BA/BSC 2nd SEMESTER
CORE (DSC)

CAP620G: COMPUTER APPLICATIONS: COMPUTER SYSTEM ARCHITECTURE

CREDITS: THEORY: 4, PRACTICAL: 2
THEORY: 60 LECTURES

UNIT-I

1. Introduction (5 lectures)
Logic gates, Boolean algebra, combinational circuits, circuit simplification, flip-flops and sequential circuits, decoders, multiplexers, registers, counters and memory units.

2. Data Representation and Basic Computer Arithmetic (10 lectures)
Number systems, complements, fixed and floating point representation, character representation, addition, subtraction, magnitude comparison, multiplication and division algorithms for integers

UNIT-II

3. Basic Computer Organization and Design (15 lectures)
Computer registers, bus system, instruction set, timing and control, instruction cycle, memory reference, input-output and interrupt, Interconnection Structures, Bus Interconnection design of basic computer.

UNIT-III

4. Central Processing Unit (15 lectures)

Register organization, arithmetic and logical micro-operations, stack organization, micro programmed control. Instruction formats, addressing modes, instruction codes, machine language, assembly language, input output programming, RISC, CISC architectures, pipelining and parallel architecture.

UNIT-IV

5. Memory Organization (7 lectures)
Cache memory, Associative memory, mapping.

6. Input-Output Organization (8 lectures)
Input / Output: External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels.

Recommended Books:

1. M. Mano, Computer System Architecture, Pearson Education 1992
2. A. J. Dos Reis, Assembly Language and Computer Architecture using C++ and JAVA, Course Technology, 2004.
3. W. Stallings, Computer Organization and Architecture Designing for Performance, 8th Edition, Prentice Hall of India,2009
4. M.M. Mano , Digital Design, Pearson Education Asia,2013
5. Carl Hamacher, Computer Organization, Fifth edition, McGraw Hill, 2012.

BA/BSc 2nd Semester

BCA620G: COMPUTER APPLIACTIONS: COMPUTER SYSTEM ARCHITECTURE

Credits: 2 Lab: 60 Lectures

PRACTICAL: Computer System Architecture

1. Create a machine based on the following architecture:

Register Set

IR DR AC AR PC FGI FGO

0 15 015 0 15 Oil 011 1 Bit 1 Bit 1 Bit 1 bit 1 Bit

Memory 4096 words 16 bits per word	Instruction format 0 34 15	
	Opcode	Address

Basic Computer Instructions

Memory Reference			Register Reference		Input-Output	
Symbol	Hex		Symbol	Hex	Symbol	Hex
AND	Oxxx	Direct Addressing	CLA	E800	TNP	F80 0
ADD	2xxx		CLE	E400	OUT	F40 0
LDA	4xxx		CMA	E200	SKI	F20 0
STA	6xxx		CME	E100	SKO	F10 0
BUN	8xxx		CIR	E080	ION	F08 0
BSA	Axxx		CIL	E040	IOF	F04 0
ISZ	Cxxx		INC	E020		
AND I	lxxx	Indirect Addressing	SPA	E010		
ADD I	3xxx		SNA	E008		
LDA I	5xxx		SZA	E004		
STA I	7xxx		SZE	E002		
BUN I	9xxx		HLT	E001		
BSAI	Bxxx					
ISZ I	Dxxx					

Refer to Chapter-5 of Morris Mano for description of instructions.

2. Create the micro operations and associate with instructions as given in the chapter (except interrupts). Design the register set, memory and the instruction set. Use this machine for the assignments of this section.
3. Create a Fetch routine of the instruction cycle.
4. Simulate the machine to determine the contents of AC, E, PC, AR and IR registers in hexadecimal after the execution of each of following register reference instructions:

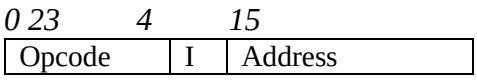
CLA e. CIR i. SNA
CLE f. CIL j. SZA
CMA g. INC k. SZE
CME h.SPA

Initialize the contents of AC to (A937)16, that of PC to (022)16 and E to 1.

5. Simulate the machine for the following memory-reference instructions with 1= 0 and address part = 082. The instruction to be stored at address 022 in RAM. Initialize the memory word at address 082 with the operand B8F2 and AC with A937. Determine the contents of AC, DR, PC, AR and IR in hexadecimal after the execution.
   a. ADD
   b. AND
   c. LDA
   d. STA
   e. BUN
   f. BSA
   g. ISZ

6. Simulate the machine for the memory-reference instructions referred in above question with 1= 1 and address part = 082. The instruction to be stored at address 026 in RAM. Initialize the memory word at address 082 with the value 298. Initialize the memory word at address 298 with operand B8F2 and AC with A937. Determine the contents of AC, DR, PC, AR and IR in hexadecimal after the execution.
7. Modify the machine created in Practical 1 according to the following instruction format:

Instruction format



a. The instruction format contains a 3-bit opcode, a 1 -bit addressing mode and a 12-bit address. There are only two addressing modes, 1 = 0 (direct addressing) and 1=1 (indirect addressing).

b. Create a new register I of 1 bit.

c. Create two new microinstructions as follows :
   i. Check the opcode of instruction to determine type of instruction (Memory Reference/Register Reference/Input-Output) and then jump accordingly.
   Check the I bit to determine the addressing mode and then jump accordingly.