ELECTRONIC DESIGN PROJECT 2

Course code	5MCV
GU Credits	10
ECTS Credits	5
Prerequisite course(s)	
Teaching staff (the first has overall responsibility)	Prof J H Davies (telephone 4115; email J.Davies) Dr F Rodriguez (telephone 4108; email F. Rodriguez)
Approximate size of class	50
Semester	both (irregular timetable)

Description of course

Aims

To introduce the design and realisation of electronics systems to solve engineering problems; good engineering design practice; tools and materials relevant to electronics and electrical engineering. To provide initial training in design skills required by professional engineers.

Objectives

Understanding

Methods of analogue-to-digital and digital-to-analogue conversion, concepts of resolution and accuracy

Knowledge

Power requirements and efficiency. Power conversion and consumption. Power demands of ICs, supply decoupling.

Skills

Choice of digital or analogue techniques. Estimation of power consumption from data sheets. Design of simple power supplies.

1. Power supplies and components

6 lectures, 2 laboratory sessions and 1 tutorial

Syllabus

Sources of power. Ideal and practical supplies: regulation. Batteries: primary and secondary, types, capacity and life. AC power supplies: rectification, simple, half-wave and full-wave; need for filter (capacitor) to reduce ripple. Zener diode regulator. Linear regulator circuits; dropout. Power dissipation: heatsinks, thermal resistance, calculation of heatsink required. Switching supplies: principle of operation, configurations. Passive components: specification, construction. Printed circuit boards (PCBs); effect of non-ideal PCB tracks; good grounding practice. Pin-through-hole (PTH) and surface mount (SMD) devices. RoHS. How to read a data sheet.

Laboratory: performance of power supply.

2. Analog to digital and digital to analog conversion

6 lectures, 1 tutorial and 1 assignment

Syllabus
Relation between analog and digital data: precision, resolution, range and accuracy. Types of classical analog to digital converters (ADC): successive approximation, pipeline. Reference sources. Signal conditioning, sample-and-hold circuit. Sampling rate, Nyquist criterion, aliasing and need for anti-aliasing filter, oversampling. Sigma–delta converters, principle of operation, effect of oversampling ratio. Types of digital to analog converter (DAC): resistor chain, *R*–2*R* ladder, sigma–delta. How to read a data sheet (again).
Assignment: selection of ADC to meet given specification.

3. Electronic Computer Aided Design

4 laboratory sessions

Syllabus
Computer-aided design for electronic circuits, graphical schematic capture, drawing standards for electronic systems, simulation using SPICE, generation of part lists, printed circuit board layout and production.

4. Electronic Design Project

4 laboratory sessions

Syllabus
System design project: assembly, test and rework of printed circuit board; design of engineering system including analogue, digital and hybrid electronics and real-time software; use of test instruments including generated test patterns; software design; integration of hardware and software.

Recommended books

Authors	Title, edition	Publisher	Year	ISBN	Cost	Code
P Horowitz and W Hill	The Art of Electronics (2^{nd} ed)	Cambridge	1989	0521370957	£55	B
A S Sedra and K C Smith	Microelectronic Circuits (5^{th} ed)	Oxford	2004	0195142527	£38	C
B Baker	A Baker's Dozen: Real Analog Solutions for Digital Designers	Newnes	2005	0750678194	£40	C
W Jung	Op Amp Applications Handbook	Newnes	2005	0750678445	£40	C
W Kester	Mixed-signal and DSP Design Techniques	Newnes	2003	0750676116	£40	C
W Kester	Data Conversion Handbook	Newnes	2004	0750678410	£40	C
R Mancini	Op Amps for Everyone	Newnes	2003	0750677015	£40	C
S J Sangwine	Electronic Components and Technology	Stanley Thornes	1998	0748740767	£25	D

Codes : A = compulsory; B = strongly recommended; C = recommended; D = wider reading

You are unlikely to want to buy these books but I have listed them because they will be useful in future projects that require electronic design. Most should be in the university library (tell

me if they are not). Some are in the department's data library, just outside the electronics workshop.

Manufacturer's web site are extremely valuable sources of information. I have found the best to be Analog Devices, National Semiconductor and Texas Instruments.

Study times

Type	Details
Lectures and tutorials	10 hours
Laboratories	30 hours
Assignments and tutorial sheets	25 hours
Review and consolidation of course material	20 hours
Revision and tests	15 hours

These times are an estimate of the work required by a typical student. There will be variations between individuals, but you will run the risk of failure if you spend significantly less time on this course than these guidelines suggest.

Assessment

%	Type	Details
50	Class tests (2)	A paper of straightforward questions to test basic knowledge will be set each semester
10	PCB design laboratory	Completion of PCB design, quality of layout
10	Power supply experiment	Report in laboratory book
10	Choice of ADC	Report submitted
20	Design project	Completion of system, report in laboratory book

There is no degree examination. All assessments must be submitted to receive credit for this course because it is formally part of your professional development.