Total number of printed pages: 2 **Programme: UG/3rd/UECE302**

JUNE 2024

DIGITAL SYSTEM DESIGN

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1.	a)	How can we represent negative numbers in binary form? Compare different methods by representing $(-61)_{10}$ in an 8-bit binary format.	5
	b)	State all the basic postulates of Boolean algebra.	5
	c)	Design a 4-bit carry look-ahead binary adder. Discuss its advantage over a ripple carry adder.	10
2.	a)	What is the advantage of using BCD codes? Explain how we can implement BCD addition using binary adders.	6
	b)	Design a gray to binary code converter circuit using K-map method.	6
	c)	Express the Boolean function $F(w,x,y,z) = \sum m(3,4,5,7,10,11)$ in SOP form. Implement the same using only 2x1 multiplexers.	8
3.	a)	Design a single bit comparator. Using three such comparators, design a 3-bit comparator circuit.	8
	b)	Design an 8x3 priority encoder with a 'valid' output. Find the simplified Boolean expression for each output.	6
	c)	Design an array multiplier which can multiply any two 3-bit numbers.	6
4.	a)	Show the design procedure to construct a J-K flip-flop from a T flip-flop.	6
	b)	Explain in detail (with necessary circuit diagram) two ways in which we can construct an edge-triggered J-K flip-flop.	8
	c)	With the help of circuit diagram, discuss the difference between a mod-5 ripple counter and a synchronous counter.	6
5.	a)	Draw the diagram of 4-bit Johnson counter and enumerate all its states.	5
	b)	Design a sequence detector using D flip-flops which can detect a 4-bit sequence '0110' with overlap.	10

c) Design a frequency divider which can divide the frequency of an input square wave by a factor of 40. 5

6. a) What are PLDs? Using an example, compare the advantages and disadvantages of PLA and PAL. 8

b) With the help of a neat circuit diagram, explain the transfer characteristics of a TTL Inverter. Discuss the function of each transistor in the circuit. 8

c) Draw the circuit diagram to realize a CMOS 2-input OR gate and verify its truth table. 4

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