationship between frequency and wavelength 1.2 List the principal bands of the electromagnetic spectrum and their associated frequencies and wavelengths 1.3 Identify the main telecommunications applications of electromagnetic radiation	• the frequencies involved and the properties of the spectrum

Learning Outcomes	Assessment Criteria	Knowledge, understanding and skills

2 Know the relationship between telecommunication circuits and transmission lines and their effect on a digital signal	2.1 Identify the circuit properties (Resistance, Capacitance, Inductance and Leakance) of alternating current (AC) circuits and describe their effects on transmission lines
	
	2.2 Design an equivalent circuit model of a transmission line using the primary line constants
	
	2.3 Describe characteristic impedance in transmission lines including open circuit, short circuit and matched termination
		• Ohms Law
		• Kirchhoff's Law
		• the formulae for calculating the:
		  - resistance
		  - capacitance
		  - inductance
		  - leakance
		of a transmission line

3 Know how binary information is transmitted as a digital signal	3.1 Describe the properties of digital signals including frequency, mark space ratio and triggered timing
	
	3.2 Describe the advantages of digital signals in terms of regeneration, accuracy and recovery
	
	3.3 Explain why digital signals need to modulated onto an analogue carrier
	
	3.4 Use keying to demonstrate how a digital signal is modulated onto an analogue carrier
		• how to describe the properties of digital signals including:
		  - frequency
		  - mark space ratio
		  - triggered timing
		• how to identify and describe the advantages of digital signals including:
		  - regeneration
		  - accuracy
		  - recovery

4 Understand how an analogue signal is converted to a digital signal	4.1 Identify different ways of converting an analogue signal to a digital signal
	
	4.2 Describe linear and non-linear forms of encoding
	
	4.3 Calculate signal to noise quantisation errors
	
	4.4 Explain Aliasing in telecommunications terms and how it can be overcome
	
	4.5 Explain the use, and limitations, of the Nyquist rule in signal sampling
		• the principles of analogue to digital conversions to include:
		  - principles of pulse amplitude modulation (PAM) with reference to sampling amplitude levels
		  - principles of pulse code modulation (PCM) in terms of converting sampled levels into binary code
		  - function of an encode/decoder combination (codec) for transmission of speech

Learning Outcomes	Assessment Criteria	Knowledge, understanding and skills
		- transmission of video - benefits e.g. higher noise immunity, enabling of bandwidth compression techniques - linear and non-linear forms of encoding - how to calculate signal to noise quantisation errors - liaising in telecommunication terms and how it can be overcome - the Nyquist rule and how it is used in sampling
5 Demonstrate an understanding of signal multiplexing	5.1 Describe the following methods of signal multiplexing: • Frequency • Synchronous Time • Asynchronous Time	• multiplexing signals in relation to: - Frequency - Synchronous Time - Asynchronous Time

Assessment

The qualification has been designed to develop knowledge, understanding and skills in the full range of functions involved in the planning and control, hardware, software and systems installation, software solutions and the production of customer support materials. It also provides opportunities for learners to study towards system and network management, to specialise in one or more specific programming languages in addition to being able to take units that are vendor specific.

Each unit within the specification is designed around the principle that candidates will build a portfolio of evidence relating to progression towards meeting the unit assessment criteria.

The unit assessment criteria reflect the demands of the learning outcomes for each unit.

In order for candidates to be able to effectively progress towards meeting the requirements of each assessment criteria, tutors must make sure that the supporting knowledge, understanding and skills requirements for each criteria are fully addressed. The identified knowledge, understanding and skills are not exhaustive and may be expanded upon or tailored to particular contexts to which the unit is being taught and the assessment criteria applied.

We recommend that teaching and development of subject content and associated skills be referenced to real vocational situations, through the utilisation of appropriate industrial contact, vocationally experienced delivery personnel, and real life case studies.

All the learning outcomes and assessment criteria must be clearly evidenced in the submitted work, which is externally moderated by OCR.

Results will be Pass or Fail.

Guidance on assessment

Candidates do not have to achieve units in any particular order and tutors should tailor learning programmes to meet individual candidate needs. It is recommended that, wherever possible, centres adopt a holistic approach to the delivery of the qualification and identify opportunities to link the units.

Centres are free to deliver this qualification using any mode of delivery that meets the needs of their candidates. Whatever mode of delivery is used, centres must ensure that learners have access to appropriate resources and consider the candidates' complete learning experience when designing learning programmes. This is particularly important in relation to candidates studying part time alongside real work commitments where candidates may bring with them a wealth of experience that should be utilised to maximum effect by tutors and assessors.

It is difficult to give a detailed answer to how much evidence is required as it depends on the type of evidence collected and the judgement of assessors. The main principles, however, are as follows: for a candidate to be judged competent in a unit, the evidence presented must satisfy:

- all the items listed, in the section 'Learning Outcomes'

- all the areas in the section 'Assessment Criteria'

Questioning the candidate is normally an ongoing part of the assessment process, and is necessary to:

- test a candidate's knowledge of facts and procedures

- check if a candidate understands principles and theories *and*

- collect information on the type and purpose of the processes a candidate has gone through

- candidate responses must be recorded

The quality and breadth of evidence provided should determine whether an assessor is confident that a candidate is competent or not. Assessors must be convinced that candidates working on their own can work independently to the required standard.

Additional information

For further information regarding administration for this qualification, please refer to the OCR document '*Admin Guide: Vocational Qualifications'* on the OCR website www.ocr.org.uk *.*