Instructions – (1) All Questions are Compulsory.

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

1. Attempt any FIVE of the following: 10

a) List the binary, octal and hexadecimal numbers for decimal no. 0 to 15.

b) Define fan-in and fan-out of a gate.

c) Compare between synchronous and asynchronous counter (any two points).

d) State two specification of DAC.

e) Write the gray code to given no. (⊥⊥0⊥)₂ = (?) Gray.

f) Define encoder, write the IC number of IC used as decimal to BCD encoder.

g) Draw the logical symbol of EX-OR and EX-NOR gate.
2. **Attempt any THREE of the following:**

a) Convert:
   
   (i) \((AD92 \cdot BC A)_{16} = (?)_{10} = (?)_{8} = (?)_{2}\)
   
   b) Simplify the following and realize it
   
   \[ Y = A + \overline{AB}C + \overline{ABC} + ABC + \overline{A}B \]

   c) Explain the following characteristics w.r.t logic families:
   
   (i) Noise margin
   
   (ii) Power dissipation
   
   (iii) Figure of merit
   
   (iv) Speed of operation

   d) Draw logic diagram of half adder circuit.

3. **Attempt any THREE of the following:**

a) Draw the circuit of successive approximation type ADC and explain it’s working.

b) Describe the operation of R-5 flip-flop using NAND gates only.

c) Give classification of memory and compare RAM and ROM (any four points).

d) State the applications of shift register.

4. **Attempt any THREE of the following:**

a) Subtract the given number using 2’s complement method:
   
   (i) \((-\text{1110}_{2}) - (-\text{1100}_{2})\)
   
   (ii) \((-\text{1010}_{2}) - (-\text{0010}_{2})\)

   b) State De-Morgan’s theorem and prove any one.

c) Compare between PLA and PAL.

d) Reduce the following expression using K-map and implement it
   
   \[ F(A, B, C, D) = \pi M (1,3,5,7,8,10,14) \]

   e) Describe the working of J-K flip-flop and state the race around condition.
5. **Attempt any TWO of the following:**

   a) Design BCD to seven segment decoder using IC 7447 with its truth table.

   b) Describe the working of 4 bit universal shift register.

   c) Design basic logic gates using NAND and NOR gate.

6. **Attempt any TWO of the following:**

   a) Design a mod-6 Asynchronous counter with truth-table and logic.

   b) Design $\perp:8$ demultiplexer using 1:4 demultiplexer.

   c) Draw the circuit diagram of 4 bit R-2R ladder DAC and obtain its output voltage expression.