Mansoura University

Faculty of Computers and Information Sciences

Course Specifications of

Computer Organization and Architecture – CS212P

University: Mansoura University **Faculty**: Computer and Information Sciences

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Program on which the course is given: General

Department offering the course: Department of **Computer Science**

Academic year/ Level: Second Year

Date of specification approval:

A- Basic Information

Title : Computer Organization and Architecture **Code :** CS212P
Credit Hours : 3 **Lecture :** 2 **Tutorial :** --- **Practical :** 2

B- Professional Information

1- Overall Aims of the Course

This course is designed for a one semester course in computer Architecture and Organization. Upon completing this course, the student should understand the concepts and standards of computer architecture and organization. This course explores modern computer architectures. It shows the difference between Instruction Set Architecture and Microcode. It covers instruction pipelining, instruction-level parallelism (ILP), alternative architectures such as VLIW, cache coherence, branch prediction and contemporary architectures such as hand-held devices and embedded systems.

2- Intended Learning Outcomes of the course (ILOs)

By completing this course successfully, the student will be able to:

a- Knowledge and Understanding

The student should acquire the knowledge and understanding of:

a1 Essential facts, concepts, principles and theories relating to computing and information and computer applications as appropriate to the program of study.

a3 Tools, practices and methodologies used in the specification, design, implementation and evaluation of computer software systems.

a5 Essential facts, concepts, principles and theories relating to computing and information and computer applications as appropriate to the program of study.

a6 The current and underlying technologies that support computer processing and inter-computer communication.

a7 Principals of generating tests which investigate the functionality of computer programs and computer systems and evaluating their results. a10 Current developments in computing and information research. a11 Requirements, practical constraints and computer-based systems. a13 Use high-level programming languages compared to low-level languages

a17 Show a critical understanding of the principles of artificial intelligence, image, and pattern recognition.

a18 Understand the fundamental topics in Computer Science, including hardware and software architectures, software engineering principles and methodologies, operating systems, compilers, parallel and distributed computing, systems and software tools.

a19 Select advanced topics to provide a deeper understanding of some aspects of the subject, such as hardware systems design, object-oriented analysis and design, and artificial intelligence, and parallel and concurrent computing.

b- Intellectual Skills

The student should be able to:

b1 Analyze computing problems and provide solutions related to the design and construction of computing systems.

b2 Realize the concepts, principles, theories and practices behind computing and information as an academic discipline.

b3 Identify criteria to measure and interpret the appropriateness of a computer system for its current deployment and future evolution.

b4 Analyze, propose and evaluate alternative computer systems and processes taking into account limitations, and quality constraints.

b7 Achieve judgments considering balanced costs, benefits, safety, quality, reliability, and environmental impact.

b8 Familiar with the professional, legal, moral and ethical issues relevant to the computing industry. b12 Perform classifications of (data, results, methods, techniques, algorithms..etc.).

c- Professional and Practical Skills The student should be able to:

c1 Operate computing equipment, recognizing its logical and physical properties, capabilities and limitations.

c4 Apply computing information retrieval skills in computing community environment and industry. c6 Design, implement, maintain, and manage software systems..

d- General and Transferable Skills

The student should be able to:

d1 Demonstrate the ability to make use of a range of learning resources and to manage one's own learning. d2 Demonstrate skills in group working, team management, time management and organizational skills..

3- Contents

No	Course Content	Lecture	Practical	Total
1	Introduction, Architecture vs. Organization	**1**	**---**	**2**

2	1.1 Logic Gates 1.1.1 Elementary Gates 1.1.1.1 Negation 1.1.1.2 Conjunction (In-Series) 1.1.1.3 Disjunction (In- parallel) 1.1.2 Universal Gates 1.1.2.1 NAND (Sheffer stroke) 1.1.2.2 NOR (Peirce arrow) 1.2 Logic Circuits 1.2.1 Logic expressions 1.2.2 Circuit Example 1.2.3 Sum-of-Product (SoP) 1.2.3.1 Programmable Logic Array (PLA) 1.2.4 Minimization and Simplification 1.3 Sequential circuits 1.3.1 LATCH 1.3.2 Flip-Flops 1.3.2.1 SR Flip–Flop 1.3.2.2 JK Flip–Flop 1.3.2.3 D Flip–Flop 1.3.2.4 T Flip–Flop 1.3.3 Counters 1.3.4 Registers 1.3.4.1 Viewing a Register	**1**	**---**	**2**

No	Course Content	Lecture	Practical	Total
	1.3.4.2Register transfer notation (RTN) 1.4Physical considerations (Gate Delay, Fan-in/out)			
3	2.1 Bits, bytes, and words 2.2 numeric data representation & bases 2.3 fixed- and floating-point systems 2.4 signed & 2s-complement representations 2.5 representation of nonnumeric data 2.5.1 Character codes 2.5.2 Graphical data 2.6 representation of records and arrays	**1**	**---**	**2**

4	3.1 History of computing devices 3.2 Theoretical Computer Science 3.2.1 Unlimited Register Machine 3.2.2 Turing machine 3.2.3 Recursive and Universal Functions 3.3 Organization of von Neumann machine 3.3.1 Control unit 3.3.1.1 Hardwired realization 3.3.1.2 Micro-programmed realization 3.3.2 Instruction Cycle(fetch, decode, execute) 3.3.3 Instruction sets and types 3.3.3.1 Data manipulation instructions 3.3.3.2 Control instructions 3.3.3.3 I/O instructions 3.3.4 von Neumann Arch. Simulator 3.4 Assembly language programming 3.4.1 Cousins of Assembly 3.4.2 Instruction formats 3.4.3 Addressing modes 3.4.4 Subroutine call and return 3.4.5 I/O and interrupts	**3**	**---**	**6**
5	4.1 Storage systems and their technology 4.1.1 Memory hierarchy 4.2 Coding 4.3 Data Compression 4.4 Data integrity 4.5 main memory organization and operations 4.5.1 Latency 4.5.2 Cycle time	**3**	**---**	**6**

No	**Course Content**	**Lecture**	**Practical**	**Total**

	4.5.3 Bandwidth 4.5.4 Interleaving 4.6 cache memories 4.6.1 Address mapping 4.6.2 Block size 4.6.3 Replacement 4.6.4 Store policy 4.7 virtual memory 4.7.1 Page table 4.7.2 TLB 4.8 fault handling and reliability			
6	5.1 I/O fundamentals 5.1.1 Handshaking 5.1.2 Buffering 5.1.3 Programmed I/O 5.1.4 interrupt-driven I/O 5.2 Interrupt structures 5. 2.1vectored and prioritized 5.2.2 Interrupt acknowledgment 5.3 external storage 5.4 physical organization, and drives 5.5 Buses 5.5.1 Bus protocols 5.5.2 Arbitration 5.5.3 direct-memory access (DMA) 5.6 Introduction to networks 5.7 multimedia support 5.8 RAID architectures	**2**	---	**4**
7	6.1 Functional organization overview 6.2 Implementation of simple data paths 6.3 instruction pipelining 6.4 instruction-level parallelism (ILP)	**2**	---	**4**
8	7.1 Flynn's Taxonomy 7.1.1 SIMD 7.1.2 MIMD 7.2 VLIW, EPIC 7.3 systolic architecture 7.4 interconnection networks 7.5shared memory systems?	**2**	---	**4**

No	Course Content	Lecture	Practical	Total
	7.6 cache coherence 7.7 memory models and memory consistency			
9	8.1 RISC vs. CISC architecture 8.2 On Data structures 8.3 branch prediction 8.4 pre-fetching 8.5 scalability	**1**	**---**	**2**
10	9.1 Hand-held devices 9.2 Embedded systems 9.3 Trends in processor architecture 9.3.1 Intel 9.3.2 Memristor 9.4 Trends in theoretical Computing 9.4.1 Quantum computing 9.4.2 DNA Computing	**1**	**---**	**2**
11	Assembly programming (Lab sessions)	**---**	**10**	**36**
	Total Hours			**46**

4- Assessment Schedule

Assessment Method	No.	Description	Week No.	Weight (%)
Assignment	1	Report	4	5
Written Exams	2	Midterm Exam	7	5
Lab exam	3	Task evaluation	11	20
Oral Exam	4	Oral questions	11	10
Written Exams	5	Final Exam	14	60
Total				100

5- List of references 5.1 Course Notes

- Lecture handouts delivered to students at the end of each lecture.
- Materials are available at http://m.el-dosuky.com/course.php?c=computer-architecture-andorganization

5.2 Essential Books (Text Books)

- Computer Organization and Architecture, by William Stallings, 9th Edition, Pearson 2012
- The Essentials of Computer Organization and Architecture, by Linda Null and Julia Lobur, Publisher: Jones & Bartlett Learning, Fourth Edition 2014

- Digital Design : Principle`s & Practices , byJohnf , Wakerly-Principle`s – 2001
- AdvancedComputer Architecture, 10th Annual Conference, ACA 2014Shenyang, China, August 23–24, 2014Proceedings, Springer
- Intel64.BasicArchitecture
- Assembly Language for x86 Processors 6e , by KIP R. IRVINE, Prentice Hall 2011

6- Facilities Required for Teaching and Learning -

Data show.

Course Content/ILO Matrix

Course Content	a1	a3	a5	a6	a7	a10	a11	a13	a18	a19	b1	b2	b3	b4	b7	b8	b12	c1	c4	c6	d1	d2
Introduction	•			•		•		•		•		•	•									
Digital logic	•	•	•	•	•	•	•	•	•		•	•	•	•								
Data representation	•		•	•								•	•								•	
Assembly level organization	•	•	•	•		•		•	•	•		•	•		•		•	•	•	•		•
Memory systems	•	•	•	•		•		•	•	•		•	•		•		•	•				
Interfacing and communication	•	•	•		•					•	•	•		•		•						
Functional organization	•	•	•		•					•	•	•		•		•						
Multiprocessor and alternative architectures		•		•	•				•	•	•	•	•	•	•	•	•	•			•	
Performance enhancements				•	•	•		•	•		•		•	•	•			•	•	•		
Contemporary architectures			•		•					•	•	•		•		•						

Learning Method/ILO Matrix

Course Content	a1	a3	a5	a6	a7	a10	a11	a13	a18	a19	b1	b2	b3	b4	b7	b8	b12	c1	c4	c6	d1	d2
Lectures	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Practical			•	•				•	•					•	•	•	•	•			•	•

Assessment Methods/ILO Matrix

Course Content	a1	a3	a5	a6	a7	a10	a11	a13	a18	a19	b1	b2	b3	b4	b7	b8	b12	c1	c4	c6	d1	d2
Assignment			•	•				•	•					•	•	•	•	•			•	•
Midterm	•	•	•	•		•	•		•	•	•	•	•					•		•	•	
Oral Exam		•		•		•	•	•	•					•	•	•	•	•				
Lab Exam				•			•				•					•	•	•	•	•	•	
Final Exam	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•		•

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