University of Macau
Faculty of Science and Technology
Department of Computer and Information Science
CISB222 – Principles of Operating Systems
Syllabus
2nd Semester 2014/2015

Part A – Course Outline

Compulsory course in Computer Science

Catalog description:

(2-2) 3 hours credit. Processes and Threads, 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:

CISB211 Computer Organization

Textbook(s) and other required material:

Operating Systems Internals and Design Principles, William Stallings, Pearson Prentice Hall, Eighth Edition, 2014. ISBN: 9781292061351

References:

- *Operating System Concepts*, 9th Edition, Abraham Silberschatz, Peter B. Galvin, Greg Gagne, John Wiley & Sons (Asia) Pte Ltd, 2014. ISBN: 9781118093757
- *Modern Operating Systems*, 4th Edition, Andrew S. Tanenbaum, Herbert Bos, Pearson Prentice Hall, 2014. ISBN: 978-0133591620

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]
- Understand the implementation issues of the operating system principles. [a, j]
- Analyze the tradeoffs inherent in operating system design. [a]
- Gain hands-on experience by doing programming projects. [j, e]

Topics covered:

- **Computer and Operating System Overview** (4 hours): Basic elements, instruction execution, interrupts, the memory hierarchy, multiprocessor and multicore organization, operating system objectives and functions, the evolution of operating systems, major achievements, developments leading to modern operating systems.
- **Process Control and Processor Scheduling** (2 hours): Concept of process, process states, process description, process control, dispatcher, decision mode, first-come-first-served, round robin, UNIX SVR4 process management.
- **Threads, Multicore and Multithreading** (2 hours): Processes and threads, types of threads, performance of software on multicore, Android process and thread management.
- **Concurrency: Mutual Exclusion and Synchronization** (4 hours): Principles of concurrency, mutual exclusion with hardware support, semaphores, monitors, message passing, readers/writers problem.
- **Concurrency: Deadlock and Starvation** (4 hours): Principles of deadlock, deadlock prevention, deadlock avoidance, deadlock detection, an integrated deadlock strategy, dining philosophers problem.
- **Memory Management** (4 hours): Memory relocation, protection and sharing, logical organization, physical organization, memory partitioning.
- **Virtual memory** (6 hours): Locality and virtual memory, paging, segmentation, combined paging and segmentation, fetch policy, placement policy, replacement policy, resident set management, cleaning policy, and load control, Windows memory management.
- **I/O Management and Disk Scheduling** (1 hour): I/O devices, organization of the I/O function, operating system design issues, I/O buffering, disk scheduling, RAID, disk cache, and Linux I/O.
- **File Management** (1 hour): Overview of files and file systems, file organization and access, file sharing, record blocking, secondary storage management, UNIX file management, Windows file system, Android File Management.

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				
2	1	1	14	56	3	1 / 2 hours

Student study effort required:

Class contact:	
Lecture	28 hours
Tutorial & Lab	28 hours
Other study effort	
Self-study	14 hours
Homework	10 hours
Projects	12 hours
Total student study effort	92 hours

Student assessment:

Final assessment will be determined on the basis of:

Homework	20%
Projects	30%
Midterm Test	20%
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
3	Process Control and Processor Scheduling	Project#1
4	Threads, Multicore and Multithreading	Homework#2
5, 6	Concurrency: Mutual Exclusion and Synchronization	Homework#3
7, 8	Concurrency: Deadlock and Starvation	Midterm Test Project#2
9, 10	Memory Management	
11, 12	Virtual Memory	Homework#4
13	I/O Management and Disk Scheduling, File Management	Homework#5
14	Conclusion	

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 computing and mathematics appropriate to the programme outcomes and to the discipline.
(j) An ability to use current techniques, skills, and tools necessary for computing practice with an understanding of the limitations.

The course secondarily contributes to the Computer Science program outcomes that develop student abilities to:
(e) An ability to function effectively on teams to accomplish a common goal.

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%

Persons who prepared this description:

Dr. Yan Zhuang

_____

Part B General Course Information and Policies

2nd Semester 2014/2015

Instructor:	Dr. Yan Zhuang	Office: E11-4091
Office Hour:	By appointment	Phone: 8822-4464
Email:	syz@umac.mo	

Teaching Assistant: Ting Shu (mb35455@umac.mo)

Time/Venue: Monday: 14:00~15:45, E12-G021 (Lecture)
Tuesday: 09:00~10:45, E6-2093 (Lab)

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.

Student Disabilities Support Service:

The University of Macau is committed to providing an equal opportunity in education to persons with disabilities. If you are a student with a physical, visual, hearing, speech, learning or psychological impairment(s) which substantially limit your learning and/or activities of daily living, you are encouraged to communicate with your instructors about your impairment(s) and the accommodations you need in your studies. You are also encouraged to contact the Student Disability Support Service of the Student Counselling and Development Section (SCD), which provides appropriate resources and accommodations to allow each student with a disability to have an equal opportunity in education, university life activities and services at the University of Macau. To learn more about the service, please contact SCD at scd.disability@umac.mo, or 8397 4901 or visit the following website: http://www.umac.mo/sao/scd/sds/aboutus/en/scd_mission.php