<MCA>
< MCAC-104>: < Computer Systems Architecture>
Unique Paper Code: < 223401104>
Semester I
March-2021
Year of admission: 2020

Time: Three Hours   Max. Marks: 70

Notes:

Answer any 4 questions.
All questions carry equal marks.
Parts of a question MUST be answered together.

1.(A)	Design an 8-bit combinational circuit that compares two 8-bit numbers. The circuit produces output 1 if the numbers are equal and 0 otherwise.
1.(B)	Simplify the following expression using rules of Boolean algebra: $F = X'Z + X'Y + XY'Z + YZ$
2.(A)	Design a bus system for 4-bit registers using three state-buffers.
2.(B)	Design a 4-to-16 decoder using 2-to-4 decoders
3.(A)	Please find out the total number of registers needed in overlapped RISC architecture where we have four windows with 56 registers in each. And we have 12 registers that are common to all procedures.
3 (B)	Design a 32x1 multiplexer using 16x1 multiplexers.
4.(A)	A digital computer has a memory unit with a capacity of 16384 words, 40 bits per word. The instruction code format consists of 6 bits for the operation part and 14 bits for the address part. Two instructions are packed in one memory word and a 40-bit instruction register IR is available in the control unit. Formulate a procedure for fetching and executing instructions for this computer. Assume there is no indirect mode bit.
4.(B)	Derive a Boolean expression for the gate structure that clears the sequence counter SC to 0. Draw the logic diagram of the gates and show how the output is connected to the lNR and CLR inputs of SC. Minimize the number of gates.
5.(A)	Design an 4-bit combinational circuit incrementer using NAND gates.
5.(B)	Implement a full adder using NOR gates.
6.(A)	Why are the read and write control lines in a DMA controller bidirectional? Under what condition and for what purpose are they used as inputs? Under what condition and for what purpose are they used as outputs?
6.(B)	Give a Boolean function for the match logic of one word in an associative memory taking into consideration a tag bit that indicates whether the word is active or inactive.
6.(C)	Find out 8-bit 2's complement representation of the decimal number −45.