CSE 3203 CT 4 Assignment
Roll No: 1803034

Assignment Problem:

Build CPU based on following requirements:

1. **Word Size of CPU = 4 bit**
2. **ALU Operations = Add, ROL , Xor**
3. **Register Number = 4**
4. **Size of RAM = 7**
5. **Word size of ISA and RAM = 15 bit**
6. **CPU Instructions = Register Mode , Immidiate Mode , Jmp ,JC**

Solution:

Simulator Design:

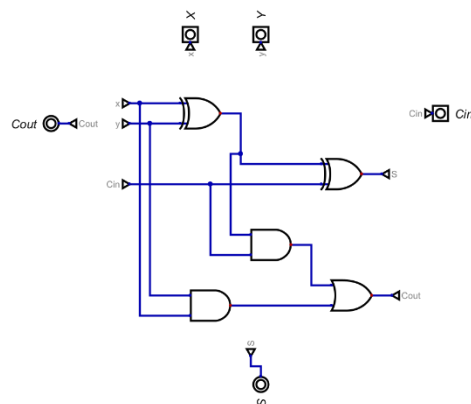1. **ALU Circuit (Top to Bottom all circuits):**

Fig: 1 bit Full Adder

Fig: 4 bit Adder

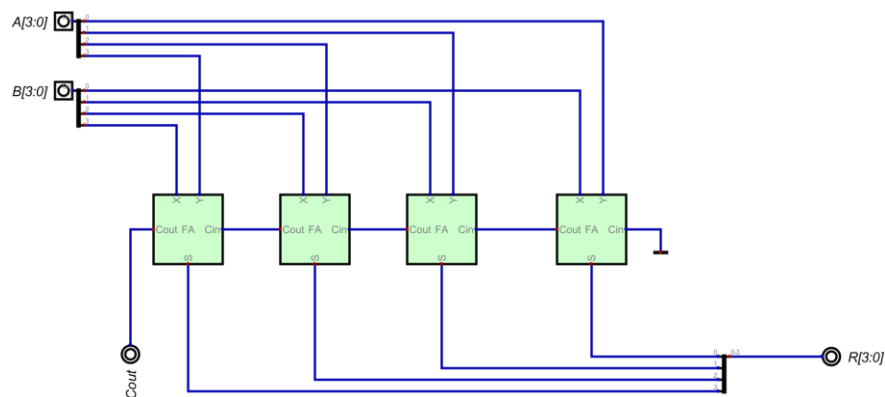**Fig: 4 bit Left Rotator**

Fig: 4 bit XOR

Fig: 4 bit ALU

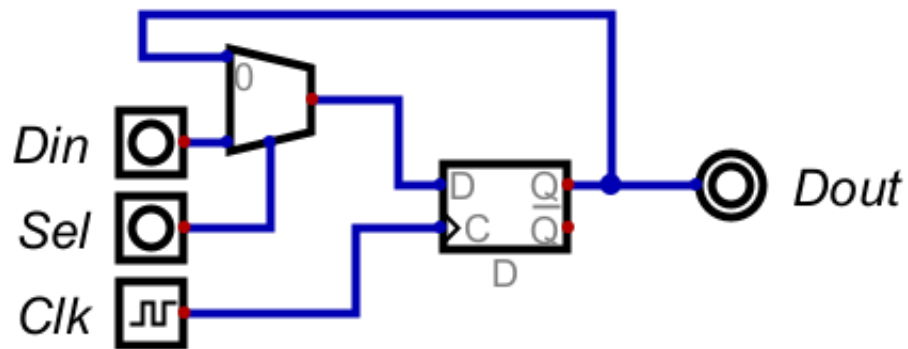## 2. Register Set Circuit (Top to Bottom all circuits):
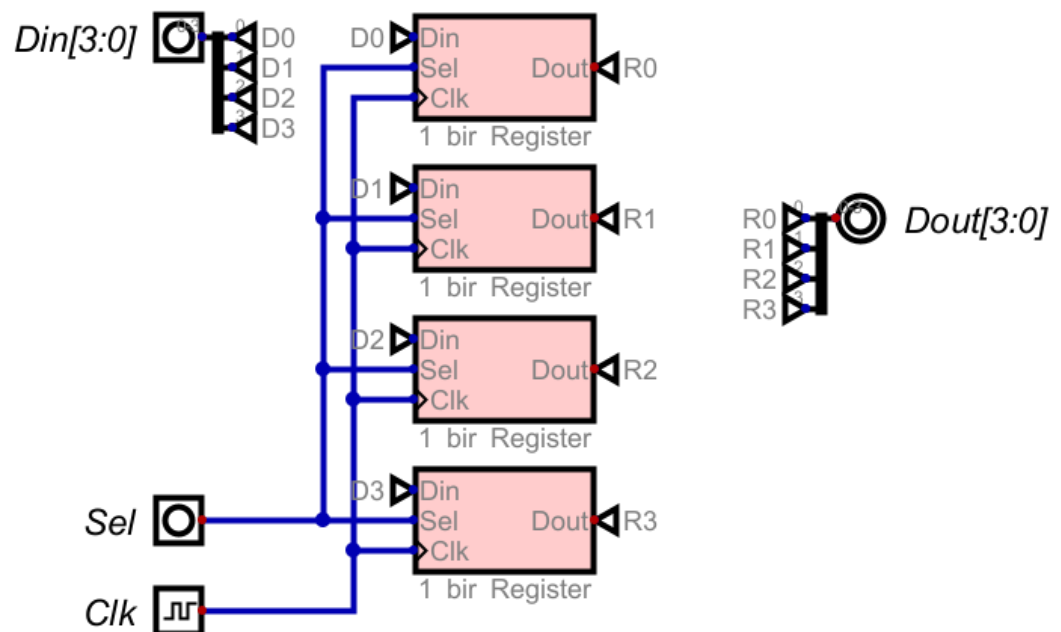

Fig: 1 bit Register
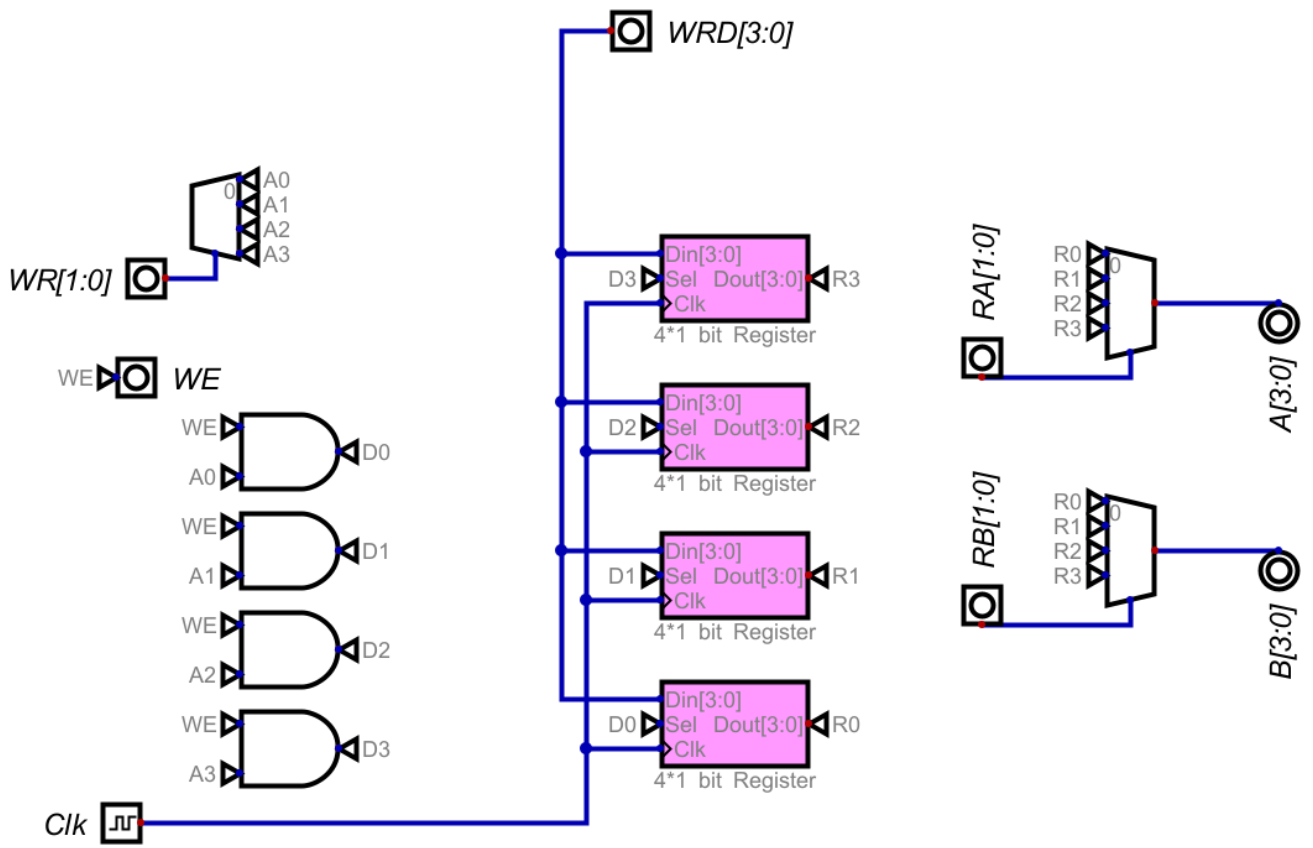

Fig: 1 x 4 Register

Fig: 4x4 Register Set

3. RAM Circuit (Top to Bottom all circuits):
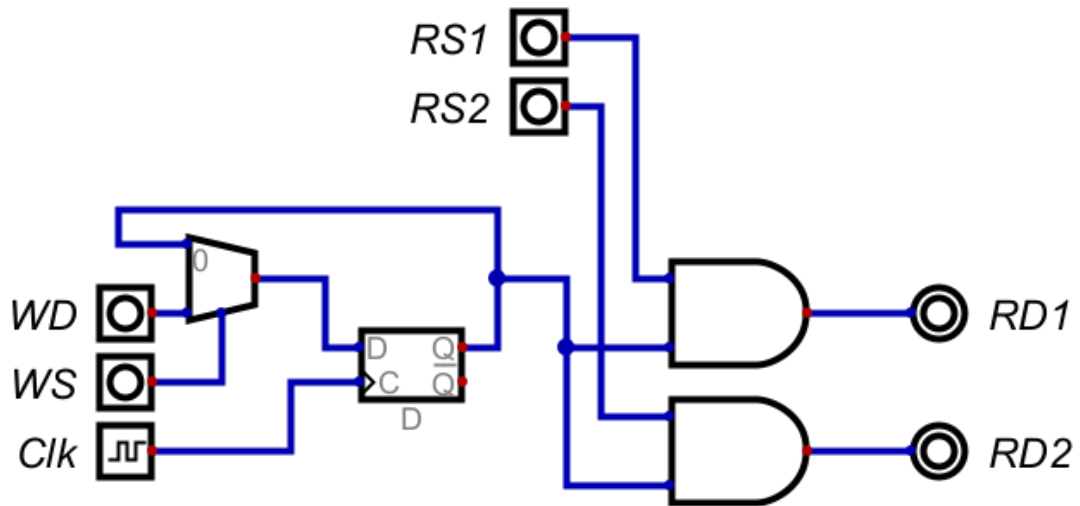
Fig: 1 x 1 RAM
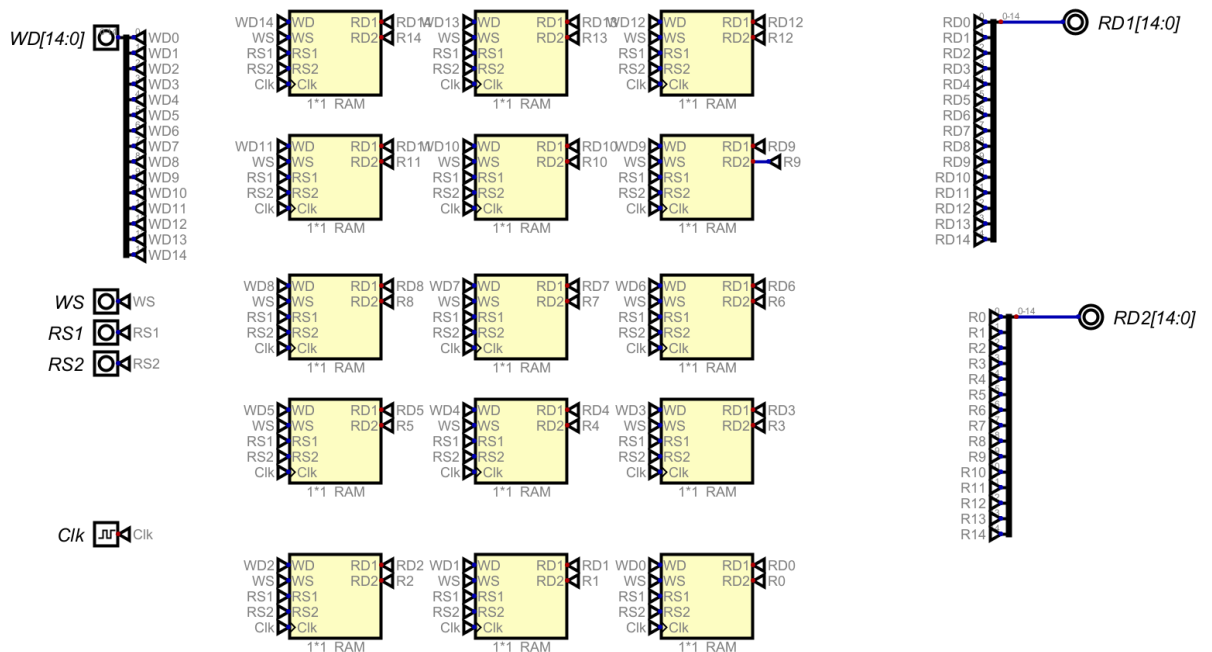
Fig: 1 x 15 RAM

Fig: 7 x 15 RAM

4. ISA

1st bit	2nd bit	3rd bit	4th bit	5th bit	6th bit	7th bit	8th bit	9th bit	10th bit	11th bit	12th bit	13th bit	14th bit	15th bit

Regular Mode

0 0 (Regular Mode)	0 0 ADD / 0 1 ROL / 1 0 XOR	X X Address of Register (RA)	X X Address of Register (RB)	X X X X X X X Don't Care (7 bit)

Immidiate Mode

0 1 (Immidiate Mode)	0 0 ADD / 0 1 ROL / 1 0 XOR	X X Address of Register (RA)	X X X X Constant (4 bit)	X X X X X Don't Care (5 bit)

Jmp Mode

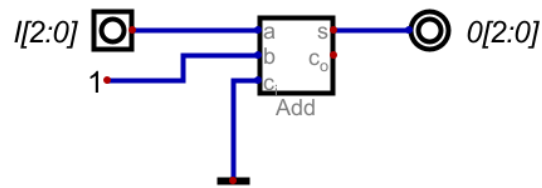| 1 0 (Jmp Mode)	0 0 JC	X X X Address of Instraction Pointer (RA)	X X X X X X X X Don't Care (8 bit)

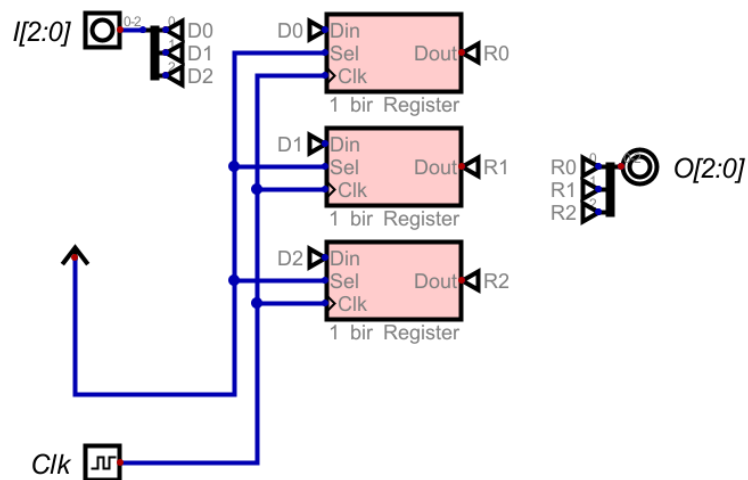## 5. CPU (Top to Bottom all circuits):

Fig : 3 bit PC Adder

Fig: 3 bit Program Counter Register

Fig: Control Unit

Mode Bit(2) OP Code(2) RA1 RA2 Don't Care
Register Mode : 0 0 0 0 (ADD) 2 bit 2bit 7 bit
0 1 (Xor)
1 0 (ROL)
Mode Bit(2) OP Code(2) RA1 COnst Don't Care
Immidiate Mode : 0 0 0 0 (ADD) 2 bit 4 bit 5 bit
0 1 (Xor)
1 0 (ROL)
Mode Bit(2) OP Code(2) RAM_Address Don't Care
J u m p M o d e: 1 0 0 0 (JC) 3 bit 8 bit

Fig: 4 bit CPU