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07-16K.			AP-10/30/07	App-12/4/07

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

Contact Person **Waleed Farag**	Email Address **farag@iup.edu**
Proposing Department/Unit **COMPUTER SCIENCE**	Phone **7-7995**

Check all appropriate lines and complete information as requested. Use a separate cover sheet for each course proposal and for each program proposal.

1. Course Proposals (check all that apply)

_____New Course _____Course Prefix Change _____Course Deletion

__X__Course Revision __X__Course Number and/or Title Change __X__Catalog Description Change

***Current* Course prefix, number and full title**	***Proposed* course prefix, number and full title, if changing**
COSC 410 Processor Architecture and Microprogramming	**COSC 410 Computer Architecture**

2. Additional Course Designations: check if appropriate

_____ This course is also proposed as a Liberal Studies Course.

_____ This course is also proposed as an Honors College Course.

_____ Other: (e.g., Women's Studies, Pan-African)

3. Program Proposals

_____Catalog Description Change _____Program Revision

_____New Degree Program _____Program Title Change _____Other

_____New Minor Program _____New Track

***Current* program name**	***Proposed* program name, if changing**

4. Approvals		**Date**
Department Curriculum Committee Chair(s)		5 Dec 06
Department Chair(s)	Wm. Ogilvie	12/7/06
College Curriculum Committee Chair		05/17/07
College Dean	Gerard Buccat	9/24/07
Director of Liberal Studies *		
Director of Honors College *		
Provost *		
Additional signatures as appropriate: (include title)		
UWUCC Co-Chairs	Gail S Eichhorst	10/30/07

* where applicable

Received NOV 06 2007 Liberal Studies

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Part-II Description of the Curriculum Change

1. New Syllabus of Record

I. Catalog Description

COSC 410 Computer Architecture 3c-01-3cr

Pre-requisites: COSC 300 and 310

Introduces the underlying working principles of electronic computers. The organization and architecture of computer components are discussed. The course expounds on details of memory hierarchy, I/O organization, computer arithmetic, processor and control unit design, instruction set architecture, instruction-level parallelism, and the ways functional components interact together.

II. Course Outcomes

Upon successful completion of the course, the student will be able to:

1. Explain the importance of studying computer architecture.
2. Evaluate various trade-offs while designing a computer system.
3. Describe how various computer components interact in order to exchange information.
4. Explain the need for the use of memory hierarchy (cache, main memory, storage devices) to ensure the design of a balanced computer system.
5. Describe how I/O systems work.
6. Discuss the relationship between the design of a computer system and the design of an operating system to operate it.
7. Describe the fundamental principles of CPU and control unit design.
8. Evaluate various trade-offs in designing the instruction set architecture.
9. Design fast ALU circuitry.
10. Identify and evaluate various techniques for improving contemporary processor performance.

III. Detailed Course Outline

A. Introduction to Computer Architecture 3 hrs
   1. Importance of computer architecture
   2. Architecture versus organization
   3. Computer history and generations
   4. Hierarchical view and operational concepts
   5. Evaluating computer performance

B. Component Interconnection and Bus Structures 3 hrs
   1. Basic components and their functions
   2. Interconnecting components
   3. Interrupt handling
   4. Bus structures and types

C. Memory Hierarchy 12 hrs
   - Cache Memory 4 hrs
     1. Cache memory basics
     2. Cache memory design (Mapping functions, replacement algorithms, write policies, etc.)

   - Main Memory and Virtual Memory 4 hrs
     1. Main memory organization and operation
     2. Main memory types (static RAM, synchronous DRAM, Rambus DRAM, DDR SDRAM, and cache DRAM)
     3. Virtual memory (paging, segmentation, thrashing, etc.)
     4. Address translation and TLBs

- Secondary Storage 4 hrs
  1. Secondary storage devices operation and performance (magnetic and optical media)
  2. Evaluating various design decisions and trade-offs while designing different components of the memory hierarchy

D. I/O and Operating Systems 6 hrs
1. I/O architecture
2. I/O types (programmed, interrupt-driven, DMA. etc.)
3. Buses (synchronous and asynchronous)
4. Interface circuits (serial and parallel)
5. Interface types (PCI, SCSI, and USB)
6. Operating systems functionalities (scheduling, memory management, etc.) and hardware support for these functions

E. The Central Processing Unit (CPU) 7 hrs
1. Structure and functions
2. Basics of computer arithmetic
3. Integer and floating point operations (addition, subtraction, etc.)
4. Design of fast arithmetic and logic circuitry
5. Addressing modes & instruction set architecture

F. Control Unit 4 hrs
1. The concept of micro-operations
2. Generation of control signals
3. Control unit implementation using hardwired control
4. Fundamentals of Microprogramming (micro-instruction sequencing, wide branch address, next instruction field, emulation, etc.)

G. Performance Enhancement 5 hrs
1. Pipeline design
2. Various hazards (structural, data, and control)
3. Performance evaluation of pipeline systems
4. Instruction level parallelism
5. Multi-core chips and thread level parallelism

H. In-class examinations 2 hrs

Total **42 hrs**

Final exam (During Final Exam Week) *2 hrs*

IV. Grading Scale

- The standard grading scale will be used:
  90%+ = A;
  80-89% = B;
  70-79% = C;
  60-69% = D;
  <60% = F.

V. Evaluation Methods

- Point Distribution. There will be three exams, outside-of-class assignments and projects. The approximate distribution of points will be:
  a. Two equal-weight class exams 35%
  b. Final exam 25%
  c. Assignments and projects 30%
  d. Student participation 10%

VI. Attendance Policy

Class attendance is regarded as being very important. Individual faculty may establish penalties for excessive numbers of unexcused absences. Excused absences will be allowed for illness, family emergencies, and involvement in university activities, such as sports. The penalties specified will meet university guidelines and be distributed to students with the course syllabus on the first day of class.

VII. Required Textbooks, Supplemental books, and Readings

Stallings, William, "Computer Organization & Architecture" 7th Edition Prentice Hall, ISBN "013-185644-8", 2006.

VIII. Special Resource Requirements

N/A

IX. Bibliography

- Carpinelli, J. "Computer Systems Organization and Architecture", Addison Wesley, 2000.
- Hamacher, C., Vranesic, Z., and Zaky, S. "Computer Organization" 5th Ed. McGraw-Hill, 2002.
- Hennessy, J. and Patterson, D., "Computer Architecture: A Quantitative Approach", 4th Ed. Morgan Kaufmann, 2006.
- Heuring, V. and Jordan, H. "Computer Systems Design and Architecture" 2nd Ed. Prentice-Hall, 2004.
- Null, L. and Lobur, J. "The Essential of Computer Organization and Architecture" 2nd Ed., Jones and Bartlett, 2006.
- Patt, Y. and Patel, S., "Introduction to Computing Systems: From bits & gates to C & beyond", McGraw-Hill Science/Engineering/Math, 2003.
- Patterson, D. and Hennessy, J., "Computer Organization and Design", 3rd Ed. Morgan Kaufmann, 2004.
- Tanenbaum, A. "Structured Computer Organization", 5th Ed. Prentice Hall, 2005.

2. Summary of the proposed revisions

Both the course title and contents were changed. The digital logic design topics (about five weeks worth of teaching) were moved to another course (COSC 300). The contents were defined because there is no syllabus of record that exists. Moreover, the contents were augmented to cover more advanced computer architecture topics given the available time as a result of the above mentioned migration of the digital logic part.

3. Justification/rationale for the revision

Currently in the computer science department, we are conducting curricular changes that affect several of our offered courses. There are two reasons behind those changes, the first one is the undergoing accreditation efforts in order to adapt our Languages and Systems track (LAS) to meet the ABET criteria. The second one is to conform to the university-wide trend of implementing an academic assessment plan.

The current title of the COSC 410 (Processor Architecture and Microprogramming) is outdated and does not reflect the dynamic changes in technology in this important field of computer science over the past decade. Therefore a more descriptive and accurate title is proposed (Computer Architecture). In addition, microprogramming has not been possible in 410 for twenty years.

The contents have been revised too. The first motivation for this revision is the shifting of some the material that used to be covered in COSC 410 to be covered in another course, COSC 300. This part is mainly the logic design; we found it much better for students to study these topics earlier in COSC 300. One other motivation is the

continuous change in the field. For instance in late 2001, the ACM/IEEE task force unveiled the 2001 computer curriculum (CC-2001) which was the first major revision to the famous CC-1991. With respect to computer architecture, the CC-2001 suggested several topics that should be covered therefore the contents of COSC 410 syllabus were changed to reflect these recommendations.

4. The old syllabus of record

Does not exist. We are applying under the provision of Syllabus of Record Amnesty for expedited review.

Part-III Letters of Support or Acknowledgement

N/A