University of Macau
Department of Electromechanical Engineering
MECH309 – Digital Systems
Syllabus
1st Semester 2012/2013
Part A – Course Outline

Compulsory course in Electromechanical Engineering

Course description:

This course provides an introduction to the basic principles of digital logic design. The main topics covered are the Algebra of Logical Variables, Logic Functions, Basic Combinatorial Circuits, Flip-flops, Registers, Counters, and Arithmetic Operations.

Prerequisite:

None

Textbook:

- R.L. Tokheim, ***Digital Electronics - Principles & Applications,*** Latest Edition, McGraw Hill.

Reference:

- E. Hughes, *Electrical and Electronic Technology*, Latest Edition, Prentice Hall.

Course objectives:

1. Introduce to students some digital electronic devices and systems, and applications in electromechanical systems. [c, k]
2. Introduce to students mathematical tools for digital logic design. [a, b, e]

Topics covered:

1. Algebra of Logical Variables – Logic circuit from a Boolean expression; Minterm and maxterm Boolean expressions; Boolean algebra.
2. Logic Functions – AND, OR, Inverter, NAND, NOR, XOR, NAND as universal, TTL & CMOS.
3. Basic Combinatorial Circuits – DeMorgan's Theorem; Boolean expression from a truth table; Truth table from a Boolean expression; Simplifying Boolean expressions using Karnaugh maps.
4. Flip-flops – Combinational vs. Sequential logic circuits; R-S FF; Clocked R-S FF; D FF; J-K FF; Latches; Triggering FF.
5. Counters – Ripple Up; Parallel; Ripple Down; Self-stopping; Frequency division using counters.
6. Shift Registers – Characteristics; Serial/Parallel data conversion; Serial load; Parallel load; Recirculating.
7. Arithmetic Operations – Binary addition; Half & full adders; Binary subtraction; Half & full subtractors; Parallel adders and subtractors; Using adders for subtraction.
8. Applications in electromechanical systems – Interfacing with switches, LEDs, buzzers, relays, motors, and solenoids.

Class schedule and credits:

Timetabled work in hours per week			No of teaching weeks	Total hours	Total credits	No / Duration of exam papers
Lecture	Tutorial	Practice				
2	0	2	14	56	3	1 / 2 hours

Contribution of course to meet the professional component:

This course prepares students to work professionally in the area of **digital electronic systems**.

Relationship to EME program objectives and outcomes:

This course primarily contributes to Electromechanical Engineering Program outcomes that develop student abilities to:
(a) an ability to apply knowledge of mathematics, science, and engineering.
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

The course secondarily contributes to Electromechanical Engineering program outcomes that develop student abilities to:
(b) an ability to design and conduct experiments, as well as to analyze and interpret data.
(e) an ability to identify, formulate, and solve engineering problems.
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Course content:

Maths	Basic Sciences	Engineering Science	Engineering Design and Synthesis	Complementary Studies	Computer Studies	Total 100%
30	0	30	40	0	0	100

Persons who prepared this description:

Mr. Seng Kin Lao

_____

Part B General Course Information and Policies

1st Semester 2012/2013

Instructor: Mr. Seng Kin Lao
Office: N327C
Office Hour: By appointment
Phone: (853) 8397-4379
Email: skeltonl@umac.mo

Time/Venue:

Every Tuesday, 9:30 a.m. – 11:30 a.m., Room U103
Every Friday, 4:30 p.m. – 6:30 p.m., Room U103

Assessment:

Final assessment will be determined on the basis of:

Homework:	10%
Lab Report:	10%
Mid-term I:	20%
Mid – term II:	20%
Final Exam (Comprehensive):	40%

Grading System:

The credit is earned by the achievement of a grade from 'A' to 'D'; 'F' carries zero credit.

Grades are awarded according to the following system:

Letter Grades	Grade Points	Percentage
A	4.0 (Excellent)	93-100
A-	3.7 (Very good)	88-92
B+	3.3	83-87
B	3.0 (Good)	78-82
B-	2.7	73-77
C+	2.3	68-72
C	2.0 (Average)	63-67
C-	1.7	58-62
D+	1.3	53-57
D	1.0 (Pass)	50-52
F	0 (Fail)	Below 50

Comment:

The objectives of the lectures are to explain and to supplement the text material. Students are responsible for the assigned material whether or not it is covered in the lecture. Students who wish to succeed in this course should read the assignments prior to the lecture and should work all homework and lab assignments. You are encouraged to look at other sources (other texts, etc.) to complement the lectures and text.

Homework Policy:

The completion and correction of homework is a powerful learning experience; therefore:

- There will be approximately 8 homework assignments.
- Homework is due one week after assignment unless otherwise noted, no late homework is accepted.
- Possible revision of homework grades may be discussed with the grader within one week from the return of the marked homework
- The course grade will be based on the average of the homework grades.

Quizzes/Mid-terms Exams:

Two mid-term exams will be held during the semester.

Note:

- Discontinued in new system, i.e. last course will be offer in 1st Semester 2012/2013.
- A student who is absent without applying for leave of absence from a course for more than 20% of its scheduled teaching periods in the aggregate will not be allowed to take the final examination and will receive a failing grade for that course.
- Check UMmoodle (webcourse.umac.mo) or email for announcement, homework and lectures.
- No make-up exam is give except for CLEAR medical proof.
- No exam is given if you are 15 minutes late in the midterm exams and 30 minutes late in the final exam. Even if you are late in the exam, you must turn in at the due time.
- Cheating is absolutely prohibited by the university.

Appendix - Rubric for Program Outcomes

Rubric for (a)	5 (Excellent)	3 (Average)	1 (Poor)
Understand the theoretic background	Students understand theoretic background and the limitations of the respective applications.	Students have some confusion on some background or do not understand theoretic background completely	Students do not understand the background or do not study at all
Use a correct model and formulation correctly	Students choose a model correctly and properly apply correct techniques	Students choose a wrong model sometime, use a wrong formula, or a different technique	Students use a wrong model and wrong formula, or do not know how to model
Compute the problem correctly	Students use correct techniques, analyze the problems, and compute them correctly	Students sometime solve problem mistakenly using wrong techniques	Students do not know how to solve problems or use wrong techniques completely

Rubric for (b)	5 (Excellent)	3 (Average)	1 (Poor)
Conduct experiments	Student successfully completes the experiment, records the data, analyzes the experiment's main topics, and explains the experiment concisely and well.	Student successfully completes the experiment, records the data, and analyzes the experiment's main topics.	Student either does not complete the experiment successfully, or completes it successfully but does not record the correct data.
Design experiments	Student understands what needs to be tested and designs an appropriate experiment that takes into account the limitations of the equipment and measurement accuracy.	Student understands what needs to be tested and designs an appropriate experiment, but may not fully understand the limitations of the measurements.	Student does not understand what needs to be tested and/or does not design an appropriate experiment.

Rubric for (c)	5 (Excellent)	3 (Average)	1 (Poor)
Design capability and design constraints	Student understands very clearly what needs to be designed and the realistic design constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.	Student understands what needs to be designed and the design constraints, but may not fully understand the limitations of the design constraints	Student does not understand what needs to be designed and the design constraints.
Process to meet desired needs	Student understands very clearly the process of the design	Student understands what the needs of the process design, but may not fully understand the limitations of the design constraints	Student does not understand the process.

Rubric for (e)	5 (Excellent)	3 (Average)	1 (Poor)
Identify applications in engineering systems	Students understand problem and can identify fundamental formulation	Students understand problem but cannot apply formulation.	Students cannot identify correct terms for engineering applications
Modeling, problem formulation and problem solving	Students choose and properly apply the correct techniques	Students model correctly but cannot select proper technique or model incorrectly but solve correctly accordingly	Students at loss as to how to solve a problem

Rubric for (k)	5 (Excellent)	3 (Average)	1 (Poor)
Use modern hardware tools in engineering practice	Student uses the hardware to measure and/or build engineering systems/designs correctly, and understands the limitations of the hardware.	Student uses the hardware to measure and/or build engineering systems/designs correctly.	Student does not use the hardware correctly.