University of Macau
Faculty of Science and Technology
Department of Computer and Information Science
SFTW231 – Operating Systems I
Syllabus
2nd Semester 2011/2012

Part A – Course Outline

Compulsory course in Computer Science

Catalog description:

(3-2) 4 hours credit. Processes, Multithreading, Concurrency, Memory, Input/Output, File management, and other topics. This course is devoted to the study of the design principles and implementation issues of contemporary computer operating systems.

Course type:
Theoretical with substantial laboratory/practice content

Prerequisites:

SFTW230 Systems and Networks I

Textbook(s) and other required material:

Operating Systems Internals and Design Principles, William Stallings, Pearson Prentice Hall, Seventh Edition, 2012. ISBN: 9780273751502

References:

Operating System Concepts, 8th Edition, Abraham Silberschatz, Peter B. Galvin, Greg Gagne, John Wiley & Sons (Asia) Pte Ltd, 2010. ISBN: 9780470233993

Major prerequisite by topic:

- The architecture and organization of a computer system.
- Data structures such as List, Stacks, and Queues.
- The notion of algorithms and fundamental concepts of programming.

Course objectives:

- Understand the fundamental characteristics and functions of modern operating systems. [a, e]
- Understand the implementation issues of the operating system principles. [a, e, k]
- Analyze the tradeoffs inherent in operating system design. [a, e, k]
- Gain hands-on experience by doing programming projects. [a, e, k, d]

Topics covered:

- **Computer and Operating System Overview** (6 hours): Basic elements, processor registers, instruction execution, interrupts, the memory hierarchy, operating system objectives and functions, the evolution of operating systems, major achievements, and developments leading to modern operating systems.

- **Process Control and Processor Scheduling** (3 hours): Concept of process, process states, process description, process control, dispatcher, scheduling criteria, decision mode, first-come-first-served, round robin, and UNIX SVR4 process management.
- **Threads, SMP, and Microkernels** (3 hours): Processes and threads, symmetric multiprocessing, microkernels.
- **Concurrency: Mutual Exclusion and Synchronization** (6 hours): Principles of concurrency, mutual exclusion with hardware support, semaphores, monitors, message passing, readers/writers problem.
- **Concurrency: Deadlock and Starvation** (6 hours): Principles of deadlock, deadlock prevention, deadlock avoidance, deadlock detection, an integrated deadlock strategy, dining philosophers problem.
- **Virtual Memory Management** (9 hours): Memory relocation, protection and sharing, logical organization, physical organization, locality and virtual memory, paging, segmentation, combined paging and segmentation, fetch policy, placement policy, replacement policy, resident set management, cleaning policy, and load control.
- **I/O Management and Disk Scheduling** (5 hours): I/O devices, organization of the I/O function, operating system design issues, I/O buffering, disk scheduling, RAID, disk cache, and UNIX SVR4 I/O.
- **File Management** (4 hours): Overview of files and file systems, file organization and access, file sharing, record blocking, secondary storage management, UNIX file management, LINUX virtual files systems, and Windows file system.

Class/laboratory schedule:

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

Student study effort required:

Class contact:	
Lecture	42 hours
Tutorial & Lab	28 hours
Other study effort	
Self-study	14 hours
Homework	6 hours
Projects	28 hours
Total student study effort	118 hours

Student assessment:

Final assessment will be determined on the basis of:

Homework	15%
Projects	30%
Midterm Test	25%
Final Exam	30%

Course assessment:

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

- Homework, projects, midterm test and final exam
- Course evaluation

Course outline:

Weeks	Topic	Course work
1, 2	Computer and Operating System Overview	Homework#1

		Project#1
3	Process Control and Processor Scheduling	
4	Threads, SMP, and Microkernels	Homework#2
5, 6	Concurrency: Mutual Exclusion and Synchronization	Homework#3 Midterm Test
7, 8	Concurrency: Deadlock and Starvation	Homework#4 Project#2
9, 10, 11	Virtual Memory Management	Homework#5
12, 13	I/O Management and Disk Scheduling	
13, 14	File Management	Homework#6

Contribution of course to meet the professional component:

This course presents the issues that influence the design of contemporary operating systems.

Relationship to Computer Science program objectives and outcomes:

This course primarily contributes to Computer Science program outcomes that develop student abilities to:
(a) an ability to apply knowledge of mathematics, science, and engineering.
(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.

The course secondarily contributes to the Computer Science program outcomes that develop student abilities to:
(d) an ability to work in teams.

Relationship to Computer Science 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									

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. Yiping Li

Persons who prepared this description:

Dr. Yan Zhuang, Dr. Simon Chi Chiu Fong

Part B General Course Information and Policies

2nd Semester 2011/2012

Instructor: Dr. Yan Zhuang
Office: N414
Office Hour: *To be announced*
Phone: 8397-4464
Email: syz@umac.mo

Time/Venue: *To be announced*

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 work all homework and projects. You are encouraged to look at other sources (other texts, etc.) to complement the lectures and text.

Homework and Project Policy:
Doing homework and projects is of vital importance to help the students to master the concepts covered, therefore:

- There will be approximately 5 homework assignments and 2 course projects.
- Course projects are group projects of 2-3 students per group.
- No late submission is accepted.
- Possible revision of homework/project grades may be discussed within one week from the grade announcement.

Test and Exam:
One midterm test and one final exam will be held during the semester. Both are 2-hour and closed book.

Note

- Attendance at both lectures and lab classes is strongly recommended.
- Check UMMoodle (http://ummoodle.umac.mo) for announcement, homework and lectures. Report any mistake on your grades within one week after announcement.
- No make-up test is given 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.
Rubric for (e)	**5 (Excellent)**	**3 (Average)**	**1 (Poor)**
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 (d)	**5 (Excellent)**	**3 (Average)**	**1 (Poor)**
Ability to work in teams	Performance on teams is excellent with clear evidence of equal distribution of tasks and effort as well as frequent meetings of the team members.	Performance on teams is acceptable with one or more members carrying a larger amount of the effort as well as infrequent meetings of the members or one or more members being absent from several meetings.	Performance on teams is poor to unacceptable with one or two members clearly carrying the majority of the effort as well as inadequate team meeting or one or more members missing the majority of the meetings.
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 appliesthe principles, skills and tools to analyze and implement engineering problems.	Student does not applyprinciples and tools correctly and/or does not correctly interpret the results.