

**1. Module details**

**Module name**

**Digital Television Principles**

**Module duration**

It is expected that students with the appropriate entry knowledge and skills will successfully complete this module in 36 to 40 hours.

**Module code**

NUE411

**Discipline code**

0703230

**2. Module purpose**

This module aims to provide students with the knowledge and skills to undertake appropriate methods to identify and repair faults in digital televisions.

**3. Prerequisites**

Communications Fundamentals NE039

Digital Electronics 2 NE180

Amplifiers 2 NE183

***Note:** It is recommended other TV and Video modules (that underpin the units in the relevant qualification that this module belongs) are successful completed.*

**4. Relationship to competency standards**

This module provides part of the underpinning knowledge and skills in the ‘Evidence Guide’ of specific units of competency in the National Electrotechnology Training Package and provides similar support, where mapped, to equivalent units in the National Metals and Engineering Competency Standards. For details refer to the module to unit maps, available from EE-Oz Training Standards.

**5. Content**

1. Digitising the Picture and Sound

Sampling rate

Sampling structure

Bit rate

Video encoding

- Serial Digital Interface

- - SDI video

- - Embedded audio

- - Embedded data

- AES Audio

2. Video Data Compression

Spatial Data Compression

Discrete Cosine Transform (DCT)

Quantising the DCT Block

Coding DCT Coefficients

3. Discrete Cosine Transform (DCT) Coder
  - Temporal Data Compression
  - Codec
  - Forward prediction
  - Bi-directional Prediction
  - Group of Pictures (GOP) Construction
  - Differential Coding
  - Video packetised Elementary Stream (PES)

## 6. Assessment strategy

### Assessment methods

Assessment should be progressive reflecting a holistic approach to ensure the module purpose is met. To assist in ensuring validity, reliability and fairness assessment instruments should include practical exercises, assignments and written tests consisting of a number of item types, such as multiple choice, short answer and problem solving.

### Conditions of assessment

Learning and assessment will take place in an environment that is conducive to a learner's development.

## 7. Learning outcome details

### Learning outcome 1

Describe the basic techniques used to process an analogue signal for integration in a digital broadcasting system.

### Assessment criteria

- 1.1 Describe the basic technique of sampling an analogue waveform and assigning quantisation levels to those samples for both video and audio.
- 1.2 Calculate the number of pixel's per line and the sampling rate for a range of typical DTV aspect ratios.
- 1.3 State typical sampling rates for Standard Definition Digital Television (SDTV) and High Definition Digital Television (HDTV) broadcasts.
- 1.4 Identify a range of different sampling structures used to sample luminance and colour difference signals.
- 1.5 Determine the total bit rate required for a 4:2:2 and a 4:2:0 sampling rate.
- 1.6 Identify the factors limiting digital television picture quality.

**Learning outcome 2**

**Assessment criteria**

- 1.7 State the minimum MPEG video requirements for HDTV and SDTV.
  - 1.8 Outline factors that create the need for video data compression.
- Describe the process used to prepare video data for integration.
- 2.1 Describe the major methods used to compress video data.
  - 2.2 Sketch a block diagram identifying the meaning of the terms: samples, block, macroblock and slice.
  - 2.3 Describe how a complete picture frame is assembled from samples, blocks, macroblocks and slices.
  - 2.4 Define the meaning of the terms: DCT coefficients, temporal frequency, spatial frequency, temporal and spatial redundancy.
  - 2.5 Describe the purpose of the Discrete Cosine Transfer (DCT) processor in the processing of video data compression.
  - 2.6 Outline the relationship between spatial frequencies, DCT coefficients and quantisation levels in the DCT block.
  - 2.7 State the correct names of the two compression techniques used to code quantised DCT coefficients.
  - 2.8 Describe how Run Length Coding (RLC) is used to group DCT values into a series of values.
  - 2.9 Describe how Variable Length Coding (VLC or Huffman coding) processes each DCT value according to probability.

**Learning outcome 3**

**Assessment criteria**

- Describe the role of the DCT coder
- 3.1 Draw a block diagram of a DCT coder.
  - 3.2 Outline the function of each block in the DCT coder.
  - 3.3 Sketch a diagram showing the typical construction of a Group of Pictures (GOP).
  - 3.4 Identify the individual frames in a GOP sequence that uses forward prediction and bi-directional prediction.
  - 3.5 State the purpose of differential coding.

## 8. Delivery of the module

### Delivery strategy

3.6 Describe the structure of a video Packetised Elementary Stream (PES).

3.7 Identify the types of information included in the PES.

Delivery strategies must be suitable for learning both theoretical and practical aspects described in the module purpose. It is considered that the most effective method to achieve this is by integration of theory and practice where students learn by experimentation, research and reports. It is recommended that learning and assessment be facilitated in a holistic manner that may require learning outcome sequence other than that indicated in the module.

### Resource requirements

Resources should be sufficient for students to carry out learning activities on an individual basis.

*Suggested Learning Resource:*

Adequate and a representative range of equipment such that each student can undertake appropriate methods to identify and repair faults in digital televisions.

Ibrahim, K.F. Television Receiver Principles. 2<sup>nd</sup> edition  
Addison Wesley Longman Ltd ISBN 0-582-35631-8

Buscombe, C.G. Television & Video Systems.  
Operation, Maintenance, Troubleshooting and Repair.  
2<sup>nd</sup> edition Prentice Hall. ISBN 0-13-442088-8

As 4933.1 - 2000  
Digital Television-Requirements for Receivers  
Part 1: VHF/UHF DVB-T television broadcasts.

Aprile, J & Humphris, R. Digital Television  
Electronic Fault Information Library.  
January 2001

Where this module is used in an approved Traineeship or Apprenticeship program learners should be advised to obtain, where available, respective EE-Oz Training Standards<sup>1</sup> **User Guides** (these outline in detail what training and work performance the Learner is required to undertake for the program).

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<sup>1</sup> EEQSBA – ElectroComms and EnergyUtilities Qualifications Standards Body of Australia Ltd trading as EE-Oz Training Standards ([www.ee-oz.com.au](http://www.ee-oz.com.au))

**Occupational health and safety requirements**

A safe and healthy environment will be provided for students and teachers as well as the particular safety procedures followed as part of the learning / teaching activity and content.