

2012

DIGITAL ELECTRONICS

Time : 3 hours

Full Marks : 70

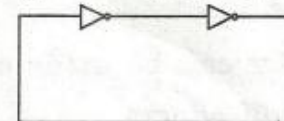
Instructions :

- (i) All questions carry equal marks.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

1. Choose the correct answer (any seven) :

- (a) The decimal equivalent of binary number 1101·0011 is
- (i) 12·1875
 - (ii) 13·1875
 - (iii) 11·1865
 - (iv) 13·1865
- (b) A full adder can be made of
- (i) two half adders
 - (ii) two half adders and a NOR gate
 - (iii) two half adders and an OR gate
 - (iv) two half adders and an AND gate

- (c) When two 16-input multiplexers drive a 2-input MUX, what is the result?
- (i) 2-input MUX
 - (ii) 4-input MUX
 - (iii) 16-input MUX
 - (iv) 32-input MUX
- (d) The 'race-around' condition occurs when
- (i) $J = 0, K = 0$
 - (ii) $J = 0, K = 1$
 - (iii) $J = 1, K = 0$
 - (iv) $J = 1, K = 1$
- (e) The maximum possible number of states in a ripple counter with 5 flip-flops is
- (i) 32
 - (ii) 15
 - (iii) 10
 - (iv) 5
- (f) The digital circuit using two inverters shown in the figure will act as



- (i) a bistable multivibrator
- (ii) an astable multivibrator
- (iii) a monostable multivibrator
- (iv) an oscillator

- (g) The logic circuit which belongs to non-saturated logic is
- ECL
 - TTL
 - CMOS
 - NMOS
- (h) A 12-bit A/D converter has a range of 0–10 V. What is the approximate resolution of the converter?
- 1 mV
 - 2.5 mV
 - 2.5 μ V
 - 12 mV
- (i) Which one of the following statements about RAM is not correct?
- RAM stands for random access memory
 - It is also called read/write memory
 - When power supply is switched off, the information in RAM is usually lost
 - The binary contents are entered or stored in the RAM chip during the manufacturing
- (j) The minimum number of flip-flop required to construct a mod-75 counter is
- 5
 - 6
 - 7
 - 8

2. (a) Draw a full-adder circuit and explain its operation.
- (b) Explain the general principle of counter-type A/D converter.
3. (a) State and prove de Morgan's theorem. How is it helpful in minimizing a given Boolean expression?
- (b) Show that
- $\overline{\overline{A+B} + \overline{A+B}} = A$
 - $(A+B)(B+C)(C+A) = AB + BC + CA$
 - $AB + \overline{B} \overline{C} + A \overline{C} = AB + \overline{B} \overline{C}$
- (c) Simplify $B + A\overline{B} + AB$.
4. (a) What is *J-K* flip-flop? How can problems associated with *R-S* flip-flop be eliminated with the help of *J-K* flip-flop?
- (b) Design a 3-bit synchronous counter using *J-K* flip-flops.
5. (a) How do you realise a parity bit checker?
- (b) Describe the operation of the parallel in serial out shift register with neat logic diagram.
6. Design a mod-8 up-down counter.

7. (a) Design a 100 kHz, 60% duty cycle square wave generator using 555 timer.

(b) A D/A converter has a full-scale analog output of 10 V and accepts six binary bits as inputs. Find the voltage corresponding to each analog step.

8. A digital system has four bits of a 4-bit word $ABCD$ as inputs. The output Y is equal to 1 when any two adjacent bits are 1, or any three or all four bits are 1.

(a) Draw the Karnaugh map for Y .

(b) Realise Y using 2-input and 3-input NAND gates only.

9. Write short notes on the following :

(a) EEPROM

(b) DTL logic

(c) Race-around condition

(d) Encoders
