



**GENERAL INSTRUCTIONS TO THE CANDIDATES**

1. Candidates are instructed to answer the questions as per Bloom's Taxonomy knowledge level (K<sub>1</sub> to K<sub>6</sub>)
2. Candidates are strictly instructed not to write anything in the question paper other than their roll number.
3. Candidates should search their pockets, desks and benches and handover to the Hall Superintendent/ Invigilator if any paper, book or note which they may find therein as soon as they enter the examination hall.
4. Candidates are not permitted to bring electronic watches with memory, laptop computers, personal systems, walkie-talkie sets, paging devices, mobile phones, cameras, recording systems or any other gadget / device /object that would be of unfair assistance to him / her.
5. Corrective measures as per KCT examination policies will be imposed for malpractice in the hall like copying from any papers, books or notes and attempting to elicit the answer from neighbours.

**B.E DEGREE EXAMINATIONS: JUNE 2016**

(Regulation 2015)

Second Semester

**COMPUTER SCIENCE AND ENGINEERING**

U15CST202: Digital Systems and Design

**COURSE OUTCOMES**

- CO1: Translate numerical values in various numbers systems and perform number conversions between number systems.
- CO2: Demonstrate the knowledge of logic gates, Boolean algebra and apply optimal minimization techniques to simplify the Boolean function.
- CO3: Analyze and design combinational and sequential circuits
- CO4: Apply the knowledge to solve the real time problems related to digital circuits.
- CO5: Compare various programmable devices and digital logic families.

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. What is the grey code for the binary code 1100? CO1 [K<sub>2</sub>]
  - a) 1100
  - b) 1010
  - c) 1001
  - d) 0101

2. The procedure for obtaining the output expression in SOP form from a truth table can be summarized, in general, as follows CO1 [K<sub>2</sub>]
- i. Give a product term for each input combination in the table, containing an output value of 1.
  - ii. Each product term contains its input variables in either combined form or uncombined form. If an input variable is 0, it appears in combined form; if the input variable is 1, it appears in uncombined form.
  - iii. Each product term contains its input variables in either complemented form or uncomplemented form. If an input variable is 0, it appears in complemented form; if the input variable is 1, it appears in uncomplemented form.
  - iv. All the product terms are OR operated together in order to produce the final SOP expression of the output.

Which of these statements are correct?

- |                     |                    |
|---------------------|--------------------|
| a) (ii) & (iv)      | b) (i),(ii) & (iv) |
| c) (i),(iii) & (iv) | d) (i) & (ii)      |
3. Which one of following is not used in combinational circuits? CO2 [K<sub>2</sub>]
- |                |                    |
|----------------|--------------------|
| a) Input       | b) Output          |
| c) Logic gates | d) Memory Elements |
4. An encoder has \_\_\_\_\_ CO2 [K<sub>2</sub>]
- |                                        |                                         |
|----------------------------------------|-----------------------------------------|
| a) $2^n$ input and n output lines      | b) n input lines and $2^n$ output lines |
| c) $2n - 1$ input and n-1 output lines | d) n-1 input and $2^{n-1}$ output lines |
5. When C=1, S=R=1, what is value of Q in SR latch CO3 [K<sub>2</sub>]
- |                   |                     |
|-------------------|---------------------|
| a) No change      | b) Q=0, Reset state |
| c) Q=1, Set State | d) Indeterminate    |
6. Identify the correct sequence of steps in the design of synchronous sequential circuits. CO3 [K<sub>2</sub>]
1. Assign binary values to the states.
  2. Choose the type of flip-flop to be used.
  3. Reduce the no. of states if necessary.
  4. Obtain the binary-coded state table.
- |                  |                  |
|------------------|------------------|
| a) 4 – 3 – 2 – 1 | b) 1 – 3 – 2 – 4 |
| c) 4 – 1 – 3 – 2 | d) 3 – 1 – 4 – 2 |



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|---------------------------------------------------------|-----------------------|
| 17. What is the Salient feature of Ring Counter?        | CO4 [K <sub>2</sub> ] |
| 18. What is meant by race condition? What is its cause? | CO4 [K <sub>2</sub> ] |
| 19. Differentiate PLA and PAL.                          | CO5 [K <sub>2</sub> ] |
| 20. Write a short note about FPGA.                      | CO5 [K <sub>2</sub> ] |

**Answer any FIVE Questions:-**  
**PART C (5 x 14 = 70 Marks)**  
**(Answer not more than 300 words)**

**Q.No. 21 is Compulsory**

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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| 21. Define prime implicant and essential prime implicants. Using Karnaugh technique, simplify the following Boolean function and implement the simplified expression using Basic gates.<br>F(w,x,y,z)= $\sum(0,1,2,4,5,6,8,9,12,13,14)$ | CO2 [K <sub>4</sub> ]     |
| 22. Convert the following                                                                                                                                                                                                               | CO1 [K <sub>2</sub> ]     |
| a) (444.456) <sub>10</sub> to Octal                                                                                                                                                                                                     | (3)                       |
| b) (11110110101) <sub>2</sub> to Hexa decimal                                                                                                                                                                                           | (3)                       |
| c) (643) <sub>10</sub> to Excess-3 code                                                                                                                                                                                                 | (4)                       |
| d) Subtract (1010) <sub>2</sub> from (1000) <sub>2</sub> using 2's complement method                                                                                                                                                    | (4)                       |
| 23. Obtain the truth table of the following functions and express each function in sum of minterms and product of maxterms.                                                                                                             | CO2 [K <sub>2</sub> ]     |
| (i). (xy+z)(y+xz)                                                                                                                                                                                                                       |                           |
| (ii). y'z+wxxy'+wxz'+w'x'z                                                                                                                                                                                                              |                           |
| 24. i) Design and explain with neat diagram three-to-eight line Decoder.                                                                                                                                                                | (7) CO3 [K <sub>3</sub> ] |
| ii) Design a 4 bit carry look ahead adder.                                                                                                                                                                                              | (7)                       |
| 25. i) Differentiate Latches and Flip-Flops. Explain SR latch with necessary logic diagrams and function tables.                                                                                                                        | (7) CO4 [K <sub>3</sub> ] |
| ii) With a neat diagram design and explain Universal Shift Register.                                                                                                                                                                    | (7)                       |
| 26. Explain the working of BCD Ripple Counter with the help of state and logic diagrams.                                                                                                                                                | CO4 [K <sub>3</sub> ]     |
| 27. i) Implement the following functions with 3 inputs,3 product terms and 2 outputs PLA                                                                                                                                                | (7) CO5 [K <sub>4</sub> ] |
| F1=AB'+AC+A'BC',F2=(AC+BC)'                                                                                                                                                                                                             |                           |
| ii) Explain about Transistor-Transistor Logic with necessary diagrams                                                                                                                                                                   | (7)                       |

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