**COURSE SPECIFICATION**

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| This course covers the current the advancement in computer architecture including the internal organization of processors , multi-core CPU’s architecture, many-core GPU’s architecture, and the memory hierarchy . The learning outcomes that a typical student might reasonably be expected to achieve are based on the three tenets that all computer architects and designers are believed on, namely: parallelism, pipelining and the principle of locality. In doing so, the student takes full advantage of the learning opportunities to participate and contribute to modern research and development that reflects the state-of-the-art as well as the art-of-the-practice in modern computer design and computing in both hardware and software domain. |

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| University of Baghdad  Instructor Dr. Asmaa Hameed | 1. Teaching Institution |
| College of Engineering/Department of Electrical Engineering | 2. University Department/Centre |
| Microprocessor and computer architecture | 3. Course title/code |
| BSc in Electrical Engineering | 4. Programme(s) to which it contributes |
| Participate in the classroom | 5. Modes of Attendance offered |
| Year for BSc | 6. Semester/Year |
| 60 hours | 7. Number of hours tuition (total) |
| 10-3-2017 | 8. Date of production/revision of this specification |
| 9. Aims of the Course | |
| Explore the advancement in computer architecture and makes the student ready to design and facilitate the current trends in computer architecture. This involve: | |
| How to determine the performance of computer in both theoretical and practical manner. | |
| Understanding the Moore’s law and its impact on computer engineering. | |
| Understanding the pipelining principle for both static and dynamic pipeline and three hazards encounter in pipeline, namely: Structural hazards, Data hazards, and branch hazards. In addition, the current trends to solve these hazards. Furthermore, how to deal with Interrupt and Exception behavior from the computer architects point of view. | |
| Understanding compiler optimization ,loop unrolling, branch prediction. | |
| Understanding the Advanced Pipelining, involve: super scalar , VLIW, and software pipelining | |
| Understanding ILP, TLP, DLP | |
| Going from unicore to multicore and many core architecture, and discuss the principle of “lazy boy era is finished”. This involve: implicit and explicit threading and processing, fine-grained, coarse grained, and SMT multithreading from hardware point of view and leads to concrete understanding and imagination of the sole of this subject. | |
| Understanding the memory Hierarchy design and Organization, how the cache memory work and the 4C’s principle in Cache memory. | |

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| 10· Learning Outcomes, Teaching ,Learning and Assessment Method |
| 1. Knowledge and Understanding   A1. Importance of the topics in computer architecture  A2. An ability to read advanced topics in computer engineering.  A3. A solid understanding of Computer Architecture  A4. How to apply Engineering analysis (time, cost, performance) in Computer design.  A5. How to apply theoretical aspects in practical products in both hardware and software design and implementation.  A6 . An appreciation of the importance of proof, generalization and abstraction in the logical development of formal theories |
| B. Subject-specific skills  B1. Ability to read and participate to improve the course by providing extra resources, examples, idea.  B2. Ability to improve the learning stepping curve.  B3. Ability of imagination.  B4. Ability to write. |
| Teaching and Learning Methods |
| Attract the student to the topics  Guided Discovery  Power Point Lecturing that summarizes the full text, in addition, a full text also available.  Assignment  Seminars  Playing some Videos to stress and improve the student capability  Do some practical examples that integrate the computer engineering subjects by arranging with Operating System Libratory using Java programming language.  Group Discussion |
| Assessment methods |
| Motivation  Quizzes  Test  Home work  Peer assessment  Oral assessment  Extra examples |
| C. Thinking Skills  C1. Analyzing.  C2. Imagination.  C3. Logical and physical thought of the topics.  C4. Problem solving , by performing a dynamic interaction between static blocks to solve a problem in a solid way. i.e., apply the learning outcomes and subject-specific skills to solve practical design problems.  C5. Ability to work within a team.  C6. Independency at the end of course. |
| Teaching and Learning Methods |
| Guided Discovery  Assignment  Seminars  Group Discussion  Do a group based mini project by arranging with Operating System Libratory. |
| Assessment methods |
| Quizzes  Test  Home work  Peer report  Group report  Mini-project assignment  Oral Discussion  Practical examples  Independent research. |

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| D. General and Transferable Skills (other skills relevant to employability and personal development)  D1. Independency.  D2. Problem Solving.  D3. Brain Storming  D4. Contribute to any fields as far as :system architectural design, detailed design, implementation, integration, and testing are concerned. |

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| **11. Course Structure** | | | | | |
| **Assessment Method** | **Teaching**  **Method** | **Unit/Module or Topic Title** | **ILOs** | **Hours** | **Week** |
| Motivation  Quizzes  Test  Home work  Peer assessment  Oral assessment  Discussion on Extra examples | Attract the student to the topics  Guided Discovery  Power Point Lecturing that summarizes the full text, in addition, a full text also available.  Assignment  Seminars  Playing some Videos to stress and improve the student capability  Do some practical examples that integrate the computer engineering subjects by arranging with Operating System Libratory using Java programming language.  Group Discussion | **New Trends in Computer Architecture and CPU's Performance Equations** | **A1**  **A2**  **A3**  **A4**  **B1**  **B2**  **B3**  **C1**  **C2**  **C3** | **12** | **1-6** |
| Motivation  Quizzes  Test  Home work  Peer assessment  Oral assessment  Discussion on Extra examples | Attract the student to the topics  Guided Discovery  Power Point Lecturing that summarizes the full text, in addition, a full text also available.  Assignment  Seminars  Playing some Videos to stress and improve the student capability  Do some practical examples that integrate the computer engineering subjects by arranging with Operating System Libratory using Java programming language.  Group Discussion | **Static and Dynamic Pipelining** | **A1**  **A2**  **A3**  **A4**  **B1**  **B2**  **B3**  **C1**  **C2**  **C3** | **12** | **7-12** |
| Motivation  Quizzes  Test  Home work  Peer assessment  Oral assessment  Discussion on Extra examples | Attract the student to the topics  Guided Discovery  Power Point Lecturing that summarizes the full text, in addition, a full text also available.  Assignment  Seminars  Playing some Videos to stress and improve the student capability  Do some practical examples that integrate the computer engineering subjects by arranging with Operating System Libratory using Java programming language.  Group Discussion | **Superscalar** | **A1**  **A2**  **A3**  **A4**  **B1**  **B2**  **B3**  **C1**  **C2**  **C3** | **16** | **13-20** |
| Motivation  Quizzes  Test  Home work  Peer assessment  Oral assessment  Discussion on Extra examples | Attract the student to the topics  Guided Discovery  Power Point Lecturing that summarizes the full text, in addition, a full text also available.  Assignment  Seminars  Playing some Videos to stress and improve the student capability  Do some practical examples that integrate the computer engineering subjects by arranging with Operating System Libratory using Java programming language.  Group Discussion | **Branch prediction** | **A1**  **A2**  **A3**  **A4**  **B1**  **B2**  **B3**  **C1**  **C2**  **C3** | **8** | **21-24** |
| Motivation  Quizzes  Test  Home work  Peer assessment  Oral assessment  Discussion on Extra examples | Attract the student to the topics  Guided Discovery  Power Point Lecturing that summarizes the full text, in addition, a full text also available.  Assignment  Seminars  Playing some Videos to stress and improve the student capability  Do some practical examples that integrate the computer engineering subjects by arranging with Operating System Libratory using Java programming language.  Group Discussion | **Memory Hierarchy** | **A1**  **A2**  **A3**  **A4**  **B1**  **B2**  **B3**  **C1**  **C2**  **C3** | **8** | **25-28** |
| Motivation  Quizzes  Test  Home work  Peer assessment  Oral assessment  Discussion on Extra examples | Attract the student to the topics  Guided Discovery  Power Point Lecturing that summarizes the full text, in addition, a full text also available.  Assignment  Seminars  Playing some Videos to stress and improve the student capability  Do some practical examples that integrate the computer engineering subjects by arranging with Operating System Libratory using Java programming language.  Group Discussion | **Overview of Multi-Core, Many-Core Architecture and Parallel Processing** | **A1**  **A2**  **A3**  **A4**  **B1**  **B2**  **B3**  **C1**  **C2**  **C3** | **6** | **29-31** |
| Quizzes  Test  Home work  Peer report  Group report  Mini-project assignment  Oral Discussion  Practical examples  Independent research. | Attract the student to the topics  Guided Discovery  Power Point Lecturing that summarizes the full text, in addition, a full text also available.  Assignment  Seminars  Playing some Videos to stress and improve the student capability  Do some practical examples that integrate the computer engineering subjects by arranging with Operating System Libratory using Java programming language  Group Discussion  Seminars  Do a group based mini project by arranging with Operating System Libratory. | **Review, Seminars, Project Discussion on up-to-date topics in Computer Architecture** | **A1**  **A2**  **A3**  **A4**  **A5**  **A6**  **B1**  **B2**  **B3**  **B4**  **C1**  **C2**  **C3**  **C4**  **C5**  **C6** | **30** | **1-31** |

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| 12. Infrastructure | |
| 1. Computer Architecture a Quantitative Approach , Hennessey & Patterson, (3rd, 4th, & 5th editions), Elsevier, (2003 , 2006, & 2012).  2. Computer Organization and Architecture Design for Performance, William Stalling, 9th edition, Pearson, 2013.  3. Computer Organization and Design: The Hardware/Software Interface Patterson & Hennessey, 4th edition, The Morgan Kaufmann Series in Computer Architecture and Design, 2008.  4. Microprocessor Architecture, Jean-Loup Baer, Cambridge University Press, 2010.  5. Structure Computer Organization, Tanenbaum, 5th edition, Prentice Hall,2006.  6. OpenCL Programming by Example, Banger & Bhattacharyya**,** PACKT, 2013.  7. Modern X86 Assembly Language Programming\_ 32-bit, 64-bit, SSE, and AVX, Kusswurm, APRESS, December 2014.  8. The Java Tutorial, 6th Edition, Gallardo et. al., Addison-Wesley Professional, December 2014. | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER |
| DataShow.  Internet.  NetBeans IDE in the Lab.  A Good Sounding system in the Lecture Hall.  E-Learning Platform.  SmartBoard. | Special requirements (include for example workshops, periodicals, IT software, websites) |
| 1. Guest Lecturer, currently we did it via some videos due to security situation of our country.  2. Consultant with experts to construct a laboratory.  3. Try to participate an advanced work shop  4. Try to make a scientific visit for both instructors and students to manufacturing companies (e.g., Intel, AMD, Nvidia, etc) via internship.  5. Update the material based on some new books (published in 2015). | Community-based facilities  (include for example, guest  Lectures , internship , field studies) |

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| 13. Admissions | |
| Computer Architecture I, Micro Processor I, Data Structure, Computer maintenance, Computer Programming, Digital System Design, Logic | Pre-requisites |
| 60 | Minimum number of students |
| 80 | Maximum number of students |