University of Macau
Faculty of Science and Technology
Department of Computer and Information Science
CISB350 – Advanced Operating Systems
Syllabus
1st Semester 2015/2016

Part A – Course Outline

Elective course in Computer Science

Catalog description:
(2-2) 3 credits. Uniprocessor Scheduling, Multiprocessor and Real-Time Scheduling, Embedded Systems, Security, Distributed Operating Systems, Distributed Process Management, Distributed File Systems, and other topics. It is an advanced level undergraduate course that covers further topics in the study of the design principles and implementation issues of contemporary computer operating systems.

Course type:
Theoretical with substantial laboratory/practice content

Prerequisites:
CISB222 Principles of Operating Systems

Textbook(s) and other required material:
Operating Systems Internals and Design Principles, William Stallings, Pearson Prentice Hall, Eighth Edition, 2015. ISBN: 9780133805918

References:
- *Distributed Systems: Concepts and Design, 5/E*, George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, Pearson Higher Education, Jul 2011, ISBN-10: 0273760599.
- Related research papers.

Major prerequisites by topic:
- Basic principles of operating systems.
- Knowledge of UNIX and C/Java programming.

Course objectives:
- Continued study of advanced topics in operating system design and implementation. [a, c]
- Study system issues in distributed systems. [a, b, i]
- Exposed to recent developments in operating systems research. [a, b]

Topics covered:
- **Uniprocessor Scheduling (3 hours)**: Types of scheduling, scheduling criteria, scheduling algorithms, and traditional UNIX scheduling.
- **Multiprocessor Multicore Scheduling (2 hours)**: Granularity, design issues, process scheduling, thread scheduling, and multicore thread scheduling.
- **Real-Time Scheduling (2 hours)**: Characteristics of real-time operating systems, real-time scheduling, deadline scheduling, rate monotonic scheduling, priority inversion, Linux scheduling, Unix SVR4 scheduling, and Windows scheduling.
- **Embedded Operating Systems and Virtual Machines (4 hours)**: Characteristics of embedded operating systems, approaches to virtualization, and example systems.
- **Operating System Security (3 hours)**: Intruders, malicious software, buffer overflow; access control, operating systems hardening, and security maintenance.
- **Distributed Systems Overview (2 hours)**: Characteristics, trends and challenges, system models, and operating system support.

- **Distributed Processing, Client/Server, Peer-to-Peer, and Clusters (4 hours)**: Client/Server computing, peer-to-peer computing, middleware, distributed message passing, remote procedure calls, and clusters.
- **Distributed Process Management (4 hours)**: Process migration, distribute global states, distributed snapshot algorithm, distributed mutual exclusion concepts, ordering events in a distributed system, distributed queue, a token-passing approach, distributed deadlock in resource allocation and message communication.
- **Distribute File Systems (4 hours)**: Design issues, NFS, AFS, and GFS.

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	**2**	**0**	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
Paper Reading	14 hours
Project	6 hours
Total student study effort	90 hours

Student assessment:

Final assessment will be determined on the basis of:

Paper Reading and Summaries	30%
Research Project	10%
Class Presentation and Participation	10%
Midterm Test	20%
Final Exam	30%

Course assessment:

The assessment of course objectives will be determined on the basis of:
Paper reading, presentation, project, test and exam

Course outline:

Weeks	Topic	Course work
1, 2	Introduction, Uniprocessor Scheduling	Project
3, 4	Multiprocessor, Multicore, Real-Time Scheduling	Paper Reading Summary #1
5, 6	Embedded Operating Systems, Virtual Machines	Paper Reading Summary #2
7, 8	Operating System Security	Presentation, Midterm Test
9	Distributed Systems Overview	Paper Reading Summary #3
10, 11	Distributed Processing, Client/Server, Peer-to-Peer, and Clusters	Paper Reading Summary #4
11, 12	Distributed Process Management	Paper Reading Summary #5
13, 14	Distributed File Systems, Conclusion	Paper Reading Summary #6

Contribution of course to meet the professional component:

This course presents the advanced topics in 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.
(b) An ability to apply knowledge of a computing specialisation, and domain knowledge appropriate for the computing specialisation to the abstraction and conceptualisation of computing models.
(c) An ability to analyse a problem, and identify and define the computing requirements appropriate to its solution.
(i) Recognition of the need for and an ability to engage in continuing professional development.

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	3								

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

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Part B General Course Information and Policies

1st Semester 2015/2016

Instructor:	Dr. Yan Zhuang	Office: E11-4091
Office Hours:	10:00 ~ 11:00, Tuesday, Thursday	Phone: 8822-4464
Email:	syz@umac.mo	

Teaching Assistant: Yan Liu
mb45445@umac.mo

Time/Venue:

Lecture:	11:00 ~ 12:45 Wednesday	E11-1021
Tutorial:	14:00 ~ 15:45 Friday	E3-3045

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 assignments and project. You are encouraged to look at other sources (other texts, papers, etc.) to complement the lectures and text.

Homework and Project Policy:
Reading research papers and doing projects are of vital importance to help the students to master the concepts covered, therefore:

- There will be approximately 6 paper reading assignments, 1 research proposal, and 1 literature survey plus presentation in class.
- Research proposal and class presentation are both group projects of 2-3 students per group.
- No late submission is accepted.

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 class discussion is strongly recommended.
- Check UMMoodle (http://ummoodle.umac.mo) for announcement, homework and lectures.
- 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