University of Macau
Faculty of Science and Technology
Department of Computer and Information Science
SFTW230 Systems and Networks I
Syllabus
1st Semester 2012/2013
Part A – Course Outline

Compulsory course in Computer Science

Catalog description:
(3-2) 4 credits. Basic concepts of computer organization. Instructions executed by a processor and how to use these instructions in simple assembly language programs. Internal representation of information; arithmetic operations and logic units. Memory hierarchy. Basic processing unit. Input and output devices and their interface with processor and memory.

Course type:
Theoretical

Prerequisites:
- ELEC110

Textbook(s) and other required material:
- Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, *Computer Organization and Embedded Systems*, 6th Edition, McGraw-Hill, 2012.

References:
- Linda Null and Julia Lobur, *The Essentials of Computer Organization and Architecture*, 3rd Edition, Jones and Bartlett, 2010.
- David Patterson and John Hennessy, *Computer Organization & Design: The Hardware/Software Interface*, 4th Edition, Morgan Kaufmann, 2011.

Major prerequisites by topic:
- Boolean algebra.
- Digital circuits.

Course objectives:
- To make students know the basic structure of a computer and the relationship between hardware and software. [a]
- To teach students machine instructions and use the assembly language to understand program execution and data representation in computers. [a, k]
- To teach students logic circuits for arithmetic operations and the IEEE floating-point number representation. [a, k]
- To provide students with an introduction to memory system, Input/Output operations, and basic processing unit. [a]

Topics covered:
- **Basic structure of computers (4 hours):** Provide an overview of computer hardware and software. Discuss the basic functional units and the ways they are interconnected to form a complete computer system. Introduce the role of system software and basic aspects of performance evaluation. Introduce the history of computer development.
- **Machine instructions and programs (12 hours):** Study the representation and execution of instructions and programs at the assembly and machine level. Discuss the principles of addressing techniques and instruction sequencing. Programming examples are provided to illustrate the basic types of operations implemented by the instruction set of any modern computer, including basic I/O operations, stack, queues, arrays and link lists etc.

- **The IA-32 instruction set (3 hours):** Introduce the IA-32 instruction set as the illustrated implementation of the concepts discussed in Topic 2.
- **Input/Output organization (3 hours):** Study three basic approaches to I/O transfers: programmed I/O, interrupts and direct-memory access. Introduce some commonly used bus standards.
- **Software (1 hour):** Introduce the software needed to prepare and run programs.
- **Memory (6 hours):** Study the semiconductor memories. Introduce the caches, virtual-memory systems and secondary storage.
- **Number representation and arithmetic operation (9 hours):** Study the arithmetic unit of a computer. Discuss the logic design for fixed-point add, subtract, multiply, and divide hardware, operating on 2's-complement numbers. Introduce the IEEE floating-point number representation standard and a set of rules for performing the four standard operations.
- **Basic processing unit (4 hours):** Introduce a register-transfer-level treatment of the implementation of instruction fetching and execution in a processor.

Class/laboratory schedule:

Timetabled work in hours per week			**No of teaching weeks**	**Total hours**	**Total credits**	**No/Duration of exam papers**
Lecture	**Tutorial**	**Practice**				
3	2	Nil	14	70	4	1 / 3 hours

Student study effort required:

Class contact:	
Lecture	42 hours
Tutorial	28 hours
Other study effort	
Self-study	42 hours
Homework assignment	10 hours
Total student study effort	122 hours

Student assessment:
Final assessment will be determined on the basis of:

Assignments	20%
Mid-term	30%
Final exam	50%

Course assessment:
The assessment of course objectives will be determined on the basis of:

- Assignments and exams
- Course evaluation

Course outline:

Weeks	**Topic**	**Course work**
1	**Basic Structure of Computers** Functional units of computers; Machine instructions and their execution; Number representation; Performance issues in computer systems; The history of computer development	Assignment 1
2-3	**Machine Instructions and Programs** Addresses, memory locations and operations; Instructions and instruction sequencing; Addressing modes	Assignment 2
4-5	**Machine Instructions and Programs** Assembly language; Basic I/O operations; Stack and queues; Subroutines; Additional instructions; Encoding of machine instructions; Program examples; **Intel Instruction Set** Registers and addressing; IA-32 instructions; IA-32 assembly	Assignment 3

Weeks	Topic	Course work
	language; Program flow control; Program examples	
6	**Input/Output Organization** Accessing I/O devices; Interrupt; Direct memory access; Standard I/O interfaces	Assignment 4
7	**Software** Software needed to prepare and run programs	
8,9	**The Memory System** Some basic concepts; Semiconductor RAM memories; Read-only memories; Cache memories; virtual memories; secondary storage	Assignment 5
10-12	**Arithmetic** Addition and subtraction of signed numbers; Multiplication of positive numbers; Signed-operand multiplication; Integer division; Floating-point numbers and operations	Assignment 6
13-14	**Basic Processing Unit** Some fundamental concepts; Execution of a complete instruction **Review**	Assignment 7

Contribution of course to meet the professional component:
This course provides students the fundamental concepts of computer organization and how computer systems work. An understanding of these concepts is necessary for being computer specialists.

Relationship to CS program objectives and outcomes:
This course primarily contributes to the Computer Science program outcomes that develop student abilities to:
(a) an ability to apply knowledge of mathematics, science, and engineering.
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Relationship to CS program criteria:

Criterion	DS	PF	AL	AR	OS	NC	PL	HC	GV	IS	IM	SP	SE	CN
Scale: 1 (highest) to 4 (lowest)		4		1	4									

Discrete Structures (DS), Programming Fundamentals (PF), Algorithms and Complexity (AL), Architecture and Organization (AR), Operating Systems (OS), Net-Centric Computing (NC), Programming Languages (PL), Human-Computer Interaction (HC), Graphics and Visual Computing (GV), Intelligent Systems (IS), Information Management (IM), Social and Professional Issues (SP), Software Engineering (SE), Computational Science (CN).

Course content distribution:

Percentage content for			
Mathematics	Science and engineering subjects	Complementary electives	**Total**
0%	100%	0%	100%

Coordinator:
Prof. En Hua Wu

Persons who prepared this description:
Dr. Wen Wu, Prof. En Hua Wu

Part B – General Course Information and Policies

1st Semester 2012/2013

Instructor:	Dr. Wen Wu	Office:	N419
Office hour:	by appointment	Phone:	8397 4469
Email:	wenwu@umac.mo		

Time/Venue: Thursday 14:30-16:30/ILG129
Monday 14:30-16:30/ILG128
Friday 14:30-16:30/ILG127

Grading distribution:

Percentage Grade	Final Grade	Percentage Grade	Final Grade
100 - 93	A	92 - 88	A–
87 - 83	B+	82 - 78	B
77 - 73	B–	72 - 68	C+
67 - 63	C	62 - 58	C–
57 - 53	D+	52 - 50	D
below 50	F		

Comment:

Reading the text is imperative. Students who want to achieve a good result of their study should do exercises of the tutorial courses and all the assignments. Students are encouraged to read and learn any other materials to complement the lectures and text.

Homework policy:

- There will be approximately 7 homework assignments.
- No late homework is accepted.
- No marks will be given in case of copying from others.

Exam:

A mid-term exam will be held during the semester. Both the mid-term and final exams are closed book examinations.

Note:

- Reading the textbook is imperative.
- Check UMMoodle (https://ummoodle.umac.mo/) for announcement, lecture notes, homework and other related resources.
- Cheating is absolutely prohibited by the university. Issues regarding the final exam follow the university rules and policies.

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.
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 (k)	**5 (Excellent)**	**3 (Average)**	**1 (Poor)**
Use modern principles, skills, and tools in engineering practice	Student applies the principles, skills and tools to correctly model and analyze engineering problems, and understands the limitations.	Student applies the principles, skills and tools to analyze and implement engineering problems.	Student does not apply principles and tools correctly and/or does not correctly interpret the results.