



Course Number	0907731
Course Title	Advanced Computer Architecture
Credit Hours	3
Course Description	Review of computer design principles, processor design, RISC processors, pipelining, and memory hierarchy. Instruction level parallelism (ILP), dynamic scheduling, multiple issue, speculative execution, and branch prediction. Limits on ILP and software approaches to exploit more ILP. VLIW and EPIC approaches. Thread-level parallelism, multiprocessors, chip multiprocessors, and multi-threading. Cache coherence and memory consistency. Advanced memory hierarchy design, cache and memory optimizations, and memory technologies. Advanced topics in storage systems. Designing and evaluating I/O systems.
Prerequisites by Course	None
Prerequisites by Topic	Students are assumed to have a background in the following topics: <ul style="list-style-type: none">• Digital Logic Design• Computer Organization• RISC Instruction Set Architectures, preferably MIPS
Textbook	Hennessy and Patterson. Computer Architecture: A Quantitative Approach, 5th ed., Morgan Kaufmann, 2012.
References	<ul style="list-style-type: none">• Patterson and Hennessy. Computer Organization & Design: The Hardware/Software Interface, 5th ed., Morgan Kaufmann, 2014.• J. P. Shen and M. H. Lipasti. Modern Processor Design: Fundamentals of Superscalar Processors, Mc Graw Hill, 2005• D. Culler and J.P. Singh with A. Gupta. Parallel Computer Architecture: A Hardware/Software Approach, Morgan Kaufmann, 1998.• J. Hayes. Computer Architecture and Organization, 3rd ed., McGraw-Hill, 1998.• Readings in Computer Architecture, Mark Hill (Editor), Norman Jouppi (Editor), Gurindar Sohi (Editor), Morgan Kaufmann Publishing Co., Menlo Park, CA. 1999.
Schedule & Duration	15 weeks, 30 contact sessions (75 minutes each) including exams.
Minimum Student Material	Textbook, References, Class Handouts, PC, the Internet, and Course Homepages at http://www.abandah.com/gheith/?page_id=1289
Minimum College Facilities	A classroom with whiteboard and projection facilities, library, and computer laboratory.
Course Objectives	The purpose of this course is to introduce advanced computer architecture topics to the graduate student. It is designed to achieve the following objectives: <ul style="list-style-type: none">• Provide awareness about current trends in computer architecture research• Introduce advanced processor design approaches• Introduce advance memory hierarchy design approaches• Introduce various techniques used to exploit parallelism in various levels

Course Learning Outcomes and Relation to Program Learning Outcomes

Upon successful completion of this course, a student should:

1. Research current solutions for a problem in computer architecture and report and present the results of this research. [iii,iv]
2. Ability to evaluate performance of alternative processor, memory, and system designs. [ii]
3. Demonstrate a sound, in-depth, and up-to-date technical knowledge of memory hierarchy designs [i]

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| 4. Demonstrate a sound, in-depth, and up-to-date technical knowledge of processor designs | [i] |
| 5. Demonstrate a sound, in-depth, and up-to-date technical knowledge of computer system designs | [i] |

Course Topics

	Topic	Hrs
1.	Introduction	3
2.	Memory Hierarchy Design	9
3.	Instruction-Level Parallelism and Its Exploitation	15
4.	Data-Level Parallelism	9
5.	Thread-Level Parallelism	6
6.	Warehouse-Scale Computers	3

Important Dates

Date	Event
Sun 17 Sep, 2017	Classes Begin
Tue 7 Nov, 2017	Midterm Exam
Tue 14 Nov, 2017	Term project proposal is due
Sun 24 Dec, 2017	Term project report is due and start of project demonstrations
Tue 26 Dec, 2017	Last Lecture
Jan 2 – 10, 2018	Final Exam Period

Ground Rules

- Attendance is required
- All submitted work must be yours
- Cheating will not be tolerated
- Open-book exams
- Join the Facebook group at <https://www.facebook.com/groups/1439049336332310/>
- Check program announcements at the Facebook group at <https://www.facebook.com/Master-in-Computer-Engineering-and-Networks-in-the-University-of-Jordan-257067841079897/>

Assessments

Exams, Projects, Reports, and Presentations

Grading Policy

Term Project's Report and Presentation	30%
Midterm Exam	30%
Final Exam	40%
Total	100%

Instructors

Prof. Gheith Abandah, abandah@ju.edu.jo
Homepage: <http://www.abandah.com/gheith>
Office Hours: Sun & Tue: 11:00 – 12:00
 Mon & Wed: 10:00 – 11:00

Class Time and Location

Section 1: Sun and Tue: 16:00–17:30, CPE 001

Program Learning Outcomes

- i** Demonstrate a sound, in-depth and up-to-date technical knowledge in the field of specialization.
- ii** Ability to identify and solve engineering problems in their chosen field of study.
- iii** Acquire the skills for continued professional development and independent self-study.
- iv** Demonstrate the ability to communicate technical information effectively and professionally both orally and in writing.

Last Updated

Sep 16, 2017