**EE6361: Advanced concepts of VLSI**

**Assignment 3**

Problem Statement: Build the control unit for Processor IIT6361- µP101, making use of execution unit built in Assignment 2.

|  |
| --- |
|  |

Figure . Control Unit

Step by step process for building the Control unit.

1. Step 1 : Define the opcode for instruction

LOAD, MOV, ADD, SUB, INC, CMP, JMP

1. Step 2.: Define the Program Memory width

|  |  |  |  |
| --- | --- | --- | --- |
| **OPCODE** | **Operand 1** | **Operand 2** | **Operand 3** |
| 4 bit | 5 bit | 1. bit | 8 bit |

1. Step 3: To get the Data of program instruction, define the address and data field for instructions and add zeros to other fields.

|  |  |  |  |
| --- | --- | --- | --- |
| **OPCODE** | **Operand 1** | **Operand 2** | **Operand 3** |
| **LD** | Yes |  | Yes |
| **ADD** | Yes | Yes | Yes |
| **SUB** | Yes | Yes | Yes |
| **INC** |  | Yes |  |
| **CMP** |  | Yes | Yes |
| **MOV** | Yes | Yes |  |
| **JMP** |  |  | Yes |

1. Create four modules namely Program Counter, Program Memory, Execution Unit Control Logic (EUCL) and Program Flow Control Logic (PFCL) as shown in Figure 1.

Combine the Control Unit to the Execution unit (built in Assignment 2) and run the processor to check the result in the memory for all the problems given below. Note that below problems are same as problems done in Execution unit (Assignment 2). All the control lines written in test bench of execution unit should now be generated automatically by the control unit.

Problem 1:

1. Load 141 to R4 check R4.
2. Load 208 to R6 check R6.
3. Load 32 to R8 check R8.

Problem 2:

1. Mov R4 to R5 check R5.
2. Mov R8 to R9 check R9.
3. Mov R6 to R7 check R7.

Problem 3: R4 + R6 => R10, check R10 and check if Carry.

Problem 4: R6 – R8 => R11, check R11and check if Barrow.

Problem 5: R8 – R4 => R12, check R12and check if Barrow.

Problem 6: INC R12 check R12.

Problem 7: R4 >= R6? check the flag.

Problem 8: R4 – R4 => R13, check R13 and check zero flag.