

1. Module details**Module name****Introduction to Television****Module duration**

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

Module code

NUE101

Discipline code

0703230

2. Module purpose

This provides students with a basic overview of TV broadcasting and reception together with a knowledge of television receivers to a block diagram level.

3. Prerequisites

NE39 Communications Fundamentals.

4. Relationship to competency standards

This module provides some of the knowledge and skills underpinning competence in the following standards: Metals and Engineering Industry National Competency Standards, Units 18.45A, 18.56A, 18.65A. National Electrotechnology Industry Standards, Units NES205, NES302, NES303, NES305, NES306, NES402, NES403, NES406, NES407.

5. Content**Broadcast TV System**

transmitter

camera

receiver

propagation

channel allocation (RF bandwidth, carrier frequencies)

Australian Standards

VHF

UHF

IF

Transmitter

block diagram of a current television transmitter showing (video and sound signal inputs, modulation - one line of video, vestigial sideband filter and PA - basic sync only)

negative vestigial sideband modulation of video signal

frequency modulation of sound signal

monochrome step test pattern and modulation levels

grey scale test waveforms (system input, system output, signal waveform, percentage modulation)

Camera

scanning principles
synchronisation
video signal

Receiver

simplified block diagram of typical television receiver including the following as single blocks (RF input, tuner, IF, Video, AGC, AFT, sync separation, scanning and EHT, generation, sound stages, video amplifier, blanking, DC lamps, luminance matrix, RGB drives and outputs, colour decoder, power supply, picture tube)

TV picture tube

principles of operation
thermionic emission
electron gun
basic raster scanning
synchronisation
monochrome tubes (typical electrode voltages, drive waveforms, phosphor)

Colour Principles

signal format
forward and reverse compatibility
luminance signal
light and colour theory
visual perception
signals
colour bar test pattern
RGB
luminance
3 tube colour cameras (simple block diagram, derivation of luminance and colour difference, signals)
principles of suppressed carrier quadrature amplitude modulation (QAM)
vector diagram of primary and complementary colours on NTSC line
principles of PAL encoding (swinging burst, diagram of primary and complementary colours, on the PAL line)
frequency interleaving
block diagram of a simplified PAL encoder (integrated into transmitter block diagram)

VHF and UHF signal propagation and distribution

signal levels
characteristic impedance
test equipment
test patterns

	<p>Safety TV picture tubes high voltages manual handling</p>
6. Assessment strategy	
Assessment methods	Assessment should be progressive reflecting an 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	Normally learning and assessment will take place in a classroom / laboratory environment.
7. Learning outcome details	
Learning outcome 1	Draw the fundamental block diagram of the Australian broadcast television system and state the function of each block.
Assessment criteria	<p>1.1 Given a blank block diagram of a basic television transmission system, label the diagram and state the function of the following blocks:</p> <ul style="list-style-type: none"> - camera - video and sound signal input processor - sync pulse generator - carrier oscillators - modulators - vestigial sideband filter - power amplifier - transmission media - aerial and receiver. <p>1.2 Sketch the signals at the input or output of each block in the television system block diagram, in the time and/or frequency domain (where appropriate) when the system is processing a grey scale step test pattern.</p> <p>1.3 State modulation levels for black level, peak white and sync.</p> <p>1.4 State why negative modulation is employed.</p> <p>1.5 Describe the type of modulation used for the sound signal.</p>

Learning outcome 2

Assessment criteria

- 1.6 List the Australian standards for:
frame and line rates
 - sub-carrier frequencies
 - RF channel bandwidth (UHF and VHF)
 - IF
 - local station carrier frequencies.

- 1.7 State the propagation characteristics of VHF and UHF frequencies.

- Sketch a diagram of a television camera, identify the main functional blocks and describe the basic function of each.**

- 2.1 Sketch a simplified diagram of a single tube, a three tube and a charge coupled device (CCD) camera labelling important functional parts.

- 2.2 Briefly describe the function of the tube components.

- 2.3 Briefly describe the principles of operation of CCD camera.

- 2.4 Sketch and describe the scanning process in a television camera identifying active and retrace periods.

- 2.5 Describe the need for synchronisation.

- 2.6 Sketch one line of video information from a monochrome camera tube identifying the line sync period.

- 2.7 Sketch one frame of video information from a monochrome camera tube identifying the field synchronisation periods.

Learning outcome 3

Describe the operation of a television receiver. Identify the main functional blocks in a block diagram and describe the basic function of each.

Assessment criteria

- 3.1 Draw the simplified block diagram of a typical television receiver showing the following as single blocks:
- RF input
 - Tuner
 - IF (vision/sound)
 - Video detector
 - AGC
 - AFT
 - Sync Separation
 - Scanning
 - EHT generation
 - Sound stages
 - Video Amplifier
 - Blanking
 - DC clamping luminance matrix
 - RGB drives and outputs
 - Colour decoder
 - Picture tube
 - Power supply.
- 3.2 Briefly state the purpose of each functional block.
- 3.3 Sketch the waveforms input and output of each block (where appropriate) when the receiver is processing a colour test bar signal.

Learning outcome 4

State the principle of operation of picture tubes, sketch a functional diagram and describe the function of the main tube components.

Assessment criteria

- 4.1 Draw a simplified labelled sketch and describe the operation of a monochrome television picture tube.
- 4.2 Describe the process of thermionic emission.
- 4.3 List typical electrode voltages in a monochrome television picture tube.
- 4.4 Sketch a three gun colour picture tube labelling all major functional parts and briefly describe the operation of the tube.
- 4.5 List typical electrode voltages in a colour television picture tube.

- 4.6 Describe the scanning process when applied to a television picture tube.
- 4.7 Describe the need for synchronisation when scanning a raster.
- 4.8 Sketch typical drive waveforms to the electrodes of a Television picture tube when processing a colour bar test pattern.
- 4.9 List safety precautions which must be observed when working with picture tubes.

Learning outcome 5

Describe the basic principles of the Australian PAL colour television process.

Assessment criteria

- 5.1 Briefly describe how the human eye perceives monochrome and colour vision.
- 5.2 State the difference between additive and subtractive mixing.
- 5.3 List the primary and complementary colours used in colour television.
- 5.4 Describe the juxtaposition method of colour mixing in display devices.
- 5.5 State the need for forward and reverse compatibility.
- 5.6 State the principles of PAL colour encoding.
- 5.7 Draw the block diagram of a PAL encoder labelling all major functional blocks and signals.
- 5.8 Sketch one line of the red, green, blue, R-Y, B-Y, G-Y and Y signals of a standard colour bar waveform.
- 5.9 State the type of modulation used for the chrominance signal and sketch the frequency spectrum of a suppressed carrier double sideband phase quadrature amplitude modulated signal.
- 5.10 Describe the purpose of the colour burst signal.
- 5.11 Sketch a vector diagram showing approximate positions and amplitudes of all primary and complementary colours plus the mean burst phase of a standard colour bar signal on an NTSC line only.

- 5.12 Sketch a vector diagram showing approximate positions and amplitudes of all primary and complementary colours plus the burst phases of a standard colour bar signal on both NTSC and PAL lines.
- 5.13 Given a block diagram of a simplified PAL encoder, describe how the R-Y, B-Y and Y signals are processed and modulated before integration into the signal encoding sections of a basic television transmitter.

Learning outcome 6

Describe typical television receiver aerials.

Assessment criteria

- 6.1 State the minimum and maximum RF input levels for a television receiver.
- 6.2 State the reasons for using coaxial cable as aerial feed.
- 6.3 Identify two types of plug and socket arrangements commonly used in television receiver antennae systems.
- 6.4 Describe the need for splitters and diplexers when dividing or combining cables carrying RF signals.
- 6.5 Correctly fit Belling Lee and F connector type coaxial plugs to a length of coaxial cable.
- 6.6 Describe safety precautions that must be observed when working with television aerial systems.

8. Delivery of the module

Delivery strategy

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

Resource requirements

Resources should be sufficient for students to carry out practical exercises on an individual basis. This will require a range of television receivers and test equipment.

Useful references include:

Ibrahim KF 1994, *Television Receivers*.
Longman Essex, England
ISBN 0-582-082-086175

Liff A et al 1993, *Colour and Black and White Television*
Prentice Hall, Englewood Cliffs
ISBN 0-13-150012-0

Zarach et al 1985, *Television: Principles and Practice*
MacMillan, Hampshire
ISBN 0-333-19221-4

**Occupational health
and safety requirements**

A safe and healthy environment will be provided for students and teachers as well as safety procedure with regard to learning / teaching activities.