QFO-AP-FI-MO02	اسم النوذج: وصف المادة	جامعة فيلادلفيا Philadelphia University
رقم الإصدار: 1 (Revision)	الجهة المصدرة: كلية تكنولوجيا المعلومات	
التاريخ: 2017/11/05	الجهة المدققة: عمادة التطوير والجودة	
عدد صفحات النموذج:		

Course Title: Advanced Operating Systems	**Course code: 750434**
Course Level: Master	**Course prerequisite (s)** : Fundamentals of Operating System (750333)
Lecture Time:	**Credit hours: 3 Hours**

Academic Staff Specifics

Name	Rank	Office Number and Location	Office Hours	E-mail Address

Course /module description:
This course covers major topics related to distributed operating systems: Synchronization/Communication, Distributed shared memory, Distributed concurrent transactions, Distributed file systems, Naming, Kernels, Resource Management.

Course/ module objectives:
This course aims to

- Provide students with a deep understanding of Distributed Operating Systems
- Expose students to current Distributed Operating System research through interactive lectures and selected research papers.

Books (title , author (s), publisher, year of publication)

- S. Tanenbaum, M. V. Steen, Distributed Systems: Principles and Paradigms, Pearson Education, 2002
- G. Coulouris, J. Dollimore, T. Kindberg, G. Blair, Distributed Systems: Concepts and Design. Addisson Wesley, 5th Edition, 2012.

Support material (s): Slides, Books; .Research papers
http://www.cs.rutgers.edu/~pxk/rutgers/notes/

Teaching methods:
16 weeks, totalizing 48 hours

- (interactive) Lectures: 48 hours

Learning Outcomes

A- Knowledge and Understanding

A1- Be familiar with a set of selected topics in Distributed Operating Systems

B- Intellectual skills (thinking and analysis).

B1- Read and critique DOS research papers

B2- Summarize and lead a discussion of DOS research papers

B3- Conduct and implement a mini-project related to one or more aspects exposed and studied in the course.

C- Practical skills:

C1- Be able to practice and use libraries, middleware and software tools related to DOS under UNIX environment.

D- Transferable Skills

D1- Work and communicate effectively as a team member.

D2- Prepare and present seminars of the research work to a professional standard.

D3- Understand ethical issues related to writing research work.

D5- Perform independent and efficient time-management.

Learning outcomes achievement:

- **Development:** A1 and B2 are developed through the lectures and laboratory sessions.
  B1, B3, and C1 are developed trough Tutorials and Lab sessions, D1, D2, D3, and D5 are developed through Homework, assignment, and seminars.

- **Assessment**: A1, B1, B2 are assessed by quizzes and examinations; B3, C2, C3, and D1-D6 are assessed by seminar.

Assessment instruments

Allocation of Marks	
Assessment Instruments	**Mark**
First examination	**20%**
Second examination	**20%**
Final Exam (written unseen exam)	**40%**
Reports, research projects, Quizzes, Home works, Projects	**20%**
Total	**100%**

Documentation and Academic Honesty

- **Protection by Copyright**

1. Coursework, laboratory exercises, reports, and essays submitted for assessment must be your own work, unless in the case of group projects a joint effort is expected and is indicated as such.
2. Use of quotations or data from the work of others is entirely acceptable, and is often very valuable provided that the source of the quotation or data is given. Failure to provide a source or put quotation marks around material that is taken from elsewhere gives the appearance that the comments are ostensibly your own. When quoting word-for-word from the work of another person quotation marks or indenting (setting the quotation in from the margin) must be used and the source of the quoted material must be acknowledged.
3. Sources of quotations used should be listed in full in a bibliography at the end of your piece of work.

- **Avoiding Plagiarism**.

1. Unacknowledged direct copying from the work of another person, or the close paraphrasing of somebody else's work, is called plagiarism and is a serious offence, equated with cheating in examinations. This applies to copying both from other students' work and from published sources such as books, reports or journal articles.
2. Paraphrasing, when the original statement is still identifiable and has no acknowledgement, is plagiarism. A close paraphrase of another person's work must have an acknowledgement to the source. It is not acceptable for you to put together unacknowledged passages from the same or from different sources linking these together with a few words or sentences of your own and changing a few words from the original text: this is regarded as over-dependence on other sources, which is a form of plagiarism.

3. Direct quotations from an earlier piece of your own work, if not attributed, suggest that your work is original, when in fact it is not. The direct copying of one's own writings qualifies as plagiarism if the fact that the work has been or is to be presented elsewhere is not acknowledged.
4. Plagiarism is a serious offence and will always result in imposition of a penalty. In deciding upon the penalty the Department will take into account factors such as the year of study, the extent and proportion of the work that has been plagiarized, and the apparent intent of the student. The penalties that can be imposed range from a minimum of a zero mark for the work (without allowing resubmission) through caution to disciplinary measures (such as suspension or expulsion).

Course/module academic calendar

week	Basic and support material to be covered	Homework/reports and their due dates
(1)	**Fundamental concepts** Distributed OS and Algorithms - Fundamental concepts - OS definition in general - DOS definition: - Well-known OS in the world are - The primary functions of an operating system - Software Concepts of Distributed / Parallel system - Evolution of modern operating systems - A spectrum of modern operating systems - Cooperative autonomous system - Centralized operating systems (Resource Manager) // see OS principles - Network operating system - Distributed operating system (DOS)	
(2)	**Fundamental concepts** Functions and Services of DOS - Services of DOS: - Features of DOS: - Concepts of DS - Loosely coupled software - Tightly coupled software - Tightly-coupled Hardware - Loosely coupled Hardware - Major components of Distributed operating systems: - Hardware Concepts of Distributed / Parallel system - Bus - Tightly-coupled Hardware - Loosely coupled Hardware - Switched - Switching in multi-processors - Crossbar switch - Omega switching - Switching in multicomputers - Grids - Hypercube - Design Issues of DOS 1. System service provider 2. User - DS characteristics	

	◦ Efficiency ◦ Flexibility ◦ Consistency ◦ Robustness ◦ Transparency ◦ Reliability	
(3)	**Fundamental concepts** - Different forms of transparency in a distributed system. - Advantages of distributed systems over centralized systems. - Advantages of distributed systems over isolated (personal) computers - Disadvantages of distributed systems - Distributed control algorithms? - Comparison between NOS and DOS	Announcement and Selection of students' assignments
(4)	**Processes in DOS** - Concurrent processes and programming - Processes and Threads - Traditional process - Thread (light weight process) - Purpose of using Threads. - Primitives of a typical thread package: - Implementing a Threads Package - In the user space - In the kernel space. - Treads Control flow - Threads packages	
(5)	**Processes in DOS** - Levels of concurrency - Thread runtime library -Implementing Threads in User Space • Advantages: • Disadvantages - Implementing Threads in the kernel space - Lightweight Process LWP - Mapping threads to LWPs - Unbound Threads: - Bound Threads: - Heavyweight Process HWP & Lightweight Process LWP difference. - Organization of threads: - One to many relation by using dispatcher thread. - One to one for concurrent/parallel system - One to one for pipelining system (sequentially) - A Thread Library - Main functions of Thread Library: - Thread-local storage	

(6)	**Processor allocation** - System performance of different system architecture in DS - Queuing systems. - The mean response time RT and the mean turnaround time TT. 1- Using isolated workstations (M/M/1): 2- Using processor pool model (multiprocessors system) M/M/n 3- A Hybrid Model - Speedup performance measures - PROCESSOR ALLOCATION - Allocation Models - Processor allocation strategies can be divided into two broad classes. - No nmigratory allocation - Migratory allocation - Design Issues for Processor Allocation Algorithms based on Process migration algorithms 1- Deterministic vs. heuristic 2- Centralized, hierarchical, or distributed 3- Optimal vs. suboptimal 4- Local or global 5- Location policy **First examination**	
(7)	**Processor allocation** Implementation of Processor Allocation Algorithms o Centralized algorithm 1 o Centralized algorithm 2 (up-down algorithm) o Hierarchical algorithm : o Distributed algorithm 1 o Distributed algorithm 2 o Theoretic Deterministic Algorithm o A Bidding Algorithm (Optimal vs. suboptimal) Bokhari's Algorithm (Optimal vs. suboptimal	
(8)	**Processor allocation** - Scheduling In Distributed Systems - Allocation of Parallel Applications: - Assessing Schedulers 1– schedule length. 2–time taken by the scheduler to generate a schedule. - Scheduling Characteristics - Tasks/threads Allocation Criteria - Clustering Algorithms - Overcome Problem of Scheduling in DOS • Backfilling optimization Scheduling • Conservative Backfilling • Aggressive EASY (Extensible Argonne Scheduling sYstem) • Gang scheduling	

	- Policies for Scheduling a) The Adaptive First Come First Serve (AFCFS) method. b) The Largest Gang First Served (LJFS) method. c) Shortest Time First (STF) method.	
(9)	**Processor allocation** - Performance metrics - The Average Response Time (ART) - Average Weighted Response Time - The Average Waiting Time (AWT) - Average Weighted Waiting Time (AWWT) - Average weighted slowdown WSLD	Students show the progress of their assignments
(10)	**Synchronization in Distributed Systems** - Clock Synchronization - When Clock synchronization has been used? - The aim of synchronization is: - Properties Distributed algorithms: - Logical Clocks - Extra information of Logical clocks - Lamport's Algorithm - Using Vector Logical time - Physical Clock Synchronization Algorithms - Cristian's Algorithm uniform clock adjustment) - Berkeley algorithm (non uniform clock adjustment)	
(11)	**Synchronization in Distributed Systems** Distributed coordination : – Distributed Mutual Exclusion – Leader Election - Distributed Mutual exclusion - A Centralized Algorithm -Advantage of Centralized Algorithm - Disadvantage of Centralized Algorithm - A Distribute Algorithm - Ricart and Agrawala's algorithm - A Token Ring Algorithm - A Comparison of the mutual exclusion Algorithms -Election Algorithms - The Bully Algorithm (ELECTION ALGORITHMS)	

	- A Ring Algorithm (ELECTION ALGORITHMS) - Modified Ring Algorithm	
(12)	**Synchronization in Distributed Systems** -Deadlock in distributed system - Definition: - Strategies of deadlocks in DS Detection and recovery Prevention Avoidance - Deadlock detection and recovery algorithms - Centralized (Deadlock Detection) - Chandy-Misra-Haas algorithm (Deadlock Detection): -Deadlock Prevention algorithms - Wait-die Algorithm Deadlock Prevention: - Wound-wait Algorithm Deadlock Prevention: - Deadlock avoidance algorithm - Process Migration: -Negotiation process migration - Transfer process	
(13)	**Synchronization in Distributed Systems** Message passing synchronization - Asynchronous message passing: - Synchronous message passing: - Message passing communication - Basic communication primitives: • send(destination, message) • receive(source, message)	
(14)	**Shared Memory in DOS**	Deadline for assignments submission
(15)	**Seminars for discussion students' assinments**	
(16)	**Final Exam**	

Expected workload:

.Books and research papers readings are expected. On average students need to spend at least 3 hours of study and preparation for each advanced topic

Attendance policy:

Absence from lectures and/or tutorials shall not exceed 15%. Students who exceed the 15% limit without a medical or emergency excuse acceptable to and approved by the Dean of the relevant college/faculty shall not be allowed to take the final examination and shall receive a mark of zero for the course. If the excuse is approved by the Dean, the student shall be considered to have withdrawn from the course.

Module References

Research papers references are listed at the end of the course textbooks (see Reading lists and Bibliography part of the textbooks).)

Module References

Lecture Notes:

Clifford Neuman, Advanced Operating System Lecture Notes, 2012

Books:

- Andrew S. Tanenbaum, Maarteen Van Steen; Distributed Systems- Principles and Paradigms, Pearson Hall, 2002
- Andrew S. Tanenbaum, Distributed Operating Systems, 1995
- Jean Bacon, Concurrent Systems, Addison – Wesley, 1998
- William Stallings, Operating Systems, Prentice Hall, 1995

Website:

- www.cdk5.net