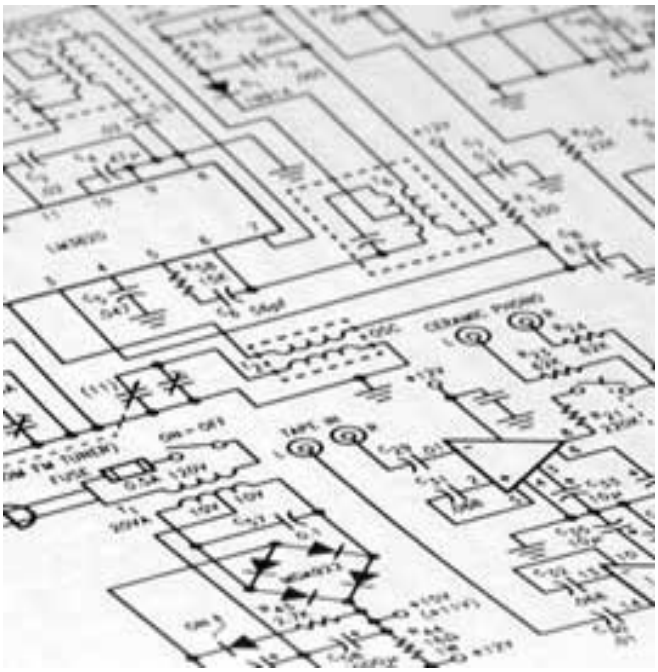
THE UNIVERSITY OF NEW SOUTH WALES

FACULTY OF SCIENCE

PHYSICS

PHYS2630

ELECTRONICS



SESSION II, 2009

Revision history: this document was created by John Smith in 2006; updated by Michael Ashley in July 2007, 2008, 2009.

Faculty of Science - Course Outline - 2009

1. Information about the Course

NB: Some of this information is available on the UNSW Virtual Handbook[1]

Year of Delivery	2009
Course Code	PHYS2630
Course Name	Electronics
Academic Unit	Physics
Level of Course	2nd
Units of Credit	3UOC
Session(s) Offered	S2
Assumed Knowledge, Prerequisites or Co-requisites	Assumed knowledge : Basic electrical circuits. Prerequisites: PHYS1002 or PHYS1221 or PHYS1231 or PHYS1241 or PHYS1022 or equivalent; Excluded: PHYS2920, PHYS2031
Hours per Week	3
Number of Weeks	12 weeks
Commencement Date	27 July 2009

Summary of Course Structure (for details see 'Course Schedule')

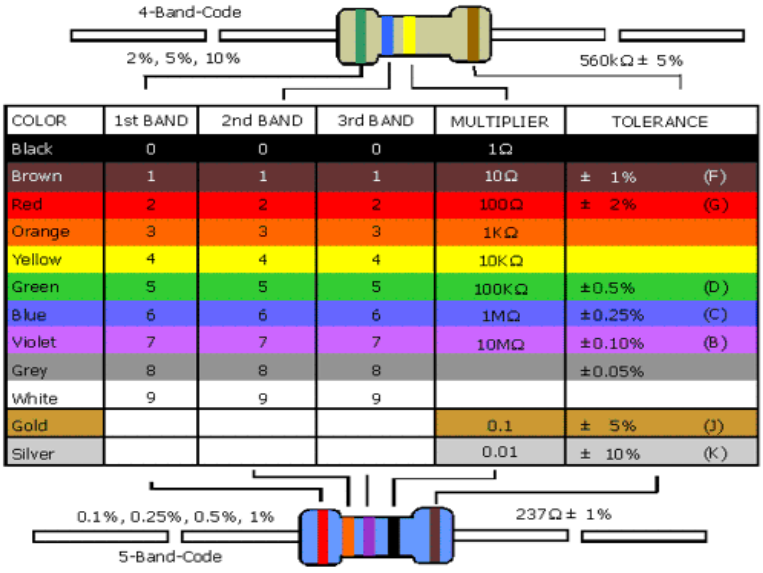
Component	HPW	Time	Day	Location
Lecture	1	9-10	Tue	OMB 151
Laboratory	2			
Lab – Option 1		10-12	Tue	2nd yr lab
Lab – Option 2		2-4	Wed	2nd yr lab
TOTAL				
Special Details				

2. Staff Involved in the Course

Staff	Role	Name	Contact Details	Consultation Times
Course Convener		Michael Ashley	Room 129 OMB 9385 5465 m.ashley@unsw.edu.au	*Tuesdays 1-2*
Additional Teaching Staff	Lecturers & Facilitators			
	Tutors & Demonstrators	Joe Wolfe Daniel Luong-Van		
	Technical & Laboratory Staff	Tamara Reztsova	2nd year lab	
	Other Support Staff			

[1] UNSW Virtual Handbook: http://www.handbook.unsw.edu.au/2006/index.html

3. Course Details

Course Description[2] (Handbook Entry)	Electronic bench experiments and tutorials on diodes, transistors, operational amplifiers, power supplies and digital electronics.
Course Aims[3]	This course is designed to provide a practical 'hands-on' introduction to electronics. Electronics not only plays a vital role in virtually all research in Physics, it also provides the thread that binds our present civilisation together. A basic knowledge of electronics is thus an essential skill for any experimental Physicist, and can also be most useful in many other disciplines, including the life sciences.
Student Learning Outcomes[4]	This course is designed to provide a practical 'hands-on' introduction to electronics. By the end of this subject you should be able to understand most circuits involving junction transistors and linear op-amps. You should also be able to design DC power supplies suitable for most purposes, and to recognise and understand the basic elements of digital logic. You should be able to undertake the following : • Recognise the values of resistors using their colour code.  COLOR / 1st BAND / 2nd BAND / 3rd BAND / MULTIPLIER / TOLERANCE Black: 0 / 0 / 0 / 1Ω Brown: 1 / 1 / 1 / 10Ω / ± 1% (F) Red: 2 / 2 / 2 / 100Ω / ± 2% (G) Orange: 3 / 3 / 3 / 1KΩ Yellow: 4 / 4 / 4 / 10KΩ Green: 5 / 5 / 5 / 100KΩ / ±0.5% (D) Blue: 6 / 6 / 6 / 1MΩ / ±0.25% (C) Violet: 7 / 7 / 7 / 10MΩ / ±0.10% (B) Grey: 8 / 8 / 8 / ±0.05% White: 9 / 9 / 9 Gold: 0.1 / ± 5% (J) Silver: 0.01 / ± 10% (K) • Calculate the values of many capacitors from their codes. • Understand how to measure input and output impedance of devices. • Understand the concept of high and low pass filters and measure their 3 dB frequency. • Construct a simple DC power supply and calculate its ripple for different currents. • Measure the current gain (beta) of a transistor. • Amplify a signal using transistors or op-amps. • Design constant current sources using transistors and op-amps. • Construct a power supply with negligible ripple. • Recognise the fundamental gates of digital logic and devise a truth table. • Build a working circuit from a circuit diagram, whilst keeping **all** the legs on the

[2] UNSW Virtual Handbook: http://www.handbook.unsw.edu.au/2007/index.html
[3] Learning and Teaching Unit: http://www.ltu.unsw.edu.au
[4] Learning and Teaching Unit – Learning Outcomes: http://www.ltu.unsw.edu.au/ref4-2-1_outcomes.cfm

	transistor. 

Graduate Attributes Developed in this Course[5]		
Science Graduate Attributes[5] (maybe replaced by UNSW, School or professional attributes)	**Select the level of FOCUS** *0 = NO FOCUS* *1 = MINIMAL* *2 = MINOR* *3 = MAJOR*	**Activities / Assessment**
Research, inquiry and analytical thinking abilities	**3**	Students are required to learn a new, succinct, symbolic language – the electronic circuit. They then must learn, through a series of problems of increasing complexity, the difficult task of converting a set of abstract symbols into a real, working circuit. They must also develop an understanding of how electronic components act individually and in concert with other components. Finally they need to develop new sets of problem solving skills for calculating various operational parameters.
Capability and motivation for intellectual development	**3**	Students will face and overcome several intellectual challenges in understanding the several levels of abstraction involved in the transition between working circuit and schematic circuit diagram. They will learn how to design electronic circuits for themselves. They should also become aware of the amazing synergy of electronics; a few basic types of components can be connected together in many different ways to fulfill many different functions. Students are positively encouraged to exercise their curiosity. Indeed the lab manual states ' Finally please remember that successful electronics is indeed an art form. You are consequently encouraged to demonstrate your creativity by experimenting and trying out your own ideas.'
Ethical, social and professional understanding	**0**	
Communication	**0**	Written and spoken communication are addressed in a companion subject – PHYS2030
Teamwork, collaborative and management skills	**2**	Laboratory classes are self-paced, thus encouraging students to improve time management skills. Collaborative skills are addressed in a companion subject – PHYS2030.
Information literacy	**3**	Students will become familiar with the language of electronic circuits. Students will also become familiar with reading and understanding a specialised literature - the data sheets for electronic devices.

[5] Access the contextualised Science Graduate Attributes and your mapped courses:
http://www.science.unsw.edu.au/guide/slatig/sciga.html
(Mapped course will also be available at this site from March 2006)

Major Topics (Syllabus Outline)	The course begins with some revision of simple linear devices such as resistors, capacitors, and inductors. It then progresses to passive non-linear devices such as diodes and their use in power supplies. The junction transistor is then introduced and various circuits that can amplify signals are explained. It is then shown how the characteristics of operational amplifiers both simplify circuit design and improve performance. The course finishes with a simple introduction to digital electronics.
Relationship to Other Courses within the Program	The course is complementary to PHYS2030 – second year laboratory and also PHYS1601- Computer Applications in Experimental Science.

4. Rationale and Strategies Underpinning the Course

Teaching Strategies	A lecture is held before each set of lab classes and provides an introduction to the relevant concepts and devices for that particular experiment. Each student is provided with a kit of parts that are used to construct different circuits during the laboratory classes. Because each student has their own kit, they are able to leave circuits wired up between different lab classes. The course concentrates on the 'art' of electronics itself, and consequently there is no writing of formal reports and the mathematical treatment is kept very simple.
Rationale for learning and teaching in this course[6],	Once they have graduated, students could be required, whether for industry or research purpose, to construct (or sometimes) repair various electronic devices. This basically requires them to: • Decide on the functions required • Design a suitable circuit • Identify and select the components to be used • Build and test the circuit. Prior to this subject students were involved only in measuring parameters on circuits that had already been wired up for them. Experience has shown that the hand-on approach, where students need to select the individual components and build a circuit themselves can lead to much improved understanding, as well as developing important practical skills. It also gives students the satisfaction of having created something themselves. Finally it also requires they make a commitment to their own learning.

[6] LTU – Teaching Philosophy: http://www.ltu.unsw.edu.au/ref3-3-5_teaching_portfolio.cfm#philosophy

5. Course Schedule

Some of this information is available on the Virtual Handbook[7] and the UNSW Timetable[8].

Week	Lectures (day), Topics & Lecturers	Tutorials (day), Topics & Lecturers	Practical (day), Topics & Lecturers	Other	Assignment and Submission dates (see also 'Assessment Tasks & Feedback')
Week 1	Introduction and revision of simple linear circuits	N/A	Laboratory classes are self-paced		Each of 8 laboratory exercises is to be marked when completed
Week 2	Non-linear devices – the pn junction diode. Simple power supplies				
Week 3	Full wave power suplies. Introduction to the junction transistor				
Week 4	Current gain. Saturation. Transistors as switches				
Week 5	Transistor amplifiers (emitter follower and common emitter)				
Week 6	Ebers-Moll eqn and its consequences,				
Week 7	Darlingtons and current mirrors				
Week 8	Op-amps.				
Week 9	Op-amp circuits				
Week 10	Op-amp limitations				
Week 11	Revision				
Week 12	Practical and theory examinations				

[7] UNSW Virtual Handbook: http://www.handbook.unsw.edu.au/2007/index.html
[8] UNSW Timetable: http://www.timetable.unsw.edu.au/

6. Assessment Tasks and Feedback

Task	Knowledge & abilities assessed	Assessment Criteria	% of total mark	Date of		Feedback		
				Release	Submission	WHO	WHEN	HOW
Lab exercise #1	Basic linear circuits with passive components	Working circuits with appropriate measurements	5	23/6/09	labs are self-paced	demonstrator	when exercise is ready	oral + marks
Lab exercise #2	Power supplies	Working circuits with appropriate measurements	5	23/6/09	labs are self-paced	demonstrator	when exercise is ready	
Lab exercise #3	Transistors and current gain	Working circuits with appropriate measurements	5	23/6/09	labs are self-paced	demonstrator	when exercise is ready	
Lab exercise #4	Transistor amplifiers	Working circuits with appropriate measurements	5	23/6/09	labs are self-paced	demonstrator	when exercise is ready	
Lab exercise #5	Ebers-Moll equation	Working circuits with appropriate measurements	5	23/6/09	labs are self-paced	demonstrator	when exercise is ready	
Lab exercise #6	Multi-transistor circuits	Working circuits with appropriate measurements	5	23/6/09	labs are self-paced	demonstrator	when exercise is ready	
Lab exercise #7	Amplifiers using op-amps	Working circuits with appropriate measurements	5	23/6/09	labs are self-paced	demonstrator	when exercise is ready	
Lab exercise #8	Current and op-amps	Working circuits with appropriate measurements	5	23/6/09	labs are self-paced	demonstrator	when exercise is ready	
Theory exam	Ability to calculate circuit parameters for a range of practical circuits; all aspects of the laboratory and lecture components of the course.	Demonstrated understanding of the syllabus	25	Week 12	Week 12	Michael Ashley	exam dept	marks
Practical exam	Ability to select appropriate components, build a working circuit, and make requested measurements.	Working circuits with appropriate measurements	25	Week 12	Week 12	Michael Ashley	exam dept	marks

* Insert rows as needed

7. Additional Resources and Support

Text Books	'The Art of Electronics' by Horowitz and Hill. Copies are available in the library and UNSW bookshop. Several copies are also available in the second year lab and can be borrowed overnight.
Course Manual	Every student is supplied with a copy of the laboratory manual
Additional Readings	Copies of several other textbooks are available in the second year lab
Computer Laboratories or Study Spaces	The 2nd year laboratory is generally open to students outside the nominal laboratory classes at the discretion of the laboratory manager.

8. Required Equipment, Training and Enabling Skills

Equipment Required	A kit of electronic components is supplied to each student. 
Enabling Skills Training Required to Complete this Course	

9. Course Evaluation and Development

Student feedback is gathered periodically by various means. Such feedback is considered carefully with a view to acting on it constructively wherever possible. This course outline conveys how feedback has helped to shape and develop this course.

Mechanisms of Review	Last Review Date	Comments or Changes Resulting from Reviews
12 week session	1/6/2008	Revised the course to fit within the 12 week session.
Major Course Review	1/6/2006	A new version of the laboratory manual is produced every year. Apart from correcting trivial matters like typographical errors, the exercises are often slightly modified from year to year in response to students' and demonstrators'

		comments. Modifications are also made because there are often changes in the students' background knowledge.
CATEI[9]	Session II 2005	There have been very few criticisms in the CATEi forms for the last 2 years. One or two students felt that more explanation of some fundamental aspects was sometimes required. If you don't understand something, then put your hand up for attention and I am always willing to try and explain it in a different fashion.
Other		

[9] Science CATEI procedure: http://www.science.unsw.edu.au/guide/slatig/catei.html

10. Administration Matters

Expectations of Students	The laboratory experiments are self-paced. It is each student's responsibility to ensure that they attend sufficient laboratory classes to complete at least 80% of the experiments.
Assignment Submissions	There are no assignments
Occupational Health and Safety[10]	All students must have signed a second year laboratory safety sheet before commencing
Assessment Procedures	Weekly laboratory experiments 50% Examinations in week 12 (theoretical & practical) 50% In most experiments you will find sections marked with an asterisk. You can expect to get a maximum mark of 8/10 for each experiment if it is done well, but the asterisked items are omitted. By doing the asterisked items you can get a maximum mark of 10/10 for each experiment If you cannot attend the laboratory for some reason, you should notify the Laboratory Manager (Tamara Reztsova). You should also follow the procedure prescribed in the University's 'Rules and Procedures' which can be found in the University Calendar. Point out in your letter to the Registrar that you have missed part of the assessment for whichever lab class you were scheduled and give the reasons (plus any documentation) for your absence. The Registrar will inform both you and the School of Physics whether your absence is approved or not, and we shall adjust your laboratory assessment accordingly.
Equity and Diversity	Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equity and Diversity Unit (9385 4734 or www.equity.unsw.edu.au/disabil.html). Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made. Information on designing courses and course outlines that take into account the needs of students with disabilities can be found at: www.secretariat.unsw.edu.au/acboardcom/minutes/coe/disabilityguidelines.pdf

Grievance Policy[11]	**School Contact**	**Faculty Contact**	**University Contact**
	Sue Hagon s.hagon@unsw.edu.au	A/Prof. Julian Cox Associate Dean (Education) julian.cox@unsw.edu.au Tel: 9385 6063	Graduate Research School Tel: 9385 2969 Compass University Counselling Services[12] Tel: 9385 5418

[10] UNSW Occupational Health and Safety: www.riskman.unsw.edu.au/ohs/ohs.shtml
[11] UNSW Grievance Policy: http://www.infonet.unsw.edu.au/poldoc/student_grievance_resolution.pdf
[12] Compass – University Counselling Service http://www.counselling.unsw.edu.au/compass_programs/

11. UNSW Academic Honesty and Plagiarism

The following information should appear in all course outlines or be available on the web in unaltered form. It is recommended, however, that additional discipline-specific advice and/or material be added to assist students wherever possible. Faculty of Science has information on the website[13]:

What is Plagiarism?

Plagiarism is the presentation of the thoughts or work of another as one's own.
*Examples include:

- direct duplication of the thoughts or work of another, including by copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person's assignment without appropriate acknowledgement;
- paraphrasing another person's work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- piecing together sections of the work of others into a new whole;
- presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and
- claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed.†

For the purposes of this policy, submitting an assessment item that has already been submitted for academic credit elsewhere may be considered plagiarism.

Knowingly permitting your work to be copied by another student may also be considered to be plagiarism.

Note that an assessment item produced in oral, not written, form, or involving live presentation, may similarly contain plagiarised material.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does *not* amount to plagiarism.

The Learning Centre website is main repository for resources for staff and students on plagiarism and academic honesty. These resources can be located via:

www.lc.unsw.edu.au/plagiarism

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- correct referencing practices;
- paraphrasing, summarising, essay writing, and time management;
- appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

Individual assistance is available on request from The Learning Centre.

Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting, and the proper referencing of sources in preparing all assessment items.

* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle
† Adapted with kind permission from the University of Melbourne.

[13] Faculty of Science – Academic Misconduct: http://www.science.unsw.edu.au/guide/slatig/acadmisc.html