1. Module details

Module name

Scanning and Deflection

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

NUE103

Discipline code

0703230

2. Module purpose

This module provides the theoretical and fault finding skills to enable students to locate faults at component level, in the deflection stages of typical colour television receivers and monitors.

3. Prerequisites

NUE101 Introduction to Television.

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

The Sync Separator
composite sync information
level clipping
vertical sync pulse derivation
horizontal sync pulse derivation

Horizontal Oscillators
oscillator types
AFC principles
operation of a simple two diode AFC circuit
typical driver circuits

Horizontal Output Stage Operation
horizontal scanning sawtooth current
flyback transformer
resonant tuning
EHT generation
scan derived dc power supplies

Safety
overvoltage and x-ray protection
automatic beam current limiting sensing
safe measurement of EHT, focus and screen voltages
safe EHT discharge

Fault Finding
sync separator
AFC
horizontal oscillator
horizontal driver
horizontal output
vertical sync
vertical oscillator
vertical drivers and output
linearity/fold-over

Vertical Output Stage
trapezoidal deflection waveform
vertical oscillator types
linear sawtooth waveform generation
complementary symmetry output stages
linearity correction feedback loops

Digital Countdown Deflection Systems
block diagram
horizontal deflection system
vertical deflection system

Raster Distortion Reduction
pincushion distortion
"S" correction
E-W pincushion correction
N-S pincushion correction

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	Normally learning and assessment will take place in a classroom / laboratory environment.

7. Learning outcome details

Learning outcome 1 **Describe the operation of a sync separator.**

Assessment criteria

1.1 Draw a basic circuit of a sync separator stage producing vertical and horizontal synchronising pulses from an incoming composite video signal.

1.2 Sketch the input and output waveforms showing all relevant timings and typical peak to peak amplitudes.

1.3 Describe the operation of a typical sync separator stage.

1.4 Sketch the vertical blanking area of a transmitted sync signal showing the important groups of sync information and the relative pulse widths and repetition periods as per Australian Standards.

1.5 Using the schematic circuit diagram of a typical TV receiver locate the integrator and differentiator stages in the output of a sync separator.

Learning outcome 2 **Describe the operation of typical synchronised horizontal oscillator and drive stages.**

Assessment criteria

2.1 Given the circuit diagrams of a typical television receiver, locate and identify the circuit paths from sync input to horizontal driver output.

2.2 Describe the operation of a typical horizontal time base.

2.3 Sketch the basic circuit diagram of a two diode phase comparator AFC system and describe the operation of the circuit.

2.4 Ascertain suitable hold in and pull in ranges of an AFC stage.

2.5 Sketch the horizontal drive waveform into the line output stage showing waveform timing and amplitude.

Learning outcome 3	**Describe the operation of a basic horizontal transistor output stage.**	
Assessment criteria	3.1	Draw the circuit diagram of a basic transistorised horizontal output stage showing the output transistor, tuning capacitor, damping diode, horizontal output transformer, coupling capacitor and yoke winding.
	3.2	Describe the function of the circuit in the generation of the horizontal scanning sawtooth current and sketch synchronised output voltage and sawtooth current waveforms.
	3.3	Describe and sketch current paths and waveforms for the four step sequence of scanning (ie. scan RHS, RHS retrace, LHS retrace, scan LHS).
	3.4	Describe the role of the line output transformer resonance in determining flyback timing and flyback pulse shape.
	3.5	Sketch the basic circuit of a split diode line output transformer and state the potentials expected from the EHT, focus and screen outputs.
	3.6	Describe the operation of a voltage multiplier circuit showing the derivation of EHT and focus voltages.
Learning outcome 4	**Demonstrate safe work practices with regard to EHT voltages in television receivers.**	
Assessment criteria	4.1	Demonstrate a safe and correct technique for measuring CRT EHT, focus and screen voltages.
	4.2	Explain why beam current limiting and overvoltage protection circuitry is usually included in the design of horizontal output stage.
	4.3	Demonstrate a safe technique for discharge of the EHT voltage.
	4.4	Locate on the schematic circuit diagram of a typical television receiver or monitor the following: - scan derived d.c. power supplies - beam current sense resistor - harmonic tuning capacitor - yoke coupling capacitor - over voltage protection circuit.
	4.5	State the effects of excessive CRT beam current and sketch a simple circuit to monitor CRT beam current.

Learning outcome 5	**Repair typical faults in a horizontal deflection stage.**	
Assessment criteria	5.1	Given the relevant circuit diagram, identify and locate major components and circuit paths in a typical receiver.
	5.2	Measure horizontal waveforms and voltages under both no fault and fault conditions.
	5.3	Adjust any relevant pre-set horizontal controls correctly.
	5.4	Safely perform tests and measurements to locate defective components in the horizontal defection system of a typical television or monitor.
	5.5	Repair typical faults in a horizontal deflection stage.
Learning outcome 6	**Describe the operation of vertical deflection circuitry.**	
Assessment criteria	6.1	Sketch the block diagram of a vertical deflection system using a directly triggered oscillator and linearity correction via feedback.
	6.2	On the block diagram sketch voltage and current waveforms at the input and output of each block.
	6.3	Describe the operating characteristics of vertical deflection circuitry.
	6.4	Draw the simplified schematic circuit diagram of a linear sawtooth generator using a constant current source and describe the operation of the circuit.
	6.5	Given the schematic diagram, locate the vertical deflection system and identify the circuit paths, in a typical receiver.
	6.6	Given the circuit diagram, locate the feedback sense resistor and the circuit path for linearity correction in a typical receiver.
	6.7	Sketch the circuit path for vertical deflection current showing the yoke winding, coupling capacitor and feedback resistor.

Learning outcome 7	**Repair defective components in the vertical deflection system of a typical television or monitor using appropriate test equipment and service information.**	
Assessment criteria	7.1	Given the relevant circuit diagram, identify and locate major components and circuit paths.
	7.2	Measure vertical waveforms and voltages under both fault and no fault conditions.
	7.3	Adjust any relevant vertical pre-set controls correctly.
	7.4	Safely perform tests and measurements to locate defective components in the vertical deflection system.
	7.5	Repair typical faults.
Learning outcome 8	**Describe the operation of typical deflection stages using a digital countdown system.**	
Assessment criteria	8.1	Draw the block diagram of a digital countdown deflection system showing the production of horizontal and vertical deflection drive signals.
	8.2	On the block diagram show typical frequencies on relevant blocks and sketch the resultant vertical and horizontal deflection drive waveforms produced by the countdown deflection system.
	8.3	Describe the operation of a typical digital countdown circuit.
	8.4	Describe how the deflection system synchronises to incoming transmitted synchronising information.
	8.5	State the reasons why no “hold” controls are required in countdown systems.

Learning outcome 9	**Describe typical raster correction circuits.**
Assessment criteria	9.1 Describe the effects upon the raster of pin cushion distortion and explain why this distortion occurs.
	9.2 Draw the modified deflection sawtooth current after being “S” corrected.
	9.3 Describe the modifications required to vertical and horizontal sawtooth currents to provide dynamic pin cushion correction.
	9.4 Draw the distorted raster shape caused by pincushion distortion.
	9.5 Draw a simple circuit showing how “S” correction provides centre axis raster linearity correction and describe how this correction is achieved.
	9.6 Given the circuit diagram, locate the feedback sense resistor and the circuit path for linearity correction in a typical receiver.
	9.7 Draw the horizontal deflection sawtooth current after correction for E-W pincushion distortion and describe how the modified sawtooth current can provide this E-W pincushion.
	9.8 Draw a simplified circuit of an E-W pin cushion correction circuit and describe its operation.
	9.9 Draw the vertical deflection sawtooth current after correction for N-S pincushion distortion and describe how the modified sawtooth current provides N-S pin-cushion correction.
	9.10 Draw a simplified circuit of a N-S pincushion correction circuit and describe its operation.

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 an learning outcome sequence other than that indicated in the module.

Resource requirements

Resources should be sufficient for students to carry out experiments 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 0-582-086175

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

Trundle E 1996, *Newnes Guide to TV and Video Technology*
Butterworth-Weinermann Oxford
ISBN 07506 23748

Botto D 1992, *A Basic Guide to Colour TV and VCRs*
Electronics Australia, Federal Publishing, Alexandria

Humphris R, *TV Deflection Systems*
EFIL Australia (03) 9760 6994

Occupational health and safety requirements

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