

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

PRESCRIPTION: AE600 ANALOGUE ELECTRONICS

AIM OF MODULE:	To provide students with the knowledge and skills needed to construct basic electronic analogue circuits and to demonstrate the successful operation of these circuits, inherent in a wide range of electronic equipment.
CREDITS:	7
KNOWLEDGE ASSUMED FROM:	BS500 Semiconductor Theory
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. Small signal amplifiers			*		30
2. Feedback			*		15
3. Simple switches			*		15
4. Stabilised power supplies			*		20
5. Operational Amplifiers			*		20
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LEARNING OUTCOMES

The student will:

- | | | |
|---|---|--|
| A | 1 | Explain the configuration and operation of small signal bipolar and unipolar transistor amplifiers and estimate and measure the operational parameters of typical simple transistor amplifiers |
| A | 2 | Explain the principles and demonstrate the application of amplifier feedback |
| A | 3 | Explain and demonstrate the operation of switched circuits using bipolar or unipolar transistors |
| A | 4 | Explain stabilised power supply principles of operation and basic design techniques and demonstrate operational parameters |
| A | 5 | Explain and demonstrate the operation of general purpose operational amplifiers and observe and record appropriate parameters |

Content

1 Small Signal Amplifiers

- Explaining the configuration and operation of small signal bipolar and unipolar transistor amplifiers will involve:
- Stating the applications for each of these types of amplifier
 - Biasing methods for Class A operation in the common base, common emitter and common source modes
 - Graphing DC and AC loadlines of a common emitter and a common source transistor
 - Deriving the gain of a single stage amplifier
 - Constructing single stage class A common emitter and common source amplifiers, estimating and then measuring
 - Voltage gain
 - Current gain
 - Input resistance
 - Output resistance
 - Bandwidth
 - Frequency response
 - Demonstrating and measuring the effect on the stage gain and bandwidth of a common emitter amplifier of disconnecting the emitter source bypass capacitor

2 Feedback

- Explaining the principles of amplifier feedback will include:
- Drawing block diagrams of an amplifier with feedback

- Describing positive and negative feedback
- Deriving the general expression for stage gain of an amplifier with feedback
- Observing the affects of applying negative feedback to an amplifier in relation to
 - Gain and stability
 - Bandwidth
 - Distortion and noise
 - Input and output impedance
- Identifying current controlled feedback and voltage controlled feedback, using a circuit diagram

3 Simple Switches

- Explaining the operation of switched circuits using bipolar or unipolar transistors will include:
 - Drawing circuit diagrams and describing the saturation state required for the switching operation
 - Describing good practice and precautions required in the design and application of transistor electronic switched circuits
 - Comparing the advantages and disadvantages of using bipolar or unipolar transistors as an electronic switch
 - Calculating the circuit requirements for and constructing a simple transistor switch

4 Stabilised Power Supplies

- Explaining the principles of operation and basic design techniques for stabilised power supplies and demonstrating operational parameters will involve:
 - Sketching block diagrams of both a series and a shunt controlled power supply
 - Describing the operation of a regulated power supply, given the circuit diagram of a Zener, transistor or three terminal IC device
 - Performing the circuit calculations necessary to produce a Zener controlled power supply
 - Performing measurements on a basic stabilised power supply

5 Operational Amplifiers

- Explaining and demonstrating the operation of general purpose operational amplifiers will include:
 - Describing the parameters of an ideal amplifier
 - Examining the data sheet of a general purpose op. amp
 - Drawing the circuit of a/an;

- Non-inverting amplifier
- Inverting amplifier
- Summing amplifier
- Deriving the formulae for calculating the voltage gain of a general purpose op. amp in terms of input and feedback resistors
- Performing measurements on a typical general purpose op. amp. configured as;
 - Non-inverting amplifier
 - Inverting amplifier
 - Summing amplifier

NOTES

A typical assessment strategy should include:

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

Reading/Reference List:

- Fundamentals of Analog Circuits (2nd Edition) by Thomas L. Floyd & David M. Buchla. ISBN-13: 978-0130606198 (Published by Prentice Hall, June 2, 2001)
- Web links:
 - **Small Signal Amplifiers** http://en.wikipedia.org/wiki/Electronic_amplifier & http://www.allaboutcircuits.com/vol_3/chpt_4/7.html (Accessed August 2010)
 - **Class A Amplifiers** <http://sound.westhost.com/class-a.htm> (Accessed August 2010)
 - **Feedback** <http://en.wikipedia.org/wiki/Feedback> (Accessed August 2010)
 - **Simple Switches** <http://www.rason.org/Projects/transwit/transwit.htm> & <http://en.wikipedia.org/wiki/Transistor#Switches> (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)
 - **Operational Amplifiers** http://en.wikipedia.org/wiki/Operational_amplifier & <http://www.eas.asu.edu/~holbert/ece201/opamp.html> (Accessed August 2010)