

CS 2253 COMPUTER ORGANIZATION AND ARCHITECTURE

Outline of the Course

The study materials provided is developed for the first level course on Computer Organization and Architecture.

The students who study Computer Organization and Architecture, generally study the introductory course on Digital Systems. The students should have some knowledge on Digital Logic Circuit Design course to go through this study materials.

Student should have also some preliminary idea about computer programming (in high level language), which will help them to understand how to program a computer to solve a problem; and how the program is executed in the computer.

Objectives

- ✓ To have a thorough understanding of the basic structure and operation of a digital computer.
- ✓ To discuss in detail the operation of the arithmetic unit including the algorithms & implementation of fixed and floating-point addition, subtraction, multiplication & division.
- ✓ To study the different ways of communicating with I/O devices and standard I/O interfaces.
- ✓ To study the hierarchical memory system including cache memories and virtual memory.

SYLLABUS

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UNIT I BASIC STRUCTURE OF COMPUTERS 9

Functional units – Basic operational concepts – Bus structures – Performance and metrics – Instructions and instruction sequencing – Hardware – Software Interface – Instruction set architecture – Addressing modes – RISC – CISC. ALU design – Fixed point and floating point operations.

UNIT II BASIC PROCESSING UNIT 9

Fundamental concepts – Execution of a complete instruction – Multiple bus organization – Hardwired control – Micro programmed control – Nano programming.

UNIT III PIPELINING 9

Basic concepts – Data hazards – Instruction hazards – Influence on instruction sets – Data path and control considerations – Performance considerations – Exception handling.

UNIT IV MEMORY SYSTEM 9

Basic concepts – Semiconductor RAM – ROM – Speed – Size and cost – Cache memories – Improving cache performance – Virtual memory – Memory management requirements – Associative memories – Secondary storage devices.

UNIT V I/O ORGANIZATION 9

Accessing I/O devices – Programmed Input/Output -Interrupts – Direct Memory Access – Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, USB), I/O devices and processors.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", Fifth Edition, Tata McGraw Hill, 2002.

REFERENCES:

1. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software interface", Third Edition, Elsevier, 2005.
2. William Stallings, "Computer Organization and Architecture – Designing for Performance", Sixth Edition, Pearson Education, 2003.
3. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill, 1998.
4. V.P. Heuring, H.F. Jordan, "Computer Systems Design and Architecture", Second Edition, Pearson Education, 2004.

MICRO LESSON PLAN

HOURS	LECTURE TOPICS	READING
UNIT I BASIC STRUCTURE OF COMPUTERS		
1	Functional units – Basic operational concepts(AV Class)	T1
2	Bus structures – Performance and metrics	T1
3	Instructions and instruction sequencing	T1
4	Hardware – Software Interface	T1
5	Instruction set architecture	T1
6	Addressing modes(AV Class)	T1
7	RISC – CISC	T1
8	ALU design(AV Class)	T1
9	Fixed point and floating point operations	T1
UNIT II BASIC PROCESSING UNIT		
10,11	Fundamental concepts(AV Class)	T1
12	Execution of a complete instruction	T1
13	Multiple bus organization(AV Class)	T1
14,15	Hardwired control	T1
16,17	Micro programmed control	T1
18	Nano programming	T1
UNIT III PIPELINING		
19	Basic concepts(AV Class)	T1
20,21	Data hazards(AV Class)	T1
22,23	Instruction hazards(AV Class)	T1
24	Influence on instruction sets	T1
25	Data path and control considerations(AV Class)	T1
26	Performance considerations	T1
27	Exception handling	T1

UNIT IV MEMORY SYSTEM		
28	Basic concepts(AV Class)	T1
29	Semiconductor RAM(AV Class)	T1
30	ROM – Speed – Size and cost(AV Class)	T1
31	Cache memories(AV Class)	T1
32	Improving cache performance	T1
33	Virtual memory(AV Class)	T1
34	Memory management requirements	T1
35	Associative memories	T1
36	Secondary storage devices	T1
UNIT V I/O ORGANIZATION		
37	Accessing I/O devices	T1
38	Programmed Input/Output	T1
39	Interrupts	T1
40	Direct Memory Access(AV Class)	T1
41	Buses(AV Class)	T1
42	Interface circuits	T1
43	Standard I/O Interfaces-PCI	T1
44	Standard I/O Interfaces-SCSI	T1
45	Standard I/O Interfaces-USB, I/O devices and processors	T1

PREPARED BY

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