

B.TECH/CSE/3RD SEM/ECEN 2104/2016
DIGITAL LOGIC & COMPUTER ORGANIZATION
(ECEN 2104)

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group - A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) The boolean expression $AB + AB' + A'C + AC$ is independent of the Boolean variable
 (a) A (b) B (c) C (d) none of the above.
- (ii) If $(12X)_3 = (123)_x$, then the value of x is
 (a) 3 (b) 3 or 4 (c) 2 (d) none of the above.
- (iii) The stack is nothing but a set of
 (a) reserved ROM address space (b) reserved RAM address space
 (c) reserved I/O address space (d) none of the above.
- (iv) Von Neumann architecture is
 (a) SISD (b) SIMD (c) MIMD (d) MISD.
- (v) In which addressing mode the effective address of the operand is generated by adding a constant value to the contents of the register?
 (a) Indexed (b) Indirect (c) Register (d) Absolute.
- (vi) Micro instructions are kept in
 (a) main memory (b) control memory
 (c) Cache memory (d) secondary memory.
- (vii) Principal of locality justifies the use of
 (a) DMA (b) Paging
 (c) Cache memory (d) Polling.

- (viii) A computer uses 8 digit mantissa and 2 digit exponent. If $a = 0.052$ and $b = 28E+11$, then $b + a - b$ will
 (a) result in an overflow error (b) result in an underflow error
 (c) be 0 (d) be $5.28E+11$.
- (ix) The number of transistor in a dynamic CMOS RAM cell is
 (a) 1 (b) 4 (c) 6 (d) 2.
- (x) A Carry Look Ahead adder is preferred over Ripple Carry adder as it
 (a) takes less memory (b) takes less components
 (c) is faster in execution (d) is economical.

Group - B

2. (a) (i) Express the Boolean function $F=xy + x'z$ in a product of maxterm form.
 (ii) Show that a positive-logic AND gate is a negative-logic OR gate, and vice versa
- (b) Simplify the Boolean function:
 $F(w, x, y, z) = \sum (1, 3, 7, 11, 15)$
 And the don't care conditions:
 $D(w, x, y, z) = \sum (0, 2, 5)$
(3 + 3) + 6 = 12
3. (a) Draw the block diagram of a BCD adder circuit with labelling and explain why six needs to be added to get the final sum.
- (b) Simplify algebraically the following Boolean expression:
 $(A + C + D) \cdot (A + C + D') \cdot (A + C' + D) (A + B')$
(5 + 3) + 4 = 12

Group - C

4. (a) A combinational circuit has four inputs and one output. The output is equal to 1 when (1) all the inputs are equal to 1 or (2) none of the inputs are equal to 1 or (3) an odd number of inputs are equal to 1.
 (i) Obtain the truth table.
 (ii) Find the simplified output function in sum of products.
 (iii) Find the simplified output function in product of sums
 (iv) Draw the two logic diagrams.
- (b) A combinational circuit is defined by the following three functions:
 $F1 = x'y' + xyz'$
 $F2 = x' + y$

$F3 = xy + x'y'$
 Design the circuit with a decoder and external gates.

6 + 6 = 12

5. (a) (i) Show the logic diagram of a clocked RS flip-flop with four NAND gates.
 (ii) Distinguish between decoder and demultiplexer.
- (b) (i) Design a BCD counter with JK flip-flops.
 (ii) Distinguish between synchronous and asynchronous sequential circuits.

(4 + 2) + (4 + 2) = 12**Group - D**

6. (a) What is the difference between a direct and an indirect address instruction? How many references to memory are needed for each type of instruction to bring an operand into a processor register?
- (b) Name and explain the various phases of each instruction cycle in a basic computer.
6 + 6 = 12
7. (a) What is cache mapping? Explain Direct mapping for a 256×8 RAM and 64×8 Cache memory.
- (b) What is a virtual memory? Why is it called virtual? What is a page? What is demand paging? What is a page fault?
(2 + 2) + (2 + 1 + 1 + 2 + 2) = 12

Group - E

8. (a) Draw and explain the block diagram of a DMA controller.
- (b) Compare the Pros and Cons of a RISC and CISC based architecture.
6 + 6 = 12
9. (a) Describe a hardwired control Unit, and also a Micro-programmed Control Unit. Identify the primary differences between the two techniques. Compare their advantages, and disadvantages.
- (b) Describe horizontal versus vertical microprogramming.

(4 + 2 + 2) + 4 = 12