University of Macau
Department of Electromechanical Engineering
CPTG104 – Computer Science
Syllabus
1st Semester 2010/2011
Part A – Course Outline

Compulsory course in Electromechanical Engineering

Catalog description:

Introduction to computer science with simple overview of computing history, organization of hardware and software. Algorithms and simple object-oriented programming techniques via theoretical concepts and practical skills. Problem solving with the programming language C/C++.

Prerequisites:

- None

Textbook(s) and other required material:

- Joel Adams & Larry Nyhoff, ***C++: An Introduction to Computing***, Third edition, Prentice Hall, 2003.

References:

- Y. Daniel Liang, ***Introduction to Programming with C++, Comprehensive***, Pearson Education, 2007.

Major prerequisites by topic:

1. None

Course objectives*:

1. Introduce fundamentals of computer history, organization of hardware and software. [a, j]
2. Learn basic concepts of programming languages. [a, j, l]
3. Learn basic knowledge of data representations in memory. [a, c, j, l]
4. Learn design principles and problem solving skills using structured and object oriented programming. [a, c, e, j, l]

Topics covered:

1. **History of computing, introduction to computer systems** – computer hardware and software, basic concepts of computer structure.
2. **Problem solving and software engineering** – basic phases of software life cycle, object-centered design.
3. **Data representation** – data types and declarations, variables, expressions and operations, assignments.
4. **Problem solving techniques** – design and implementation of algorithms, properties of algorithms, notations for describing algorithms.
5. **Introduction to classes** – class structure and declaration, data encapsulation, input and output classes, format control, computing with string objects.
6. **Principles of high level programming languages** – selection, repetition, control structures, blocks, and scope.
7. **Functions and libraries** –parameters of functions, function prototypes, calling a function, inline functions, function templates, function signature and overloading, recursive functions, library construction, using a library in a program, and incorporating functions and libraries.
8. **Files and streams** – use file streams to carry out I/O, standard input and output with files, processing data involving files, file streams as parameters.
9. **Object-oriented data structure** – Arrays, vector<T> class template, STL (Standard Template Library) containers and algorithms.

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				
3	1.2	0.8	14	70	3	1 / 3hrs

Topic outline:

Week no.	Topics	Notes	Hours
1	Introduction to Computer Science History of computing, organization of computer systems, computer hardware and software.		3
2	Problem Solving and Software Engineering First look at C++ program, illustrate the basic phases of software life cycle, and introduce object-centered design. First look at classes and object-oriented design.		4
3	Types and Declarations Data representation, C++'s syntax rules and naming conventions, study variables and constants. First look at using attribute variables in classes.		5
4	Mid-Autumn Festival		
5	Operations and Expressions Study software development using OCD, examine various data types and operators for building expressions, study assignment operators, look at input and output operators along with format manipulators. First look at class constructors – default and explicit-value, and initialize instance variables as well.	Assignment 1	5
6	Functions Study how to build functions, how a function is called, and how a function is executed. Study libraries and see how they can be reused in different programs. First look at class methods.	Assignment 2	6
7	Using Classes Study basic features of classes and how to use them. Study the input and output classes. Study the string class. First look at how to develop instance methods.		5
8	Selection Introduction of selection structure, examine the if statement in detail, study the switch statement and the implementation of certain multi-alternative selections. First look at mutator methods in classes.	Assignment 3 Lab Quiz 1	5
9	Repetition Examine C++'s for statement in detail, study while and do loops, look at various kinds of input loops. Introduce the object-oriented concept of reusability via inheritance.		5
10	Midterm Exam	Assignment 4	2.5
11	Functions in Depth Study parameter passing of functions, see the inline functions and when to use, introduce recursive functions. Expand on earlier discussions of class and instance variables and examine scope rules for classes.	Lab Quiz 2	6
12	Files and Streams Use OCD to solve a problem involving files, examine how to use file streams to carry out I/O, learn open and close file streams. Look at string streams and how they can be used for I/O.	Assignment 5	6
13	Arrays, vector<T>s, and STL Solve a list-processing problem using an array, study in some detail the vector<T> class template, take a look at the Standard Template Library (STL) and its algorithms.		5
14	Final Review	Assignment 6 Lab Quiz 3	3

Contribution of course to meet the professional component:

This course teaches students with no prior experience in computing to understand ideas at the core of computer science and solve simple problems with programming language.

Relationship to EME program objectives and outcomes:

This course primarily contributes to EME programs outcomes that develop student abilities to:

(a) an ability to apply knowledge of mathematics, science, and engineering.

(c) an ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

(j) a knowledge of contemporary issues.

(l) an ability to use the computer/IT tools relevant to the discipline along with an understanding of their processes and limitations.

The course secondarily contributes to EME program outcomes that develop student abilities to:

(e) an ability to identify, formulate, and solve engineering problems.

Contribution to Program Outcomes:

Program Outcomes	Contribution to POs# 5 ----------> 1 Significant Least				
	5	4	3	2	1
(a) An ability to apply knowledge of mathematics, science, and engineering;	✓				
(b) An ability to design and conduct experiments, as well as to analyze and interpret data;					
(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;	✓				
(d) An ability to function on multidisciplinary teams;					
(e) An ability to identify, formulate, and solve engineering problems;		✓			
(f) An understanding of professional and ethical responsibility;					
(g) An ability to communicate effectively;					
(h) The broad education necessary to understand the impact of engineering solution in a global, economic, environmental, and societal context, especially the importance of health, safety and environmental considerations to both workers and the general public;					
(i) An ability to recognize the need for, and to engage in life-long learning;					
(j) A knowledge of contemporary issues;	✓				
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice appropriate to the degree discipline;	✓				
(l) An ability to use the computer/IT tools relevant to the discipline along with an understanding of their processes and limitations.		✓			
# Note 5: Significant contribution; 4: Supporting contribution; 3: Moderate contribution; 2: Marginal support; 1: Least support					

Course content:

Maths	Engineering Science	Engineering Design and Synthesis	Complementary Studies	Computer Studies	Total 100%
0	30%	20%	0	50%	100

Course Modulator

Prof. Pak Kin Wong

Persons who prepared this description:

Dr. Sam Chao, Prof. Pak Kin Wong

Part B General Course Information and Policies

1st Semester 2010/2011

Instructor: Dr. Sam Chao
Office: N426
Office Hour: by appointment
Phone: 8397-4476
Email: lidiasc@umac.mo

Time/Venue: (*to be announced*)

Assessment:

Final assessment will be determined on the basis of:

Homework	10%	Lab Quiz	20%
Mid-term	30%	Final Exam	40%

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:

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 6 homework assignments.
- Homework is due one week after assignment unless otherwise noted, no late homework is accepted.
- The course grade will be based on the average of the HW grades.

Quiz

One mid-term exam and approximately 3 Lab quizzes will be held during the semester.

Note

- Recitation session is important part of this course and attendance is strongly recommended.
- Check course web pages for announcement, homework and lectures. Report any mistake on your grades within one week after posting.
- No make-up exam is give except for CLEAR medical proof.
- 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
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 (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, or cannot understand problem.	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 (j)	5 (Excellent)	3 (Average)	1 (Poor)
Relevance to the Present Time	Student displays an understanding of the theoretical or practical impact and an ability to correlate a subject, perception, communication, association and reasoning from a global and societal perspective.	Student is able to display an understanding of current topics and issues with some knowledge regarding their impact in a bigger global and societal sense.	Student has difficulty demonstrating an awareness or familiarity with current topics and issues relevant to most current global and societal affairs.

Rubric for (l)	5 (Excellent)	3 (Average)	1 (Poor)
Use computer/I.T. tools relevant to the discipline	Student uses computer/I.T. tools and software relevant to the engineering discipline, and understands their limitations.	Student uses computer /I.T. tools and software relevant to the engineering discipline.	Student does not use computer/I.T. tools and software relevantly, and does not understand their limitations.