

**VIT**Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SLOT: D2+TD2

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - I
FALL SEMESTER 2025-2026

Programme Name & Branch :B.Tech & Computer Science and Engineering
Course Code and Course Name :BACSE103 Computation Structures
Faculty Name(s) :Dr. P. Antony Seba
Class Number(s) :7307/7239/5260/7233/7242/7246/7308,7254/7243/7305
Date of Examination :20-08-25
Exam Duration :90 minutes **Maximum Marks:50**

General instruction(s):

- Answer All Questions
- M- Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcomes:
 1. To design and optimize minimal combinational circuits.
 2. To analyze and design sequential circuits utilizing various types of flip-flops

Q.No	Question	M	CO	BL
1.	A full adder system's output sum is defined as 1 for the following input minterms, $\text{sum} = \sum m(1,2,4,7)$ and the output carry is defined as 1 for the following input minterms, $\text{carry} = \sum m(3,5,6,7)$ i) Plot the given minterms on a 3-variable K-Map. ii) Use the sum of products method to simplify the Boolean expression for sum and carry. iii) In what way does a carry look ahead adder address the issue of carry propagation delay while adding 1001 and 1111?	10	1	3
2.	Construct an 8 to 1 multiplexer using 4 to 1 and 2 to 1 multiplexers. Justify the working of the circuit by explaining what happens when the select lines are $S_2 = 1, S_1 = 0, S_0 = 1$. Identify which input gets selected and explain the data flow.	10	1	3
3.	a) i. A spacecraft telemetry system sends data to Earth using binary coded signals. One of the parameters being transmitted is the fuel pressure, which is encoded as a binary fraction. Decode this value into a human readable decimal format for analysis by mission control. b) i). In an industrial plant, sensor IDs are stored in an octal format for memory efficiency. A technician receives a sensor ID as Convert the octal number into hexadecimal format to configure it in a new monitoring system interface which supports only hex values.	5	1	3
		5		
4.	a) Design a home automation system using a simple binary encoder and decoder to detect which of four windows (Window 3, Window 2, Window 1, Window 0) are open. The encoder outputs represent the active window. The encoder inputs are active-high (1) means window open, low (0) means closed. The decoder is then used to display the status on an LED panel (LED3, LED2, LED1, LED0). Draw the logic diagram, truth table of encoder and If the window sensors give the following status: • Window 3 = 0 (Closed) • Window 2 = 1 (Open)	5	1	3



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	- Window 1 = 0 (Closed) - Window 0 = 0 (Closed) Which LED will light up? Justify your answer by explaining the encoder and decoder operations step-by-step.			
	b) An automotive safety system uses three sensors - A (airbag deployed), B (brake engaged), and C (collision detected) to determine whether a warning light should be illuminated. The logic signal controlling the warning light, Q, is implemented by the following gate structure: - One AND gate combining inputs A and B, producing output AB. - Another AND gate take inputs B and C, producing output BC. - The output BC is then sent into another OR gate with input C, yielding BC + C. - Finally, the outputs AB and (BC + C) go into a final OR gate, whose output is Q. i) Draw the circuit and derive the initial Boolean expression for Q based on the described logic. ii) Simplify the expression using Boolean algebra rules to its most efficient form.	5		
5.	An elevator control system uses an SR Flip-Flop to manage the door state (Open/Closed). The system has two inputs: - S (Set) 1 when the "Open Door" button is pressed. - R (Reset) 1 when the "Close Door" button is pressed. The output (Q) represents the door state: - Q = 1 Door Open - Q = 0 Door Closed Constraints: - The invalid state (S=R=1) must be avoided (causes system error). - Initially, the elevator door is closed (Q = 0). Sequence of Events: - A passenger presses the "Open Door" button (S=1, R=0). - The door opens, and after some time, the "Close Door" button is pressed (S=0, R=1). - While closing, another passenger quickly presses both "Open Door" and "Close Door" simultaneously (S=1, R=1). Questions: - Describe the state of the elevator door (Q) after each event? - What happens when both S and R are 1 at the same time? - How can this system be modified to avoid the invalid state using single input and a clock?	10	2	3
