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:	2008
PRESCRIPTION EXPIRY DATE:	Nov 2011

Level and Assessment Schedule

TOPICS	Highest Skill Level R	C	A	P	Suggested Assessment Percentage
1. Small signal amplifiers			*		30
2. Feedback			*		15
3. Simple switches			*		15
4. Stabilised power supplies			*		20
5. Operational Amplifiers			*		20
					100

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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

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- 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;

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        - 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 2008)
    - **Class A Amplifiers** http://sound.westhost.com/class-a.htm (Accessed August 2008)
    - **Feedback** http://en.wikipedia.org/wiki/Feedback (Accessed August 2008)
    - **Simple Switches** http://www.rason.org/Projects/transwit/transwit.htm & http://en.wikipedia.org/wiki/Transistor#Switches (Accessed August 2008)
    - **Stabilised Power Supplies** http://www.elecfree.com/electronic/3-30-v25-a-stabilized-power-supply-with-lm723-and-2n3055/ (Accessed August 2008)
    - **Operational Amplifiers** http://en.wikipedia.org/wiki/Operational_amplifier & http://www.eas.asu.edu/~holbert/ece201/opamp.html (Accessed August 2008)

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