LONDON SOUTH BANK UNIVERSITY

unit guide

DIGITAL ELECTRONICS 1

EEE-1-812

Blackboard Site Available

Faculty of Engineering, Science and the Built Environment

2007-8

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Unit Title	Digital Electronics 1: Chips
Reference No. *(showing level)*	Level 1
Value *CAT points (1 unit = 15 points)*	15
Pre-requisites	None
Co-requisites	None
Excluded combinations	None
Faculty	F.E.S.B.E.
Short Description	Description: Using standard digital i.c.s to implement basic operations. Building and testing simple "glue-logic" digital circuits using basic 'off the shelf' components, simple i/o devices, prototype boards and standard workstation instrumentation. Work will also involve computer simulation, faultfinding, and documentation of results. Most of the work will be based around the 74HC series chips although you will be introduced, via lecture demonstrations, to programmable logic array chips and PIC microcontrollers. The theory will cover basic techniques in coding, Boolean logic and K-mapping , to show how an idea can be converted into a circuit by applying these techniques. The workshop will consist of 12 practical hardware sessions.
Aims	To give confidence in using standard i.c.s in your designs. To see the importance of a design method in implementing electronics To use CAD tools for simulation and design To become familiar with a standard workstation for building and testing. To realise that work has not been done unless it is well-documented To give insight to fully programmable electronic circuits.
Learning Outcomes	Students will know how to: • create a 10 kHz, 5 V clock oscillator • connect two 4-bit counters to create an 8 bit counter • implement logic from a truth table of 3 or 4 variables • use a K-map to simplify logic • use a single switch to select up to 16 different functions • detect when a switch has been pressed • select 1 from 8 inputs • select 1 from 8 outputs • create an 8 bit serial data stream • create an 8-bit parallel data byte from a serial data stream • perform arithmetic or logic on two 4-bit numbers • understand how a single chip can be programmed to create

	multifunction logic (PLDs) • confidently use LEDs and switches to create inputs to and outputs from, digital circuits. • search for electronic data • document their work • use standard instrumentation and a breadboard for building and testing • simulate circuits using a CAD package
Transferable Skills	• written and graphical documentation as a means of communication and an aid to memory • retrieving data from catalogues/manuals/web pages • manual dexterity • general IT skills of using a PC • having a structured approach to a task • reading and absorbing information • following sets of instructions • meeting deadlines • searching for and finding information
Technical Skills	• using an oscilloscope and the other standard workstation instruments • keeping a technical logbook of all work done • circuit building on breadboard • faultfinding using logic probes and LEDs • drawing schematics and interpreting them • simplifying combinational logic to one gate type only • using computer simulation tools. • correct component selection [+ resistor /capacitor colour coding] • creating a truth table from a 'real-world problem' or a project brief • searching for and finding data
Teaching Style	12 two-hour lectures/tutorials will cover the theory 12 two-hour workshops/tutorials will cover the practical investigation of the theory. Most of the material will be available on the web
Summary of Content	**Theory:** Schematics, functional blocks, number systems, digital coding standards, truth tables, K-maps, DeMorgan's law, Boolean algebra, Combinational logic, sequential logic, asynchronous circuitry and introductory sequential design.. **ICs to be covered**: The main 74HC series :Logic gates, encoder, decoder, data selector/multiplexer, demultiplexer, flip-flops (JK, D, SR, T), counters, shift register, ALU. Astable oscillators. An intro to PLDs and PICs.

Calendar of Topics	**Simple digital i/o devices** DIL switches, pull-up resistors and LEDs **Lecture Topics** 1. Number Systems and Codes - decimal, Binary, hexadecimal, BCD,parity, ASCII 2. COMBINATIONAL LOGIC:-Logic, Boolean algebra, logic gates, gate symbols, creating simple logic gate circuits from Boolean expressions and vice versa, Truth tables (TT), the 74xxx series of chips. 3. De Morgan's Law, converting one gate type into another, converting logic gate circuits into one type only (usually 2-i/p NAND) 4. Decoders (chips and from standard gates) and the, Multiplexors (Data Selectors) chips and from std, gates, using multiplexors to create circuits from TTs, Demultiplexors (chips and from standard gates) 5. SEQUENTIAL LOGIC - cross-coupled NAND SR-flip flop (ff), clocked SR ff, edge-triggered ffs, JK ff, D ff, 6. Asynchronous counter using JKffs, MOD-x asynchronous counters 7. I.c. synchronous counter chips. 8. Binary arithmetic - addition-adders (half/full adders), subtraction -negative numbers representation, subtracting binary numbers, simple binary multiplication/ division 9. Introduction to programmable logic (schematics of PROM, PAL, PLA) - overview only. 10. Introduction to microcontrollers. Using PICs - demo only **Demonstrations** Demonstration of Schematic capture/Simulation tools. Demonstration of assembly language programming and operation of a PIC.
Assessment *Elements & weighting*	3 hour exam (70%) A laboratory logbook (30%)
Sources for Literature	CORE: • Blackboard site • Digital Systems by Tocci and Widmer. Pub. by Prentice Hall, Publisher: Prentice Hall; 10International Ed edition (31 Mar 2006), ISBN-10: 0131739697, ISBN-13: 978-0131739697 SUPPLEMENTARY: • Art of Electronics by Horowitz and Hill . Pub. Cambridge Press 1998 3rd Edition

Extra Notes:

Workshop Material

There will always be a member of academic staff available in the workshop to give you advice if get stuck. We ask you to work in pairs during the workshop session and to keep with the same partner throughout the unit.

At the beginning of the workshop sessions you will bring with you a laboratory book, in which you write up your procedures, results, comments and conclusions during the session. You will have your logbook signed at regular intervals. The logbook will not leave the laboratory.. Since the workshop booklet contains detailed text concerning the procedures required, you only need to write up a *brief* method in your laboratory book. The laboratory book is an immediate record of your work and does not therefore need to be perfectly neat, we only ask that you write legibly and concisely, preferably in pen (fine fibre-tipped are best for text and diagrams). Diagrams, graphs and tables should be sketched freehand. Rulers and typed text are reserved for formally presented reports only.

Laboratory books are often called 'log books'. Logbooks are kept by engineers, pilots, captains... as a permanent account of events or work done and for this reason they *should* be written in ink. Mistakes or unwanted information can be neatly crossed through. Do not worry about making mistakes, everybody does it. A laboratory book with no mistakes and no crossed-out parts is assumed not to be an immediate record of work done and will be marked with caution.

Web Page Support

Check the unit Blackboard site regularly for information.

What to do during your self-study time

Each main topic covered in a lecture will have an associated section in the core textbook where the work is covered in more detail.

Before a lecture:

Look at the topic to be covered in the forthcoming lecture and read through the work in the textbook. This will give you a familiarity with the subject and the terms used before the lecture.

During the lecture:

The lecture will then provide the introduction to the topic, its main areas, clarification of the more difficult areas and an overview of its role in electronic applications. It is a good idea to make notes (on an A4 refill pad) during the lecture, it will help you to understand and remember more about the lecture work during your revision time. At the end of the lecture, you will be asked to attempt certain tutorial questions as set by the lecturer or in the textbook. Place your notes in an A4 binder and mark them clearly as "Digital Electronics 1- Chips"

After the lecture:

This is where the real work starts. Collect together your notes from the lecture -can you still read what you've written? - Copy them out neatly if required. It is important here, that you try to understand what you've written, while the lecture is fresh in your mind. Find the correct place in the textbook and now work through the text and the tutorial questions. It 's a good idea to answer these questions either in a special tutorial laboratory book with a section for 'Digital Electronics 1-Chips' or to write them on similar-sized paper as your lecture notes, so that they can be filed in with your lecture notes in the appropriate place.

How much time to spend
Since the workshop exercises are designed to support the lecture material, it is wise to spend some time each week reading the workshop sessions book. ***For each week of lectures and workshop, you should try to spend up to 6 hours of self study work***, answering questions, copying notes out, reading around the subject (looking at other books) and reading the workshop sessions book. You will notice that the total amount of time it is recommended that you spend on this unit is 10 hours a week!

Workshop Rules - Please read the following carefully.

Laboratory logbooks, attendance and assessment.

1.Buy a laboratory book from the SU bookshop (or any stationary shop). Better to buy orange-covered book with 5mm squares on all pages if possible.
2.Laboratory books will not leave the lab until they have been signed out by the supervisor.
3.Laboratory books must have the following information written on the cover.

a) Your name (with your family name underlined)
b) Your I.D. number
c) Unit title as written on your timetable.
d) Semester 1or 2 (as appropriate)
e) the year "2007/2008"
f) Supervisor's name
g) Laboratory number – T622

4.Laboratory books must be written in permanent ink and must not have pages torn out.
5.All labs finish at 5 minutes to the hour. You should be out of the lab by this time.
6.All work should be stopped at 10 minutes to the hour (the second hour).
7.After work stops you will hand your laboratory book to the academic supervisor. The logbook STAYS in the lab.. There will also be a register which will be the record of your attendance. More than 2 non-attendances of a lab will result in a proportional reduction in the laboratory book mark.
8.Anyone missing two or three consecutive laboratory sessions without reason will be reported to the school office.
9.You will work in pairs
10.You will receive verbal feedback concerning your work at various points throughout the semester.
11.You will receive feedback concerning your logbook entries during the semester and a final mark following the last laboratory session.
12. You will be expected to attempt (and write about) more than 60% of the workshop assignments available to obtain a pass.

Health and Safety in T622

The following items are not in any order of importance, so please read them all.

1. Read all the health and safety notices on the lab notice board.
2. Put all coats and bags out of the way under the workbench or by the coat hangers.
3. No personal audio systems can be used in the lab (this includes mobile phones).
4. No running in the lab
5. Note the positions of fire extinguishers for use in an emergency only
6. Note that there are two exits from the lab
7. In case of a fire alarm, exit through either lab door and walk down the stairs following the fire exit signs. One set of stairs is near the rear lab door, check these as soon as possible. Do not use the lift.
8. Do not move or attempt to repair any equipment. All faults or queries must be reported to the technician.
9. Do not work in the lab on your own
10. Note that it is impossible to be locked in. All locks have a quick release mechanism operational from inside the lab.
11. Keep fingers away from mains outlets.
12. All lab equipment is limited to a maximum (safe limit) of 30V 1A output and is safety checked regularly.
13. Note where the electricity supply stop buttons are. Use only in case of an emergency.
14. If you suspect someone is being electrocuted **do not touch him or her but immediately hit the red stop button** after which then you can attend to them and call for assistance.
15. If any medical emergency arises, call for help, there will always be a trained first-aider nearby.
16. All lab soldering irons are low voltage types but use with care as they can still burn you if used carelessly.
17. Wear goggles when using PCB drilling machines.
18. Please be very careful when using electrolytic (polarised) capacitors as they can explode if connected with the wrong polarity.
19. If you smell burning, immediately turn off the supply to your circuit and resist the temptation to touch any components. Short-circuited integrated circuits and resistors can easily burn you. Wait a short while before checking (the components will remain warm for a minute or two) .
20. No experiments can be undertaken which involve voltages and currents larger than those stated in item 12.
21. Do not drink the water from the taps in the lab.

Assessment:
A pass is 40% in the unit, made up of two elements. The weighting of these elements towards a unit mark is as follows:

Workshop laboratory book 30%. (this includes attendance) Exam 70%

Assessment Deadlines:
The logbook must be submitted to the faculty T313 office by 3.30pm 16th May 2008.
Please submit your logbook to the academic who takes you in the lab and **not** to Colin Lunn.

Unit Co-ordinator:
Colin Lunn, Room T403, Tel: 020-7815-7541
E-mail: lunnc@lsbu.ac.uk