

**NEW ZEALAND INSTITUTES OF TECHNOLOGY AND POLYTECHNIC
QUALIFICATIONS IN INFORMATION & COMMUNICATIONS TECHNOLOGY**

PRESCRIPTION: AE610 ANALOGUE ELECTRONICS APPLIED

AIM OF MODULE:	To provide students with the knowledge and skills required for configuring and successfully operating specialised electronic analogue circuits, inherent in a wide range of electronic equipment.
CREDITS:	7
KNOWLEDGE ASSUMED FROM:	BS500 Semiconductor Theory & AE600 Analogue Electronics
STUDENT LEARNING HOURS:	70
CONTENT REVISED:	2010
PRESCRIPTION EXPIRY DATE:	November 2013

Level and Assessment Schedule

TOPICS	Highest Skill Level				Suggested Assessment Percentage
	R	C	A	P	
1. Amplifiers			*		35
2. Waveform generators and switches			*		25
3. Operational Amplifiers & Linear Integrated Circuits			*		25
4. Stabilised power supplies			*		15
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LEARNING OUTCOMES

The student will:

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|---|---|--|
| A | 1 | Explain the configuration, biasing methods and operation of multi-stage, large signal and RF bipolar and unipolar transistor amplifiers and measure and record the operating parameters of these devices |
| A | 2 | Explain the principles and demonstrate the operation of basic sinusoidal oscillator circuits and non-sinusoidal oscillators and switches and measure and record waveforms |
| A | 3 | Explain and compare discrete component circuits with linear integrated circuits, investigate sample product sheets, including their specifications and parameters, and investigate and record the performance of a sample device |
| A | 4 | Explain the operation of stabilised power supplies and investigate and record the performance of a sample device |

Content

1 Amplifiers

- Explaining the configuration, biasing methods and operation of multi-stage, large signal and RF bipolar and unipolar transistor amplifiers and measuring and recording the operating parameters of these devices will include:
 - The biasing conditions required for Class A, B, and C amplifiers
 - Class A, B, and C amplifier applications
 - Inter stage coupling and their application including;
 - Resistance-capacitance
 - Direct
 - Transformer
 - Tuned
 - Audio large signal amplifiers including;
 - Single ended
 - Class A push pull
 - Class B push pull
 - RF Class C amplifier
 - Operation of a bi-polar and a uni-polar transistor at high frequencies and the Miller effect
 - Multi-stage amplifier operation including;
 - Effect on gain with changes of frequency

- Measuring and recording;
 - frequency response
 - signal amplitude limits
 - the effect on the stage gain and bandwidth of disconnecting the emitter source bypass capacitor
 - input and output impedance
- Function of the individual RF Amplifier components
- Selectivity of a tuned amplifier
- Gain Bandwidth product
- Applications of buffer amplifiers
- Impedance-matching for maximising efficiency

2 Waveform Generators and switches

➤ Explaining the principles and demonstrating the operation of basic sinusoidal oscillator circuits and non-sinusoidal oscillators and switches and measuring and recording waveforms will include:

- Producing oscillations using an amplifier with positive feedback
- L-C oscillators and R-C oscillators
- Factors that affect both the short term and long term frequency stability of oscillators
- Methods for improving the frequency stability of oscillators eg. Piezo-electric crystal control
- Various types of non-sinusoidal oscillators and switches such as;
 - Astable
 - Monostable
 - Bistable
 - Schmitt
 - Miller integrator
 - Application of unijunction transistors

3 Operational Amplifiers & Linear Integrated Circuits

➤ Explaining and comparing discrete component circuits with linear integrated circuits, investigating sample product sheets, including their specifications and parameters, and investigating and recording the performance of a sample device will involve:

- Comparing the advantage and disadvantages of LICs over discrete component circuits
- Accessing current manufacturer's data sheets to investigate the performance of:
 - Operational amplifiers configured as;

- Inverting
- Non-inverting
- Summing amplifiers, including AC applications and how these are effected by slew rate, bandwidth and Common Mode Rejection Ratio (CMRR)
- Large signal IC amplifiers
- RF and IF modules

4 Stabilised Power Supplies

- Explaining the operation of stabilised power supplies and investigating and recording the performance of a sample device will include:
 - Sketching the block diagram of a series and a shunt controlled power supply
 - Describing the operation of of a Zener, transistor or three terminal IC device regulated power supply, given the circuit diagram
 - Performing the calculations necessary to produce a zener controlled power supply
 - Demonstrating the operation of and measuring and recording the appropriate data for a given device

NOTES

A typical assessment strategy should include:

- Theory tests
- Assignments
- Laboratory exercises
- Group activities
- Kinaesthetic activities

Reading/Reference List:

- Basic Operational Amplifiers and Linear Integrated Circuits (2nd Edition) by Thomas L. Floyd and David M. Buchla. ISBN-13: 9780130829870 (Published by Prentice Hall, December 26, 1998)
- Web links:
 - **Amplifiers** <http://www.electronics-tutorials.com/amplifiers/amplifiers.htm> & <http://www.electronics-tutorials.com/amplifiers/broad-band-amplifiers.htm> (Accessed August 2010)
 - **Waveform Generators and Switches** <http://www.electronics-tutorials.com/oscillators/oscillator-basics.htm> & http://webcast.berkeley.edu/course_details.php?seriesid=1906978242 (Accessed August 2010)
 - **Operational Amplifiers & Linear Integrated Circuits** http://www.supplyframe.com/search_phrases/datasheet_pdf/op_amp_datasheet.shtml & <http://www.linearsystems.com/datasheets/SD5400.pdf> (LIC example) http://www.electronics-explained.co.uk/pdfs/analogue_systems_all.pdf & http://en.wikipedia.org/wiki/Operational_amplifier & <http://www.eas.asu.edu/~holbert/ece201/opamp.html> (Accessed August 2010)
 - **Stabilised Power Supplies** <http://www.electfree.com/electronic/3-30-v25-a-stabilized-power-supply-with-lm723-and-2n3055/> (Accessed August 2010)