

24RE TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Digital Logic (EX502)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Define digital signal and explain Gray code with example. [1+5]
2. Prove that positive X-OR is equivalent to negative X-NOR. [5]
3. a) Convert the following term into standard min term. $A \cdot B' \cdot C$. [3]
- b) Use K-map method to implement the following function and also draw the reduced circuit using NOR gate. [5]

$F(A, B, C, D) = \sum_m(0, 2, 4, 6, 8, 10, 15)$ and

$d = \sum_m(3, 11, 14)$
4. a) Realize the logic circuit of the following using 8:1 MUX. [4]

$F(W, X, Y, Z) = \sum_m(1, 2, 5, 7, 8, 10, 12, 13, 15)$

- b) When FF_H is ANDed with CO_H what will be the resulting number? Subtract (26) 10 from (16) 10 using 2's complement binary method. [2+2]
5. a) Differentiate between level and Edge triggering? [3]
- b) Explain the operation of two bit magnitude comparator with truth table and circuit diagram. [5]
6. a) Describe different types of registers with diagram. [8]
- b) Illustrate how 1011 data can be stored and retrieve in parallel in serial out shift register with neat timing diagram and truth table. [8]
7. Differentiate synchronous and asynchronous sequential circuits. Explain the operation of mod-12 synchronous counter with timing diagram. [2+6]
8. a) Define state diagram and state table with example. [2]
- b) Design a sequential machine that has one serial input and one output z . The machine is required to give an output $z = 1$ when the input X contains the message 110. [8]
9. Draw the schematic diagram of TTL two input NOR Gate. [6]
10. Explain briefly the block diagram of an instrument to measure frequency. [5]

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1. Define digital IC signal levels. What is Gray Code? Explain with example. [3+3]
2. Construct the given Boolean function: $F = (A+B)(C+D)E$ using NOR gates only. [4]
3. Simplify $F(A,B,C,D) = \pi(0,2,5,8,10) + d(7,15)$. Write its standard SOP and implement the simplified circuit using NOR gates only. [4+4]
4. a) What is priority Encoder? Design octal to binary priority encoder. [2+4]
b) Design a 2 bit magnitude comparator. [4]
5. Design a combinational logic that performs multiplication between two 4 bit numbers using binary parallel adder and other gates. [8]
6. Draw the circuit diagram and explain the operation of positive edge triggered JK flip-flop. What are the drawbacks of JK flip-flop? [7+1]
7. Explain the Serial in Serial out (SISO) shift register with timing diagram. [4]
8. Design the synchronous decade counter and also show the timing diagram. [8]
9. Design a sequential machine that detects three consecutive zeros from an input data stream X by making output, $Y = 1$. [12]
10. Draw the schematic circuit for CMOS NAND gates. What do you mean by totem-pole output? [4+4]
11. Describe the operation of a frequency counter. [4]

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1. List out the name of universal gates and why they are called universal gate? Realise Ex-OR Gate using only NAND gates. [2+2]
2. Explain Excess 3 code with suitable examples. [6]
3. Simplify the function using K-map $F = \sum(0,1,4,8,10,11,12)$ and $D = \sum(2,3,6,9,15)$. Also convert the result into standard minterm. [3+5]
4. Design a 32 to 1 multiplexer using 16 to 1 and 2 to 1 multiplexers. [5]
5. Design a 3-bit even parity generator and 4-bit even parity checker circuit. [3]
6. Draw the block diagram of n-bit full adder and explain its operation. [8]
7. Write down the drawbacks of SR flip flop. Explain the operation of data flip flop with timing diagram and truth table. [1+7]
8. With clear circuit and timing diagram, explain the operation of Serial in - Serial out shift register. [4]
9. Define ripple counter. Explain the operation of mode-10 ripple counter with timing diagram. [1+7]
10. Design a sequential machine that has one serial input and one output z. The machine is required to give an output $z = 1$ when the input x contains the message 1010. [12]
11. Describe the voltage profile of TTL. Explain the operation of TTL to CMOS interface. [2+6]
12. What is frequency counter? Explain with block diagram. [4]

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Subject: - Digital Logic

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1. Draw the general input output voltage profile for TTL gates and also mention the noise margin. What do you mean by Gray code? [3+1+2]
2. Why NAND and NOR gates are called Universal gates? Illustrate with examples. [4]
3. What do you mean by HDL? Design a 2 to 4 line decoder circuit using HDL. [2+3]
4. Simplify $\pi(0, 4, 5, 8, 9, 11, 15)$ using K-Map and write its standard SOP expression. [4+2]
5. Draw the circuit of 4 bit RCA (Ripple Carry Adder), using only block diagrams. What are the problems associated with RCA. Explain how these problems can be eliminated. [4+2+2]
6. Draw the schematic diagram of TTL NOR gate. Discuss the characteristics of TTL 74XX series gates. [6]
7. Draw the circuit diagram of edge triggered JK flip flop and explain it. [5]
8. What is a shift register? With clear timing diagram, describe the operation of a 4-bit parallel - in serial - out (PISO) shift register. [2+6]
9. What is a counter? Design a MOD - 6 synchronous counter. Draw its timing diagram.
10. Design a synchronous state machine with the following specification: [12]
 - a) No. of input: 1
 - b) No. of output: 1
 - c) The output of the machine is to be set high when the data in the input is 110 in sequence, starting from the MSB (Use SR flip - flop).
11. With an example, state and explain the problems associated in the design of asynchronous sequential circuit. [6]
12. Design a two bit magnitude comparator. [6]

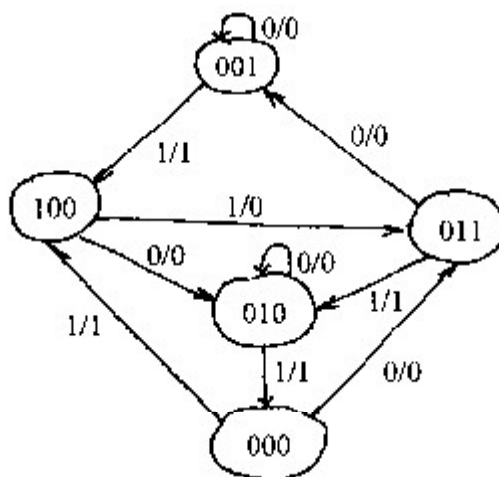
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Subject: - Logic Circuits

- ✓ Candidates are required to give their answers in their own words as far as practicable.
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- Convert the following numbers from the given base to the bases indicated: [1×6]
 - Octal 623.77 to decimal, binary and hexadecimal
 - Hexadecimal 2AC5.D to decimal, octal and binary
- Perform the subtraction with the following decimal and binary numbers using 9's and 1's complement respectively. [2+2]
 - 3570-2100 (Using 9's complement)
 - 10010-10011 (Using 1's complement)
- Prove the following Boolean expression: [4+4+2]

$$AB + A\bar{B}C + \bar{A}BC = AB + AC + BC$$
 And simplify $\Sigma(1,2,3,8,9,10,11,14)$ and $d(0,4,12)$ by using K-map and write its standard product of sum (POS) expression.
- Construct a 5×32 decoder using 3 to 8 decoders and standard logic gate if necessary. Define the term 'decoder'. [8]
- State De-Morgan's theorem. Why NAND and NOR gates are called an universal logic gates. [3+6]
- Explain about JK-flip-flop along with their truth table and characteristic equation. [6]
- Design a mod-10 synchronous counter showing its state circuit diagram and output waveforms. [6]
- Describe briefly the operation of a 4-bit serial in-parallel out register with a clear circuit diagram. [5]
- A sequential circuit has one input and one output. The state diagram is shown in figure. Design the sequential circuit with RS-flip-flops. [10]



- Explain with wave diagram how can you display a letter E in a CRT under 5×7 matrix format. [6]
- Write short notes on: (any two) [5×2]
 - Multiplexing and demultiplexing
 - Gray code
 - Fan-in and fan-out, propagation delay
 - Parity generator