

## Jharkhand University of Technology, Ranchi

### Diploma 2nd Semester Examination, 2024 (NEP)

Subject : Digital Electronics

Subject Code : ECE201

Time Allowed : 3 Hours

Full Marks : 70

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*Answer in your own words. Answer any five questions in which  
Question No. 1 is compulsory, and from rest of the questions answer any four only.  
All questions carry equal marks.*

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1. Choose the correct alternative:

2×7=14

- (i) What is the main difference between analog and digital signals?
- (a) Analog signals are continuous, while signals are discrete.
  - (b) Analog signals are discrete, while digital signals are continuous.
  - (c) Both (a) and (b) are discrete.
  - (d) Both (a) and (b) are continuous.
- (ii) What is the 2's complement of the binary number 0101?
- (a) 1010
  - (c) 1011
  - (b) 1101
  - (d) 1111
- (iii) Which logic gate can be used to construct all other logic gates (AND, OR, NOT)?
- (a) XOR
  - (b) NAND
  - (c) NOR
  - (d) Both (b) and (c)
- (iv) How does a serial adder differ from a parallel adder?
- (a) Serial adder adds multiple bits at once, parallel adder adds one bit at a time
  - (b) Serial adder uses more gates, parallel adder uses fewer gates
  - (c) Serial adder adds bits one at a time, parallel adder adds all bits simultaneously
  - (d) Serial adder is faster, parallel adder is slower
- (v) What is the main function of a demultiplexer?
- (a) To select one of several input signals and forward it to a single output line
  - (b) To distribute a single input signal to one of many output lines
  - (c) To increase the number of input signals
  - (d) To perform arithmetic operations
- (vi) In a BCD-to-seven-segment decoder, how many segments are controlled by the decoder?
- (a) 6
  - (b) 7
  - (c) 8
  - (d) 9

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- (vii) What is propagation delay in a logic family?
- The time it takes for a signal to be transmitted across a circuit
  - The time delay from input to output in a logic gate
  - The delay in manufacturing an IC
  - The time it takes for an IC to heat up during operation
2. (a) Explain the differences between analog and digital signals. Convert the decimal number 156 to its binary, octal and hexadecimal equivalents. Show all steps clearly. 7+7
- (b) Simplify the following Boolean expression using Boolean algebra:
- $$(A + C + D)(A + C + D')(A + C' + D)(A + B')$$
3. (a) Discuss the OR, AND, NOT, NAND, NOR gates with their symbols and truth tables. 7+7
- (b) Minimize and realize following logic functions using K-map.
- $$f(A, B, C, D) = \Sigma m(0, 1, 2, 5, 8, 9, 10)$$
4. (a) Discuss the concept of a Half Adder (HA) in detail. Include the truth table, derive the logical expression for the Sum and Carry outputs and illustrate the gate-level implementation using basic logic gates.
- (b) Analyze the working of a three-bit parallel adder circuit. Explain how it adds, two 3-bit numbers and how the carry is managed through the Full Adders. 7+7
5. (a) Draw logic circuit of 4 : 1 multiplexer and explain its working. Write the logical expressions and draw the truth table.
- (b) Describe the working of a 1 : 4 Demultiplexer. Explain the relationship between the number of outputs and control lines. Write the logical expressions and draw the truth table. 7+7
6. (a) Describe the working principle of a Decimal-to-BCD encoder. Include a logic diagram, truth table and practical applications.
- (b) Explain the working of a BCD-to-Decimal decoder. Include a logic diagram and a truth table. Discuss how the decoder converts BCD inputs to a decimal output. 7+7
7. Write shorts notes on (any four): 3½×4=14
- BCD-to-seven segment decoder
  - Serial & Parallel adders
  - Two-bit magnitude comparator
  - Half Subtractor (HS)
  - Propagation delay, fan-out, fan-in.