

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), Nov. 2017
B. Tech. in Electronics & Communication Engineering, Semester III

Roll No.....

ECE306: DIGITAL ELECTRONICS

Time: 3.0 hours Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
 2. Assume suitable data wherever required and mention it clearly.
 3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.
 4. Use of Non-Programmable calculator is allowed.
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Q.1A Objective type multiple choice questions (10 questions @ 1 mark) 10

- i. A 4-bit synchronous counter uses flip-flops with propagation delay times of 25 ns each. The maximum possible time required for change of state will be
 - a) 15 ns.
 - b) 25 ns.
 - c) 45 ns.
 - d) 60 ns.
- ii. The number of 16K x 4 RAMs to make a 64K x 16 RAM is
 - a) 4
 - b) 16
 - c) 64
 - d) 1024
- iii. A 16x5 ROM stores
 - a) 4 words of 16 bits each
 - b) 16 words of 5 bits each
 - c) 16 words of 4 bits each
 - d) 5 words of 16 bits each
- iv. A combinational PLD with a programmable AND array and a fixed OR array is called
 - a) PLD
 - b) ROM
 - c) PAL
 - d) PLA
- v. In the decimal numbering system, what is the LSD?
 - a) The middle digit of a stream of numbers
 - b) The digit to the right of the decimal point
 - c) The last digit on the right
 - d) The digit with the most weight
- vi. The race around condition occurs when $\text{clk}=1$, $J=?$, $K=?$
- vii. For designing 128 x 64 ROM, the size of decoder is

- viii. What do understand with 'BJT'?
- ix. Master and Slave FF operates with opposite clock (T/F)
- x. Transistor-transistor logic (TTL) uses the bipolar transistor as its main circuit element. (T/F)

Q.2 Each Question is of 2.5 marks 10

- i. Given $(AB)' + A'B = C$, find $(AC)' + A'C$.
- ii. Give at least four comparison of ROM, PLA and PAL.
- iii. Explain different types of RAM.
- iv. Explain even and odd parity codes.

Q.3A Design a logic circuit with 4 inputs A,B,C,D that will produce output '1' only whenever two adjacent input variables are 1s. A and D are also to be treated as adjacent. Implementing it using both universal gates. 05

Q.3B Do the following conversions. 05

- i. $(756.603)_8 = \text{Hexadecimal}$
- ii. $(B9F.AE)_{16} = \text{Octal}$

Q.4A Consider the following codes and answer the given questions. 05

Code A	Code B	Code C
1111111	3 bit Gray Code	3 bit Binary Code
1000011		
1111110		
0000000		
1111000		
1010101		
1111001		
1100001		

- i. $d_{\min}$ for Code A.
- ii. $d_{\min}$ for Code B.
- iii. $d_{\min}$ for Code C.
- iv. Capability of Code A, Code B and Code C in terms of error detection and error correction.

Q.4B Draw the state diagram, state table and ASM chart for a JK flip flop. 05

OR

Q.4B Design a Mod 13 ripple counter using JK flip flop and draw the output waveforms. 05

Q.5A Determine the size of the PROM required for implementing the following logic circuits: 05

- i. a binary multiplier that multiplies two four-bit numbers;
- ii. a dual 8-to-1 multiplexer with common selection inputs;

- iii. a single-digit BCD adder/subtractor with a control input for selection of operation.

Q.5B Design a Johnson counter with 5 flip-flops. List all the states produced with five flip-flops. Also show the timing waveforms. 05

Q.6A Tabulate the truth table for an 8×4 ROM that implements the Boolean functions 05

$$A(x,y,z) = \sum m(0,3,4,6)$$

$$B(x,y,z) = \sum m(0,1,3,7)$$

$$C(x,y,z) = \sum m(1,5)$$

$$D(x,y,z) = \sum m(0,1,4,5,7)$$

Considering now the ROM as a memory. Specify the memory contents at addresses 1 and 4.

Q.6B The following is a truth table of a three-input, four-output combinational circuit: 05

Inputs			Outputs			
x	y	z	A	B	C	D
0	0	0	0	1	0	0
0	0	1	1	1	1	1
0	1	0	1	0	1	1
0	1	1	0	1	0	1
1	0	0	1	0	1	0
1	0	1	0	0	0	1
1	1	0	1	1	1	0
1	1	1	0	1	1	1

Tabulate and design the PAL structure for the table and mark the fuse map.

Q.7A Write the IC number for all the logic gates. 03

Q.7B A lawn sprinkling system is controlled automatically by certain combination of the following variables. 07

Season (S=1 if summer; 0 otherwise)

Moisture content of the soil (M=1 if high; 0 if low)

Outside temperature (T= 1 if high; 0 if low)

Outside humidity (H=1 If high; 0 if low)

- The sprinkler is turned on under any of the following circumstances.
- The moisture content is low in winter.
- The temperature is high and the moisture content is low in summer.
- The temperature is high and the humidity is high in summer.
- The temperature is low and the moisture content is low in summer
- The temperature is high and the humidity is low.

Use a K-Map to find the simplest possible logic expression involving the variables S,M,T and H for turning on the sprinkler system.

- Q.8A How many flip-flops will be complemented in a 10 bit binary ripple counter to reach the next count after the following counts? 03
- 1001100111
 - 0011111111
 - 1111111111

- Q.8B Design a 4 bit shift register that can work as SIPO and PISO in a same circuit. 07
- OR

- Q.8B Implement the following equations using a suitable PLA circuit. 07
- $$A(x,y,z) = \sum m(1,2,4,6)$$
- $$B(x,y,z) = \sum m(0,1,6,7)$$
- $$C(x,y,z) = \sum m(2,6)$$
- $$D(x,y,z) = \sum m(1,2,3,5,7)$$

- Q.9A A certain memory has a capacity of 8K x 16. 03
- How many data input and data output lines does it have?
 - How many address lines does it have?
 - What is the capacity in bytes?

- Q.9B The controller of a car wash machine is designed to produce the following sequence of steps 07

Water spray (W)	Sponge (S)	Heater (H)
0	0	0
1	0	0
1	1	0
0	0	1
0	0	0

The sequence starts at $W = S = H = 0$ following the pressing of a button B: i.e. $B = 1$ if pressed, $B = 0$ otherwise. If B is pressed while the heater is on ($H = 1$) then return to the step with the heater off ($H = 0$) and water spray on ($W = 1$) and sponge on ($S = 1$). Otherwise B has no effect until the entire sequence of steps is complete. Draw a state diagram for the system.

- Q.10 A sequential circuit has two flip flops (A and B), two input x and y, and one output z. The flip-flop input equations and circuit output equation are 10

$$J_A = B'x + By' \quad K_A = B'xy'$$

$$J_B = A'x \quad K_B = B + xy' \quad z = Bxy + Ax'y'$$

- Draw the logic diagram the circuit.
 - Tabulate the state table.
- Derive the state equation for A and B.

OR

- Q.10 Minimize the following expression 10
- $$f = \sum m(0,1,2,8,9,15,17,21,24,25,27,31)$$
- Also list the PI and EPI terms.