

**CSE 3203 CT 4 Assignment**  
**Roll No: 1803063**

**Assignment Problem:**

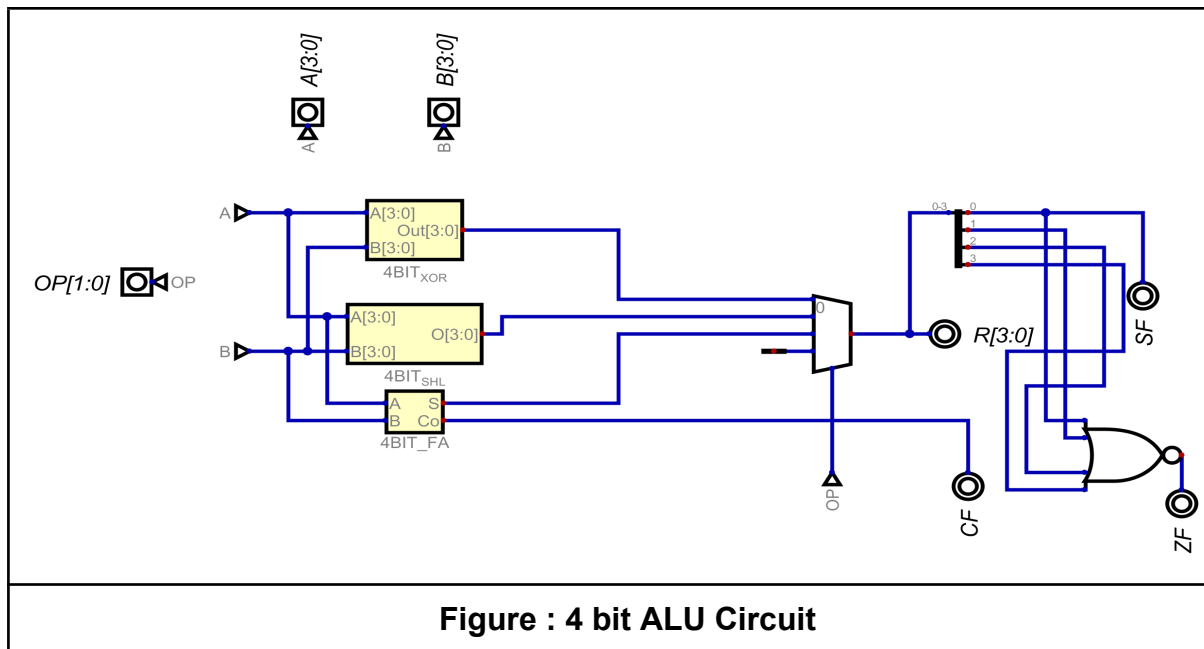
**Build CPU based on following requirements:**

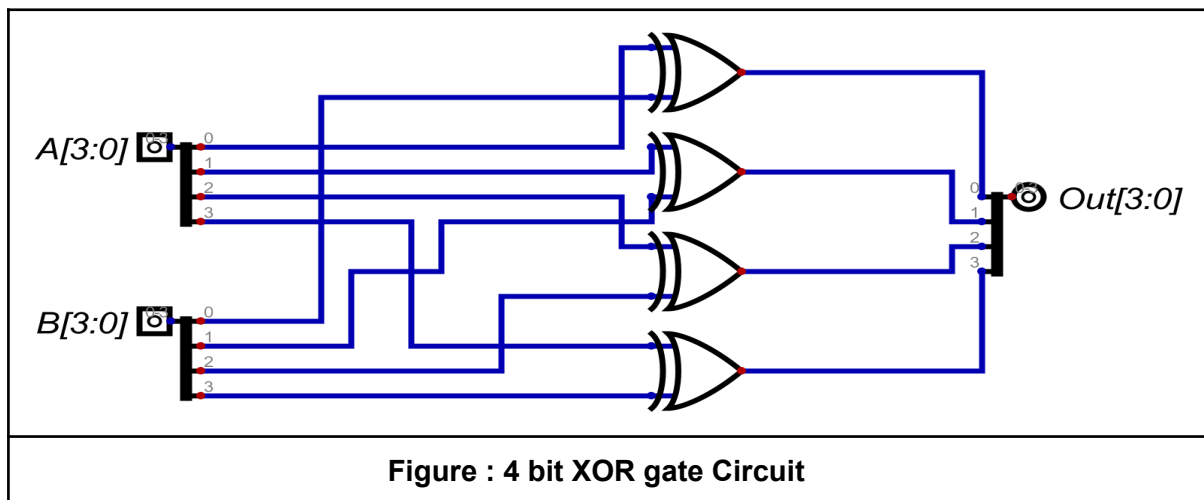
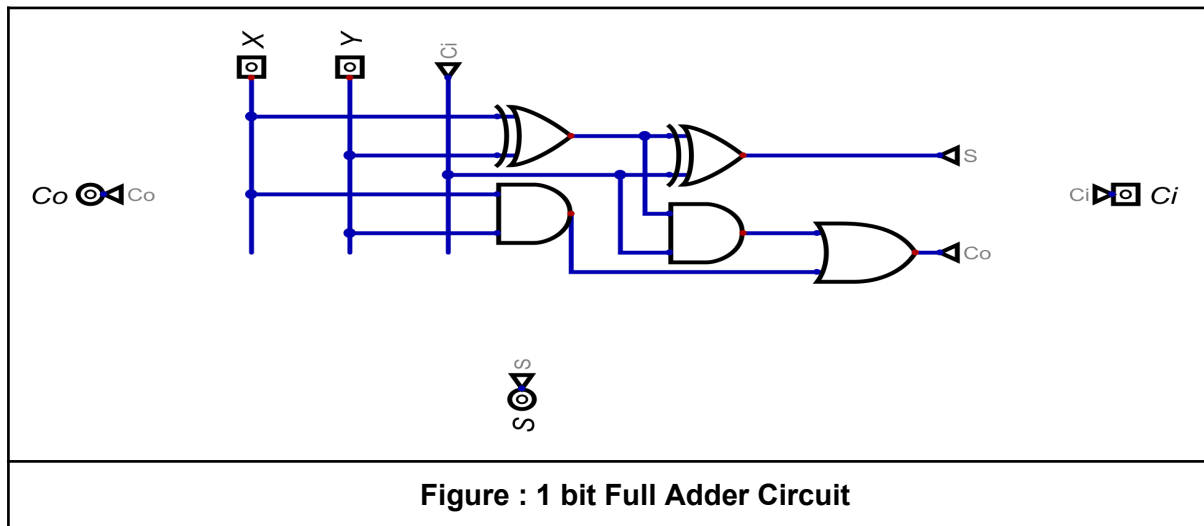
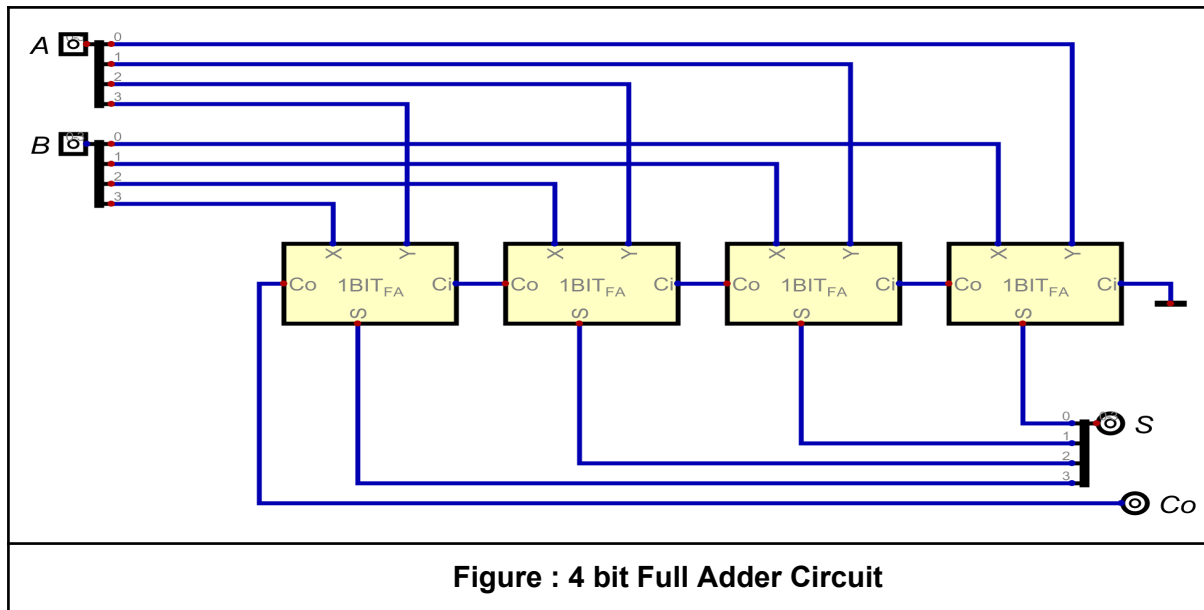
- 1 Word Size of CPU = 4
- 2 ALU Operations = XOR, ADD, SHL
- 3 Register Number = 3
- 4 Size of RAM = 9
- 5 Word size of ISA and RAM = 16
- 6 CPU Instructions = Register Mode, Immediate Mode, JMP, JL

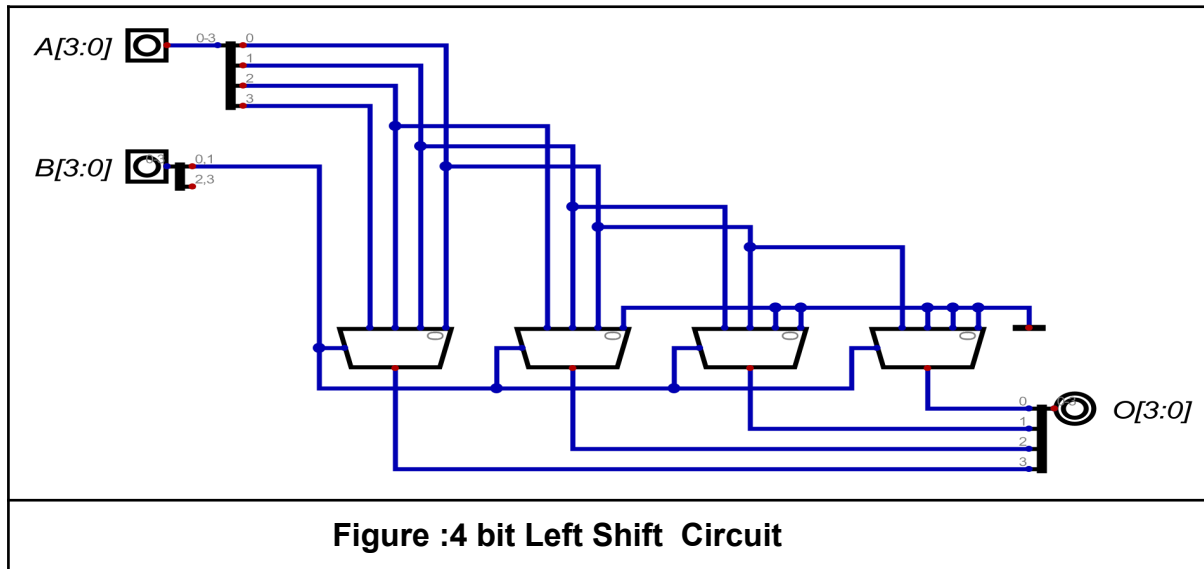
**Solution:**

**Simulator Design:**

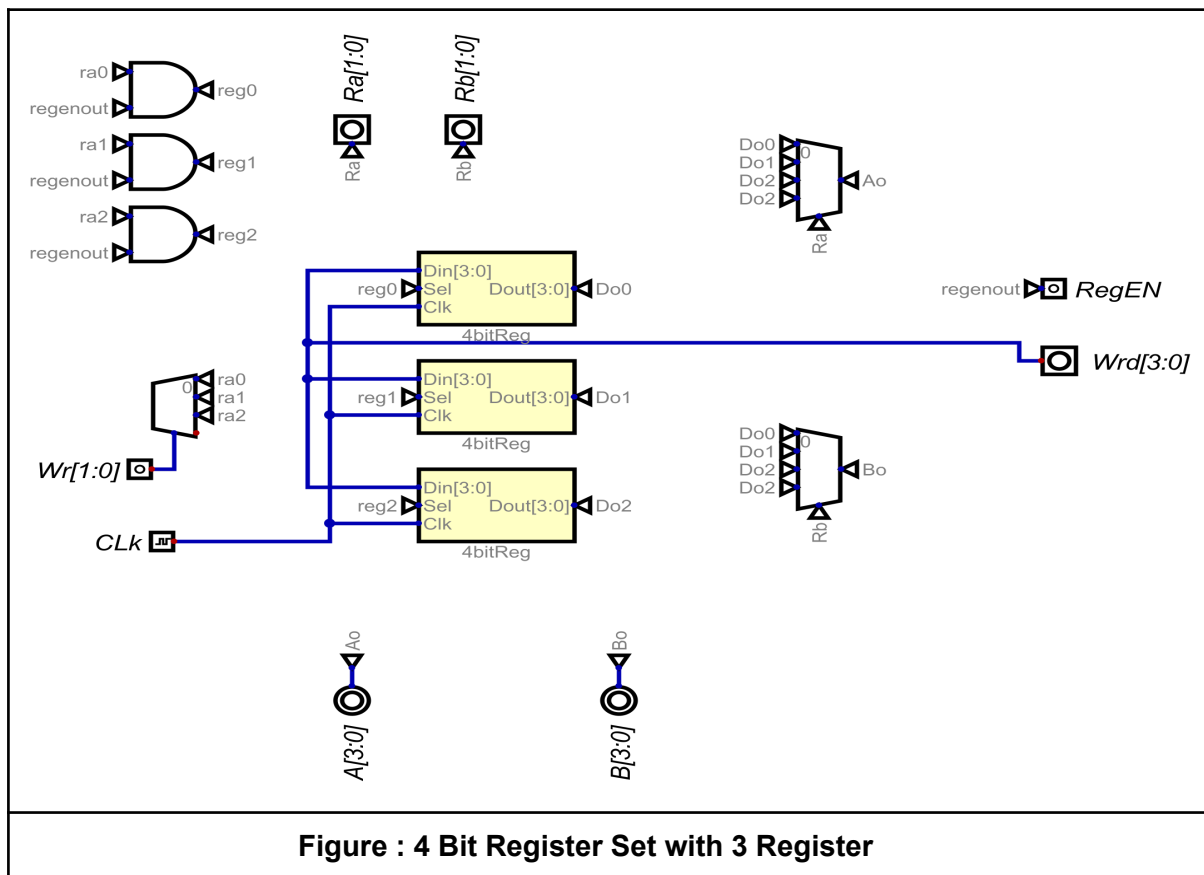
- 1 ALU Circuit (Top to Bottom all circuits):







## 2 Register Set Circuit (Top to Bottom all circuits):



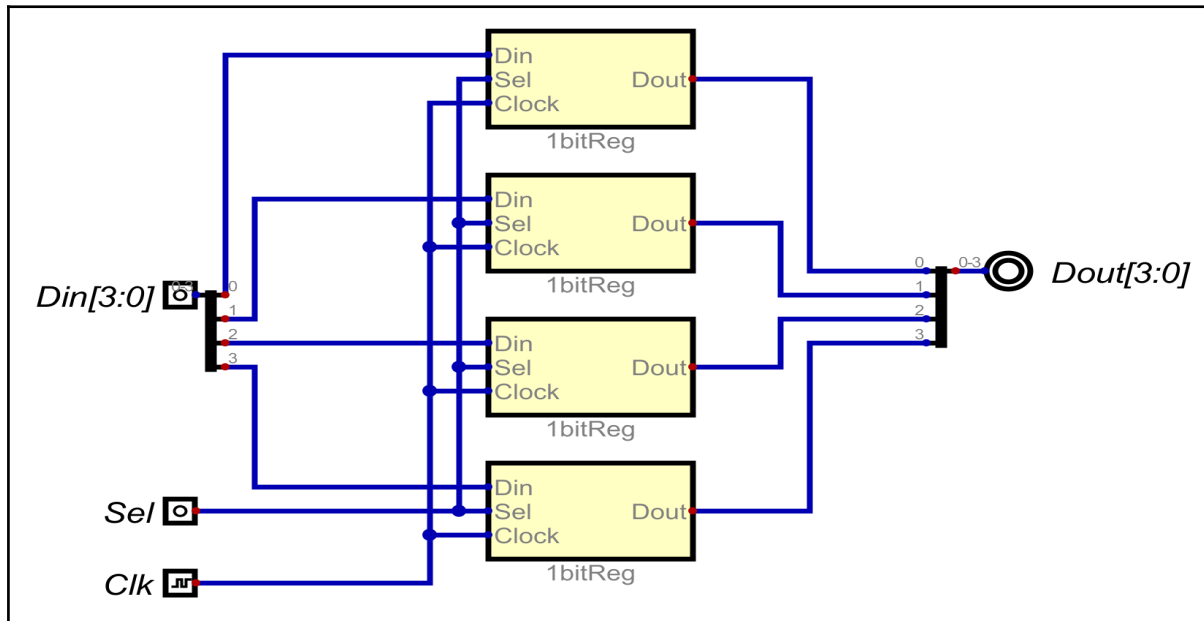


Figure : 4 Bit Register Circuit

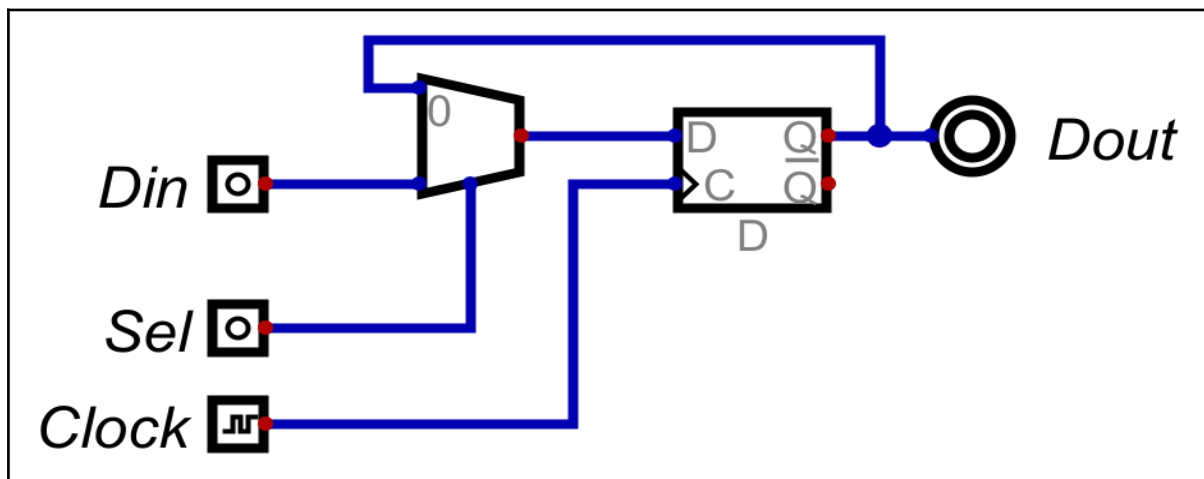


Figure : 1 Bit Register Circuit

### 3 RAM Circuit (Top to Bottom all circuits):

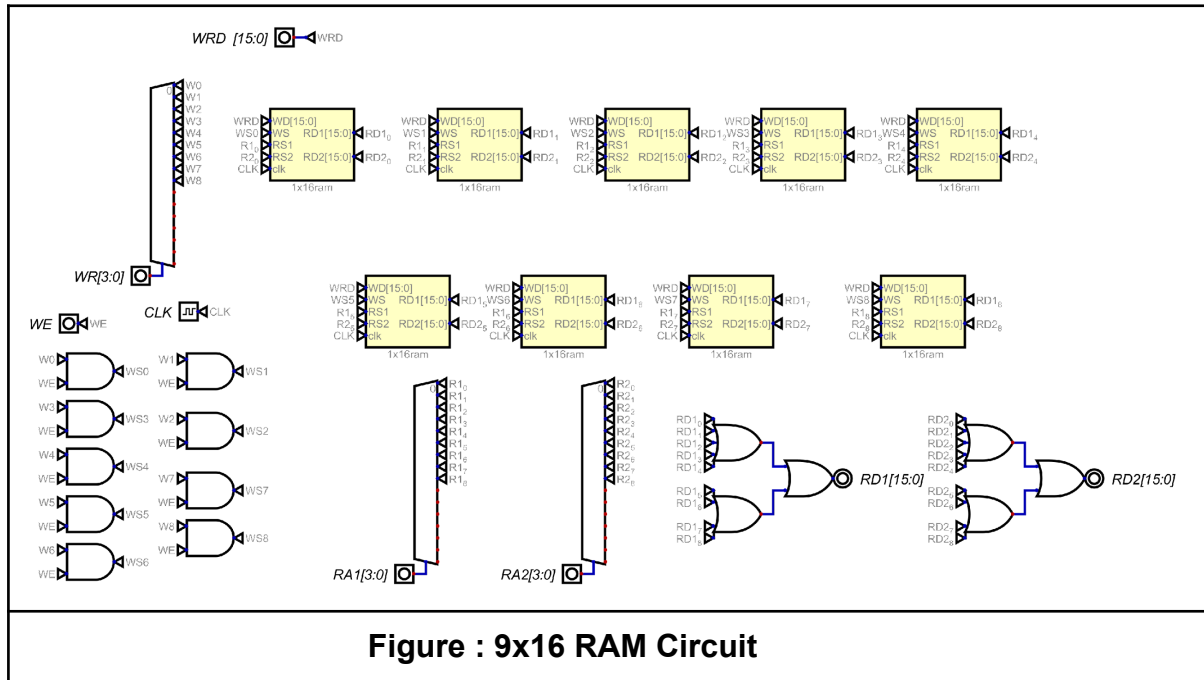


Figure : 9x16 RAM Circuit

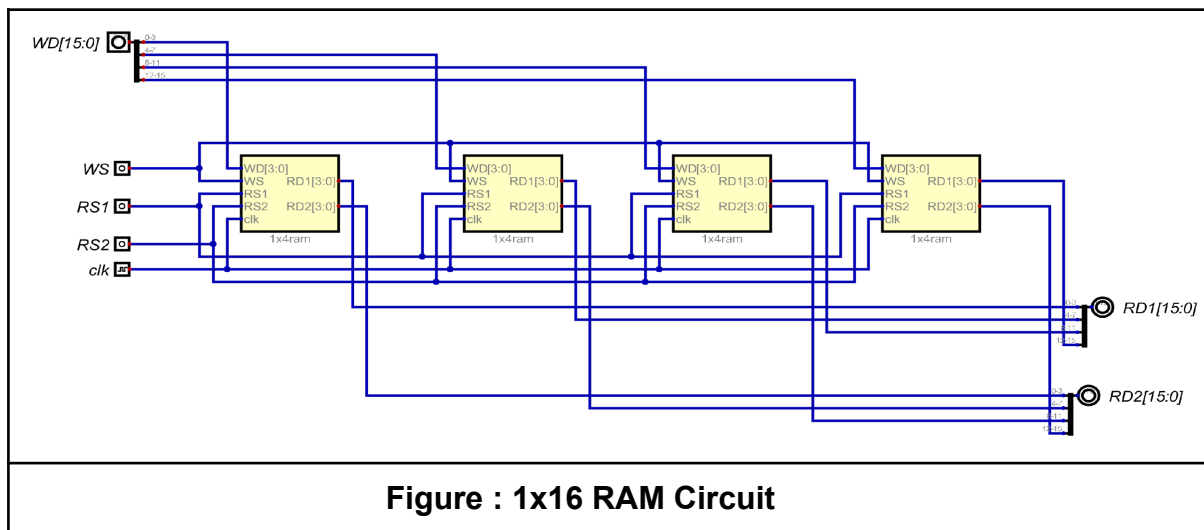
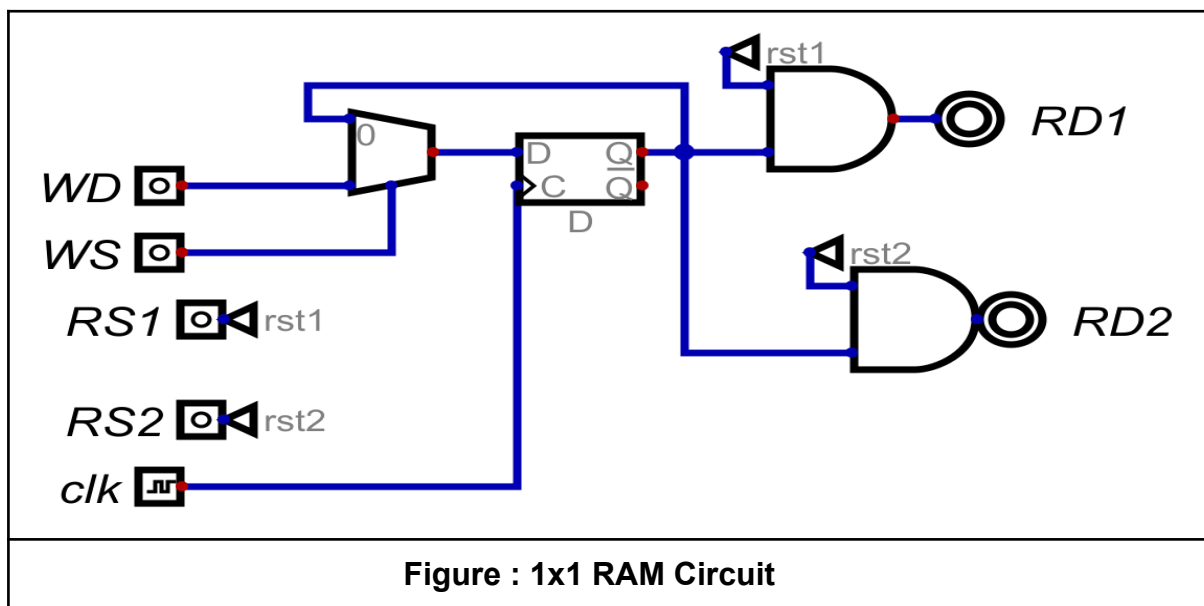
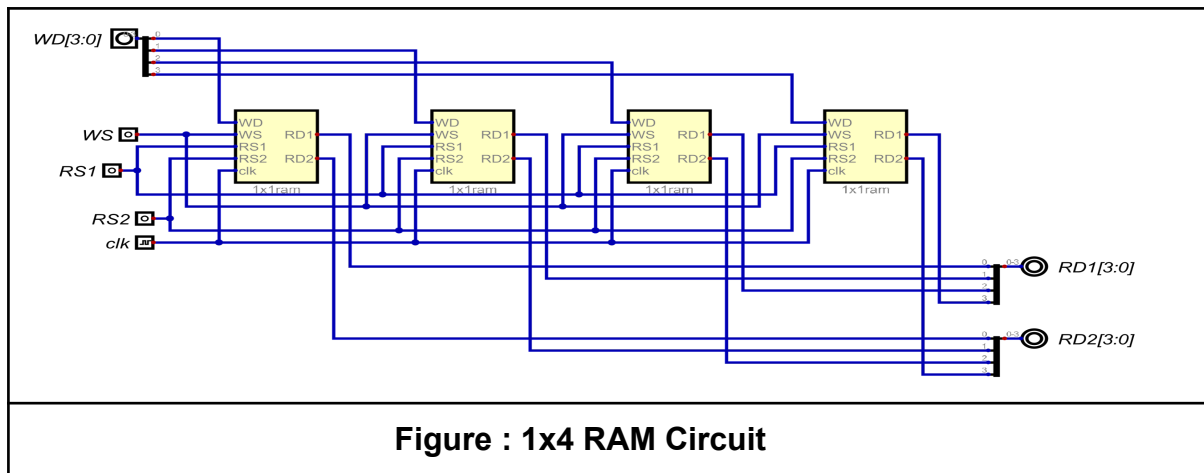


Figure : 1x16 RAM Circuit



## 4 ISA

### ISA Format of ALU Instruction (Register Mode) :

Opcode (4 Bit)		Register 1	Register 2	Unused
2 Bit	2 Bit	2 Bit	2 Bit	8 Bit
Type of Instruction	Operations	Ra (00-10)	Rb(00-10)	xxxxxxx

### ISA Format of ALU Instruction (Immediate Mode) :

Opcode (4 Bit)		Register 1	Value	Unused
2 Bit	2 Bit	2 Bit	4 Bit	6 Bit
Type of Instruction	Operations	Ra (00-10)	Value (0000-1111)	xxxxxx

### ISA Format of Jump Instruction :

Opcode (4 Bit)		Address	Unused
2 Bit	2 Bit	4 Bit	8 Bit
Type of Instruction	Operations	Value (0000-1000)	xxxxxxx

XOR (Op = 00), Left Shift (Op = 01) , ADD (Op = 10)

JMP (Op = 00), JL (Op = 01)

## 5 CPU (Top to Bottom all circuits):

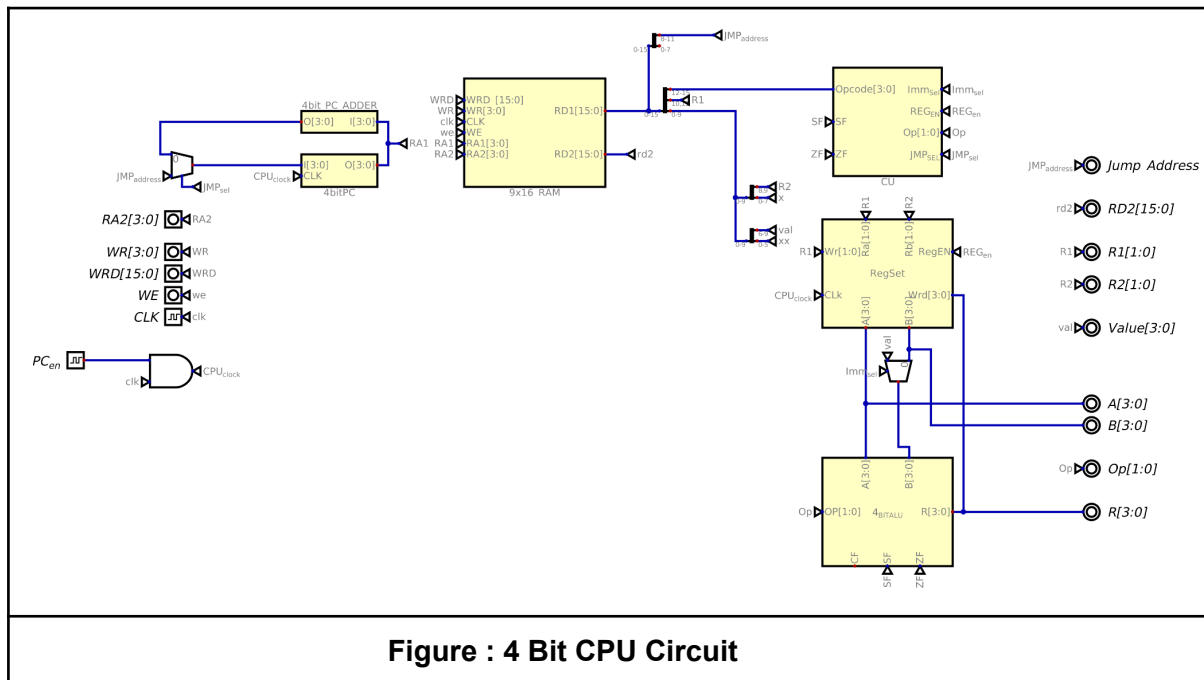


Figure : 4 Bit CPU Circuit

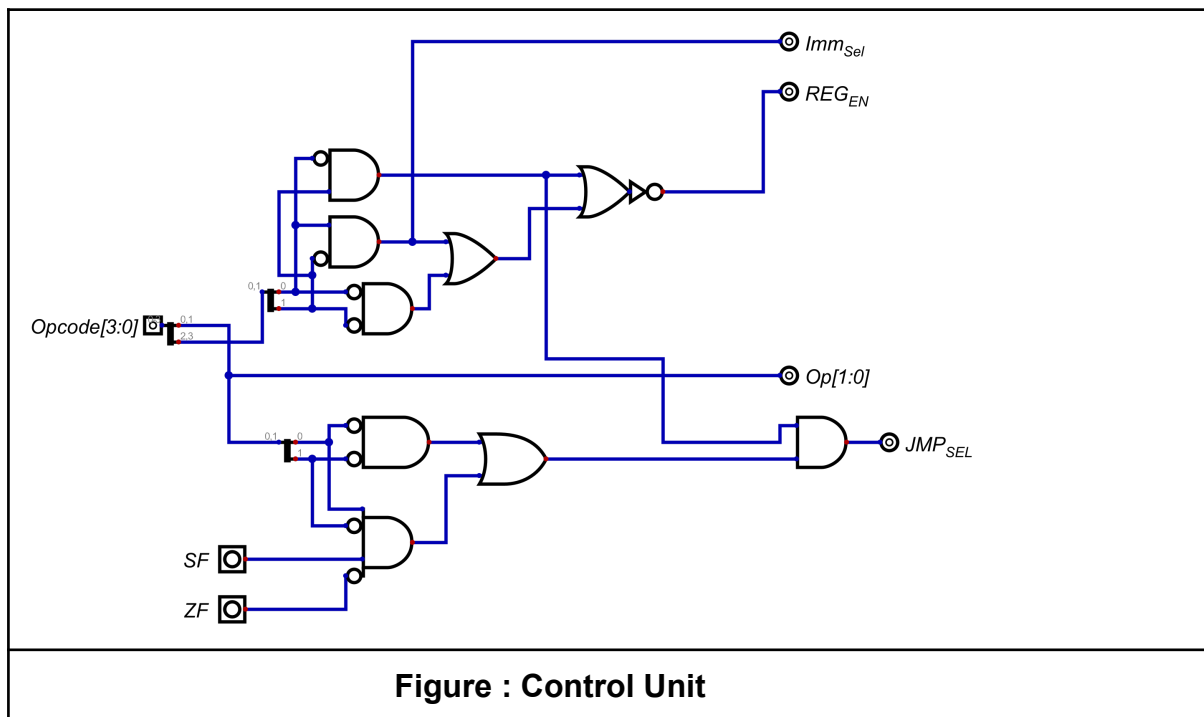


Figure : Control Unit



