M.TECH. INTELLIGENT AUTOMATION AND ROBOTICS FIRST YEAR SECOND SEMESTER – 2024

Embedded Systems and Technologies

Time: 3 hours | Full Marks: 100

Answer any **4** questions.

1. Design an ASIC for a Fibonacci Sequence Generator. Draw and explain the data-flow path, IC signal pins and the complete logic diagram. [25]

2. An output pulse z is to be coincident with the second x_2 pulse, immediately following an x_1 pulse. Design the sequential state machine. [25]

3. a) What is a hierarchical state machine?

b) Design the state diagram of a hierarchical state machine of an elevator. Consider power failure and recovery and fire-extinguishing cases in your hierarchical design. [5+20]

4. a) Using at least 3 states, construct a stochastic automaton to recognize the sequence *abb*.

b) Show the problem of evaluation of the above sequence with presumed probabilities.

c) Realize the same by a fuzzy automaton.

d) Realize (a) by lattice automaton, and evaluate the lattice belief to recognize *abb* for a given lattice/ Hasse diagram. Show the Hasse diagram. [7+6+6+6]

5. a) Develop a PLA to store 01 at address 101, 10 at address 110, and 11 at address 111.

b) Write the outputs y_1, y_0 as a function of input address $a_2a_1a_0$.

c) What is a PLD? Modify the equivalent PAL of the given PLA into a PLD. What is the logic function that the PLD realizes?

d) Show how will you realize Half-adder on a Fairchild Corporation's p-ASIC architecture?

[7+3+10+5]

6. a) Draw and explain the schematic architecture of Arm Processor.

b) Show the steps of computation of the instruction ADD r_0, r_1, [r_2] and demonstrate the data and address flow paths inside the processor.

c) What is the importance of the process statement in VHDL programming? Explain why and how the process statement is used to avoid glitch in a digital circuit. [8+5+12]

7. a) Draw and explain the functional block diagram of a dot-matrix printer.

   b) Develop an interface between a dot-matrix printer and 8085A based micro-computer system to transfer 10 bytes of data to the printer from the system buffer.

   c) Also construct an assembly-level program to realize part (b). [10+5+10]

8. a) State the principle of interrupt masking in an 8085 microprocessor using the I-register.

   b) Develop an assembly level program to change the set-point in a process control loop under online condition (i.e., without shutting down the process) using nested interrupt handling. The user is supposed to press the following key sequence: Vector Interrupt, 5, 2 to describe the updated set-point as 52 decimal in a given memory location (say 2080H) reserved for set-point storage. [5+20]