

Reg.No.:



VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN  
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]  
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

**Question Paper Code: 60012**

B.E / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2025

Third Semester

Information Technology

U23IT301– DIGITAL SYSTEMS DESIGN

(Regulation 2023)

Time: Three Hours

Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Mention 3 applications of Karnaugh map and what is its use in Boolean function minimization.	2	K2	CO1
2.	Convert the binary number 1011.01 to its decimal equivalent.	2	K2	CO1
3.	How does an encoder operate within a digital system, and what is its primary purpose?	2	K1	CO2
4.	Provide the logic expression for a full subtractor circuit.	2	K2	CO2
5.	Distinguish between level triggering and edge triggering in flip-flops.	2	K2	CO3
6.	Draw the truth table of a JK flip-flop and explain its behavior.	2	K2	CO3
7.	Define static hazard and dynamic hazard with brief examples.	2	K1	CO4
8.	Indicate the purpose of state reduction in asynchronous sequential circuit design.	2	K2	CO4
9.	Compare Static RAM and Dynamic RAM in terms of assembly and operation.	2	K2	CO5
10.	What is a Field Programmable Gate Array? List two advantages of using FPGAs in digital system design.	2	K1	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	i. Simplify the Boolean function: $F=ABC'D'+ABC'D+AB'C'D+ABCD+AB'CD+ABCD'+AB'CD'F$ Using Boolean algebra and Karnaugh map methods. Show all steps and explain the advantages of each method.	6	K2	CO1
	ii. Using a Karnaugh map, minimize the Boolean function defined by the min-terms $\sum m(1,3,7,11,15)$ with don't care conditions at $d(2,5,10)$ . Show all grouping steps and provide the simplified expression. Implement the simplified function using only NAND gates.	7		
(OR)				
	b) Convert the decimal number 45.625 to its binary representation. Also, convert the binary number 1101.101 to decimal.	13	K2	CO1
12. a)	Design a 2-bit magnitude comparator. Derive the logic expressions for equality, greater than, and less than outputs with detailed truth tables and circuit diagrams.	13	K3	CO2
(OR)				
	b) Convert the following:		K3	CO2
	i. Gray code 1101 to binary	5		
	ii. Binary 1011 to Excess-3 code	4		
	iii. BCD 1001 to Gray code	4		
	Show the steps involved in each conversion.			
13. a)	Discuss the architecture and operation of SR, JK, D, and T flip-flops. Compare their applications in sequential circuits.	13	K3	CO3
(OR)				
	b) Design a 3-bit up-down counter using JK flip-flops. Include the state diagram, excitation table, and circuit diagram.	13	K3	CO3
14. a)	Create a table comparing the different types of hazards in asynchronous circuit static hazard, dynamic hazard, and essential hazard. For each type, explain its cause and describe methods commonly used to eliminate or reduce these hazards.	13	K3	CO4
(OR)				
	b) Given a state table for an asynchronous circuit, perform state reduction and redesign the circuit, ensuring it is free from races and hazards. Show all steps with explanations.	13	K3	CO4
15. a)	Illustrate and explain the architecture of Programmable Logic Array (PLA) and Programmable Array Logic (PAL). Compare their flexibility and typical uses in digital circuit design.	13	K2	CO5

(OR)

- b) Explain the structure, functioning, and typical applications of ROM, PROM, EPROM, and EEPROM. Discuss the key advantages and limitations associated with each type of ROM. 13 K2 CO5

PART – C

(1 x 15 = 15 Marks)

Q.No.	Questions	Marks	KL	CO
16. a)	Design and explain the working of a 2-bit magnitude comparator. Illustrate with truth tables and logic diagrams. Additionally, discuss the implementation of code conversions between Gray code to binary and binary to Gray code with suitable examples.	15	K3	CO2

(OR)

- b) Given a combinational logic function  $F = (A + B) C'$  Show how it can be implemented using both PLA and PAL structures. Provide the programming steps and compare the implementations. 15 K2 CO5