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

       [Diagram of two inverters]

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

AK13—650/74
( Turn Over )
(a) The logic circuit which belongs to non-saturated logic is

(i) ECL
(ii) TTL
(iii) CMOS
(iv) NMOS

(b) A 12-bit A/D converter has a range of 0–10 V. What is the approximate resolution of the converter?

(i) 1 mV
(ii) 2.5 mV
(iii) 2.5 μV
(iv) 12 mV

(i) Which one of the following statements about RAM is not correct?

(i) RAM stands for random access memory
(ii) It is also called read/write memory
(iii) When power supply is switched off, the information in RAM is usually lost
(iv) The binary contents are entered or stored in the RAM chip during the manufacturing

(i) The minimum number of flip-flop required to construct a mod-75 counter is

(i) 5
(ii) 6
(iii) 7
(iv) 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

(i) \( \overline{A + B + \overline{A} + B} = A \)
(ii) \( (A + B)(B + C)(C + A) = AB + BC + CA \)
(iii) \( AB + B \overline{C} + \overline{A} \overline{C} = AB + B \overline{C} \)

(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