THE AUSTRALIAN NATIONAL UNIVERSITY
DEPARTMENT of ENGINEERING

ENGN3227 Analogue Electronics
[20-10-2006] Course Outline and Assessment Schedule – Semester 2, 2006

[1] COURSE INFORMATION

1.1 Course Coordinator

Name: Dr. Salman Durrani
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Email: salman.durrani@anu.edu.au
Web-Site: http://engnet.anu.edu.au/DEpeople/Salman.Durrani/
Appointments: By Email.

1.2 Lab Demonstrators

1. Changbin (Brad) Yu brad.yu@nicta.com.au (Tel: 56242)

1.3 Lab Supervisor

1. Ian McRobert (Office: E202) ian.mcrobert@anu.edu.au

1.4 Pre-Requisite

1. ENGN2211 Electronic Circuits & Devices.

1.5 Text Book

1. Floyd & Buchla, "Fundamentals of Analog Circuits", 2nd edition, Pearson/Prentice Hall, 2002.

1.6 Web Site

1. http://webct.anu.edu.au
   It is your responsibility to regularly check the webpage regularly (**at least once a week**) for course information and announcements.

1.7 Teaching and Learning Activities

	No.	Day	Time	Location
Lectures: (Weeks 1-13)	Lecture 1:	Tuesday	11:00 AM-12:00 PM	PSYC G06
	Lecture 2:	Thursday	09:00 AM-10:00 AM	PSYC G06
Tutorial: (Weeks 2-6,8-13)	Group A	Tuesday	12:00 PM-01:00 PM	CSIT N109
	Group B	Wednesday	09:00 AM-10:00 AM	MCC T6
Computer Labs: (Weeks 6,9)	Group 1:	Tuesday	2:00 PM-4:00 PM	Chem G51B
	Group 2:	Thursday		
Hardware Labs: (Weeks 7,8,10)	Group 1:	Tuesday	2:00 PM-5:00 PM	Ian Ross Room 104
	Group 2:	Thursday		
Project Lab Time: (Weeks 6-13)		Friday	2:00 PM-5:00 PM	Ian Ross Room 104

[2] COURSE DESCRIPTION

2.1 Course Outline

This course aims to develop an understanding of the fundamental principles of analysis, design and implementation of analogue electronic circuits. The course focuses on analogue electronic circuits based on the operational amplifier and related integrated circuits. Specific topics include:

1. **Basic op-amp circuits**: Op-amp characteristics, differential amplifier, comparators.
2. **Communication circuits**: Sampling circuits, ADC and DAC converters, oscillators and timer circuits.
3. **Active op-amp filter circuits**: Filter responses types (low-pass, high-pass, band stop and band-pass), filter design methods (Butterworth response), Sallen-Key filter implementations.
4. **Special purpose op-amp circuits**: Voltage regulators, instrumentation and measurement amplifiers, isolation amplifiers, simple modulation circuits.
5. **Multistage power amplifier circuits**: Classification (A, B, C).

Application areas discussed include telecommunications and control systems. MATLAB and PSPICE are used extensively in the design and implementation.

2.2 Learning Outcomes

Knowledge Base

Having successfully completed this course, students should be able to:-

1. Analyse and design analogue electronic circuits for specific applications using op-amps.
2. Classify the various techniques used for analogue to digital conversion and evaluate their relative merits.
3. Describe the basic filter types and filter response characteristics and implement basic filter configurations.

Engineering Ability

Having successfully completed this course, students should be able to:-

1. Select appropriate mathematical techniques to model circuits and justify any assumptions involved.
2. Apply systematic analysis methods to explain the working of the circuits.
3. Utilise a systems approach to identify key design parameters and justify choice of particular electronic components.

Practical Skills

Having successfully completed this course, students should be able to:-

1. Implement op-amp circuits using printed circuit boards and perform circuit measurements using electrical measurement devices (oscilloscope, function generator, digital multimeter, power supply).
2. Model and optimise the performance of analogue electronic circuits using mathematical software packages (e.g. Matlab and PSPICE).
3. Read circuit diagrams and recognize building blocks such as op-amp circuits, filters and timers.

2.3 Library Reserve (2 day loans)

1. Design with Operational Amplifiers and Analog Integrated Circuits, 3rd ed., S. Franco, McGraw-Hill, 2001. [TK7874 .F677 2002] http://library.anu.edu.au/record=b2202698
2. Microelectronic Circuit Design, 2nd ed, R. Jaeger, and T. Blalock, McGraw-Hill, 2004. [TK7874 .J333 2004] http://library.anu.edu.au/record=b2202651
3. The Art of Electronics, 2nd ed., P. Horowitz and W. Hill, Cambridge University press, 1989. [TK7815.H67 1989] http://library.anu.edu.au/record=b1779264
4. Electronic devices, A Design Approach, A. Kaminian and M. Kazimierczuk, Prentice Hall, 2004. [TK7870 .A527 2004] http://library.anu.edu.au/record=b2202693
5. Electronics: A Systems Approach, 2nd edition Neil Storey, Prentice Hall, 1998. [TK7870 .S857 1998] http://library.anu.edu.au/record=b2202656

[3] POLICIES AND PROCEDURES

3.1 Assessment

There are FOUR components to the assessment for this course:

No.	Component	Marks
1.	Computer Labs	5% (2 Computer Labs, each worth 2.5%)
2.	Hardware Labs	15% (3 Hardware Labs, each worth 5%)
3.	Project	25%
4.	Final Exam	55%

3.2 Permitted Exam Materials

1. A4 page (one sheet) with hand-written notes on both sides.
2. Non-Programmable Calculator.

3.3 Lecture Notes

1. The lecture notes will be posted on the course web site after each lecture/week.

3.4 Tutorial

1. Please see "Tutorial: Electronics Project" document for details.

3.4 Problem Sets

1. At the start of each week, Problem Sets covering the course material will be prepared and posted on the course web-site. The solutions to the Problem Sets will be posted at the end of each week.
2. The Problem Sets are assessable as follows: ONE Question in the Final Exam will be taken from the Problem Sets with changes in numerical values. The question wording may be modified as required.

3.5 Hardware Laboratories

1. There are three hardware laboratories, worth 15% of overall marks.
2. [**Lab Kit**] Obtain a set of lab components kit from Pam Shakespeare, Student Administrator (in WEEK 5). A bread board is also required; most students will have one from the prerequisite course.
3. [**HLab Groups**] Sign up (via WebCT) for ONE of the two HLab groups. Each student will attend labs only at those times during designated lab weeks. Experiments are conducted by teams of two persons. It is expected that the composition of the teams is maintained for the three experiments.
4. [**Pre-Lab**] Preliminary preparation for the laboratories is essential. Read the Reading, Objectives and Summary of Theory sections BEFORE coming to the HLab.
5. [**Lab Time**] Complete the Procedure section DURING lab time. The Lab tutor will make a note that all procedure steps and measurements have been completed during lab time.
6. [**HLab Reports**] HLab Reports will be prepared by every student AFTER completing the lab. Reporting should include the preparatory work, the direct measurements, results and outcomes of the experiments and Evaluation & Review Questions.
7. [**Report Submission**] Reports are to be handed in to the Lab demonstrators at the start of the laboratory session next week (this may be a computer lab). Reports should be limited to a maximum of 10 pages (ideally 5-6 pages) and the first page should clearly show the Student Name, University ID and HLab Group.
8. [**Assessment Criteria**] Each lab report is worth up to 5 marks. All labs will be assessed taking into account the preparatory study, the actual work done during the laboratory and the

documentation of the lab report.

9. [**Attendance Policy**] You must attend the Labs in order to receive a mark for the lab. Any student absent from their HLab Group will receive a 0 mark.

3.6 Computer Laboratories

1. There are two computer simulation laboratories (worth 5% of overall marks) that support the hardware laboratories.
2. [**CLab Groups**] Sign up (via WebCT) for ONE of the two CLab groups. Each student will attend labs only at those times during designated lab weeks.
3. [**CLab Reports**] CLab Reports will be prepared by every student and will be worth up to 5 marks each. Reports will be marked by Lab demonstrators at the end of the laboratory session.
4. [**Attendance Policy**] You must attend the Labs in order to receive a mark for the lab. For CLabs, the lab may be marked at a later date only if permission is sought in advance.

[4] TENTATIVE COURSE SCHEDULE

Week	Lectures	Textbook Chapters	Prob Sets	Tutorial	Labs
1 (17Jul-23Jul)	L01 Intro to ENGN3227 Lecture Cancelled	6.1		No Tutorial Class	
2 (24Jul-30Jul)	L02 Intro to Op-amp L03 Op-amp Characteristics	6.3, 7.1	P01		
3 (31Jul-06Aug)	L04 Op-amp Theory L05 Differential amplifiers	6.4–6.6 6.2	P02		
4 (07Aug-13Aug)	# L06 Comparators	8.1	P03		
5 (14Aug-20Aug)	L07 DAC Circuits #	8.2,14.3,14.4	P04	Project plan due ***Wed. 16 Aug***	
6 (21Aug-27Aug)	L08 ADC Circuits L09 Op-amp Freq Response	14.5, 14.6 7.1–7.3	P05		CLab1: Comparators
7 (28Aug-03Sep)	# L10 Active Filters	9.1, 9.3	P06	No Tutorial Class	HLab1: Op-amp xtics & Comparators
	Mid Semester Break				
8 (18Sep-24Sep)	L11 Filter Design L12 555 Timer	9.2, 9.4–9.6 10.5–10.6	P07 P08	Tutorial Classes resume	HLab2: Freq resp. & Active filters
9 (25Sep-01Oct)	# L13 Oscillators	10.1–10.4	P09		CLab2: Timers & Oscillators
10 (02Oct-08Oct)	# L14 Voltage Regulators	11.1–11.3	P10		HLab3: Timers & Oscillators
11 (09Oct-15Oct)	L15 Instrumentation L16 Integrator & Differentiator	12.1 8.3	P11	PCB design due: ***Fri 6 Oct*** (PCB Order: *Mon 9 Oct*) (PCB Delivery: *Mon 16 Oct*)	
12 (16Oct-22Oct)	# L17 Electronic System Examples			Project Report due: ***10 am Tue 24 Oct*** (ENGN3227 Submission Box)	
13 (23Oct-29Oct)	L18 Final Exam Review			Project Demos: ***Thur 26 Oct***	