



Australian Government

Department of Education, Employment and Workplace Relations

ICTTEN8196A Evaluate and apply digital signal processing to communications system

Release: 1

ICTTEN8196A Evaluate and apply digital signal processing to communications system

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit describes the performance outcomes, skills and knowledge required to analyse, apply and simulate the operation of digital signal processing (DSP) to signals in a telecommunications system. Digital signal processing is essential in digital communications systems including signal conditioning and processing functions such as modulation and multiplexing. No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement but users should confirm requirements with the relevant federal, state or territory authority.
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Application of the Unit

Application of the unit	Field officers responsible for the management and maintenance of digital communication systems apply the skills and knowledge in this unit. They combine the technical skills of this unit with design skills to develop solutions in modern applications, such as internet protocol TV (IPTV), digital TV, fast broadband and internet applications.
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Licensing/Regulatory Information

Refer to Unit Descriptor

Pre-Requisites

Prerequisite units		

Employability Skills Information

Employability skills	This unit contains employability skills.
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Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Apply DSP design criteria to telecommunications system	1.1. Review DSP criteria applied to signal processing 1.2. Perform frequency domain analysis on telecommunications signals 1.3. Apply digital processing techniques to DSP baseband communications signals used in digital systems 1.4. Generate the output of a comb filter in digital filtering application using convolution theorem and autocorrelation
2. Determine linear time invariant (LTI) system properties	2.1. Simulate telecommunication entities using simulation software functions 2.2. Perform calculations to find numerical approximations of the continuous-time convolution process 2.3. Simulate echo cancellation by applying simulation software using adaptive DSP algorithms and an inverse filtering method
3. Analyse digital telecommunication signals processing	3.1. Analyse the result of digitally passing a signal through a first-order recursive discrete-time filter 3.2. Determine frequency response of a simple continuous-time system using Fourier transform 3.3. Analyse amplitude modulated signals using Fourier transform
4. Analyse time and frequency forms of signals by applying simulation of signal processing	4.1. Program a simulated software application to represent a comb filter with a signal applied from a telecommunication system 4.2. Produce a report analysing the simulated output results and relevance of a DSP filter to a telecommunications system

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

Required skills

- analytical skills to evaluate a range of complex technical data
- communication skills to work effectively within group
- information technology skills for word processing, using statistical data and

REQUIRED SKILLS AND KNOWLEDGE

- desktop research
- literacy skills to:
 - read and interpret technical documentation
 - write reports including recommendations
- numeracy skills to perform mathematical calculations
- research skills to:
 - gather and record data from measurements
 - gather data, observe and analyse signal issues
- technical skills to :
 - apply simulation software
 - operate telecommunication test equipment
 - use telecommunications management networks

Required knowledge

- digital communications systems
- Fourier transforms
- LTI
- modulation methods, amplitude (AM), frequency (FM) and phase (PM) and digital formats
- organisational policy and procedures
- responses to non-compliance
- radio frequency (RF) awareness
- workplace and industry environment

Evidence Guide

EVIDENCE GUIDE	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
Overview of assessment	
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Evidence of the ability to: • apply DSP criteria to a telecommunications system • evaluate LTI system properties • analyse DSP, time and frequency forms of signals by applying signal processing.
Context of and specific resources for assessment	Assessment must ensure: • a telecommunications operations site • digital communication systems, simulation software and telecommunications test equipment currently used in industry.
Method of assessment	A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit: • oral or written questioning to assess required knowledge • direct observation of the candidate carrying out analysis and fault solution development within a digital communication system.
Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example: • ICTTEN8197A Produce engineering solutions using numerical computations and simulation. Aboriginal people and other people from a non-English speaking background may have second language issues. Access must be provided to appropriate learning and assessment support when required. Assessment processes and techniques must be culturally appropriate, and appropriate to the oral communication skill level, and language and literacy capacity of the candidate and the work being performed.

EVIDENCE GUIDE

In all cases where practical assessment is used it will be combined with targeted questioning to assess required knowledge. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.

Where applicable, physical resources should include equipment modified for people with special needs.

Range Statement**RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

DSP criteria include:

- anti-alias and reconstructive filters
- distortion
- Nyquist sampling rate
- quantisation error and noise
- sampling theory
- signal conditioning
- signal converters:
 - ADC
 - DAC
- Z-domain representation and transforms.

Frequency domain analysis may include:

- discrete Fourier transform (DFT)
- fast Fourier transform (FFT)
- modern spectral analysis
- power spectra
- signals:
 - aperiodic
 - periodic
 - random
- time and frequency representation.

RANGE STATEMENT	
DSP baseband communications signals may include:	• bandpass sigma delta systems • data equalisation • error control and coding • matched filtering • modulation: • AM • FM • PM • pulse shaping • quaternary phase shift keying (QPSK) - quadrature amplitude modulation (QAM) digital communications • root raised cosine • signalling: • amplitude shift keying (ASK) • frequency shift keying (FSK) • phase shift keying (PSK).
Digital filtering refers to:	• comb and ARMA filters • digital filter design parameters and methods • FIR and IIR Filters • poles and zeroes and z-domain.
Telecommunication entities may include:	• discrete-time Fourier transform (DTFT) based filter of given design parameters • DTFT operation • generation of dual tone multi frequency signals • telephone touch tone system.
Simulation software functions may include:	• conv • filter • isim.
Adaptive DSP algorithms include:	• acoustic echo control and noise control • channel equalisation • echo control for feedback suppression • inverse system identification • Kalman • least squares • least mean squares • QR algorithms • recursive least squares (RLS).

RANGE STATEMENT

Telecommunication system may include:

- AM with carrier
- FM
- PSK
- single-sideband AM.

Unit Sector(s)

Unit sector	Telecommunications
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Co-requisite units

Co-requisite units		

Competency field

Competency field	Telecommunications networks engineering
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