Unique Paper Code : 32341102

Name of the Paper : Computer System Architecture

Name of the Course : **B.Sc. (H) Computer Science**

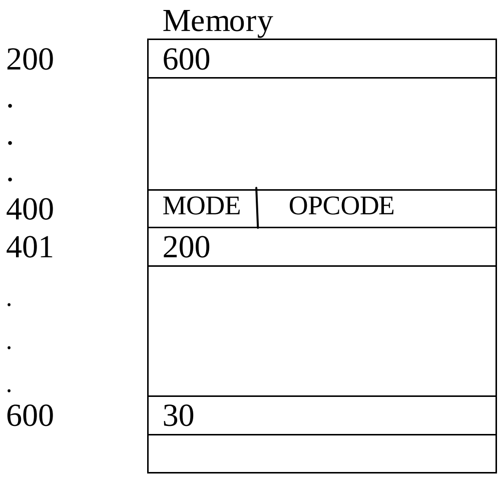
Semester : I

Duration : 3 Hours Maximum Marks: 75

Attempt Any Four Questions
All Questions Carry Equal Marks.

Q1. A combinational circuit controls a light bulb using three binary switches. The bulb glows whenever even number of switches is turned ON. Draw truth table for the said combinational circuit and obtain an optimized Boolean expression in Sum Of Products (SOP) and Product Of Sums (POS) forms using Karnaugh Maps. Also draw the logic diagrams for Boolean expressions obtained in both SOP and POS forms.

Q2. Consider the following snapshot of a memory to answer the questions that follow:



A two word instruction is stored at location 400 with its address field at location 401. Which addressing mode is being used if the value of operand is 30, 200 and 600 respectively? If the effective address obtained by using indexed register addressing mode is 300. What is the content of index register? If the OPCODE of the instruction is BUN, what would be the value of program counter before and after the execution of the instruction? What would be the value of program counter before and after the execution of the instruction if the OPCODE is ADD? Give the excitation table for a flip flop AB whose characteristic table is given as follows:

A	**B**	**Q(t+1)**
0	0	Q'(t)
0	1	0
1	0	1
1	1	Q(t)

Q3. Perform the following operations as directed:

- Convert 4433_5 in the given radix to decimal number system and then to binary number system
- $CF6D_{16}$ to octal number system
- Add 64_8 and 35_8
- Subtract $7B_{16}$ from $C4_{16}$ using signed 2's complement form
- Give BCD representation of 5468.

Q4. Specify the number of bytes that can be stored in a 32M × 16 memory. How many address lines and data lines are required for it? How many 32 × 8 chips are required to provide a memory capacity of 1024 × 8. Show the interconnections required to construct a 256 × 8 ROM from 128 × 8 ROM chips and a decoder.

Identify the type of following I/O interface commands:

- check to see if a printer is ready for printing
- skip to the beginning of a tape
- check for an error during an I/O transfer
- write a block of data onto a magnetic disk.

Q5. A computer uses a memory unit of 256K words of 16 bits each. A binary instruction code is stored in two words of memory. The instruction has four parts: an addressing mode field to specify one of the two addressing modes, an operation code, a register code part to specify one of the 256 registers and an address part. Calculate the number of bits in each part of the instruction and indicate them by drawing the instruction format. Calculate the number of operations that can be supported by the above mentioned instruction format.

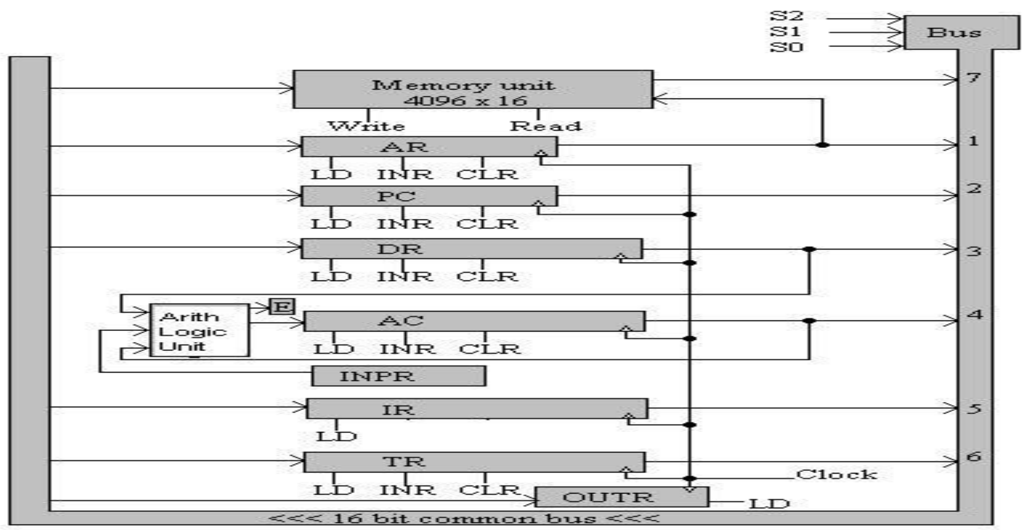


Figure I. The Common Bus System

Consider the common bus system of a basic computer depicted in Figure I. The control inputs given in Table I are active in the common bus system at a time instant t_0. Give register transfer statements to specify the register transfer that will be executed during the next clock transition t_1.

	S_2	S_1	S_0	LD of register	Memory	Adder
I.	1	0	1	PC	-	-
II.	1	0	0	DR	Write	-
III.	0	0	0	AC	-	Add
IV.	1	1	1	TR	Read	-
V.	0	1	1	OUTR		-

Table I. Control Inputs active in Common Bus System at time instant t_0

Q6. A non pipe line system takes 30 ns to process a task. The same task can be processed in a four – segment pipe line with a clock cycle of 10ns. Determine the speedup ratio of the pipe line for 100 tasks.

Explain briefly the following microoperations:

- M [AR] $\leftarrow$ PC, PC $\leftarrow$ AR+1
- If (FGI = 1) then PC $\leftarrow$ AR
- E $\leftarrow$ C_{out}
- If (AC(15) = 1) then S $\leftarrow$ 0
- (IEN)(FGO+FGI): R$\leftarrow$1

Using the appropriate operation codes listed in Table II, specify the 14-bit control word that must be applied to the processor to implement each of the following microoperations: R5$\leftarrow$R4 $\wedge$ R1, R3 $\leftarrow$ R2

OPR Select	Operation
00000	Transfer A
00110	OR A and B
10100	ADD A and B
10110	Complement A
00100	Subtract A – B
01110	AND A and B

Table II. Encoding of ALU operations

Write a program to evaluate the arithmetic statement: (A – B) / C + D using one address instructions.