Code: AE-09

Subject: ANALOG & DIGITAL ELECTRONICS
Time: 3 Hours
Max. Marks: 100

NOTE: There are 9 Questions in all.
- **Question 1 is compulsory and carries 20 marks. Answer to Q. 1. must be written in the space provided for it in the answer book supplied and nowhere else.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 A.   **Choose the correct or best alternative in the following:**
          (2x10)

a.   The open-loop voltage gain of 741 OPAMP is typically

(A) 40 dB.   **(B)** 200 dB.
(C) 100 dB.   **(D)** 70 dB.

b.   How many comparators would a 12-bit flash ADC require?

(A) 4000   **(B)** 3095
(C) 4095   **(D)** 2512

c.   Schottky TTL gates have propagation delay time of the order of

(A) 6 ns.   **(B)** 5 ns.
(C) 2 ns.   **(D)** 8 ns.

d.   The number of flip-flops required to construct a MOD-10 counter that counts from zero through decimal '9' is

(A) 8.   **(B)** 16.
(C) 32.   **(D)** 4.

e.   MOSRAMS are available with around

(A) 1024 memory cells.   **(B)** 4096 memory cells.
(C) zero memory cells.   **(D)** 800 memory cells.

Q.1 B.   True or False

f.   An instrumentation amplifier should not have a high CMRR

   (A) True   **(B)** False

g.   In a Chebyshev filter of even order, the oscillatory curve of the magnitude response starts from unity

   (A) True   **(B)** False

h.   As the gate voltage switches from a LOW voltage to a HIGH voltage, the   N-MOSFET will switch from a very LOW resistance to a HIGH resistance

   (A) True   **(B)** False

i.   The circuit for a DEMUX is basically the same as for a decoder, provided
                                                the decoder has an enable input

   (A) True   **(B)** False

j.   Due to its simple circuit structure, MOS circuitry is not so well suited for LSI

   (A) True   **(B)** False

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2   a.   What are the characteristics of the 741 practical OPAMP? List the important features of the above device.   **(9)**

   b.   Define the following for an OPAMP
       (i) Input bias current   (ii) output offset voltage drift
        Briefly describe how the input bias current can be measured for an OPAMP.   **(4)**

   c.   Draw the circuit of a basic instrumentation amplifier that uses three OPAMPS.   **(3)**

Q.3   a.   Which is the feature of the commercially available OPAMPS that helps the designer to design active filters upto frequencies of several megahertz. You are given a Low-pass and a high-pass filter, how would you construct a band-reject filter? What is the transformation to be used to convert a LPF to a HPF.
                                        (9)
   b.   Design a second order high-pass Butterworth active filter for a lower cut-ff frequency of 2.5 kilohertz.   **(7)**

Q.4 a. Define the Chebyshev polynomial as power the recursive formula. Indicate the above polynomial valid for the passband and stopband of a low-pass Chebyshev filter. Briefly describe the properties of the Chebyshev polynomial. **(9)**

b. Write a note on the basic CMOSFET switch. **(7)**

Q.5 a. Draw the circuit of a 3-input open-collector TTL NAND gate and explain its operation. **(9)**

b. What is the principle on which ECL operates? Based on this, what is the other name given to ECL? Draw the circuit of a two-input ECL OR/NOR gate and briefly explain. **(7)**

Q.6 a. What is an encoder? Draw the schematic of a general encoder with X inputs. Explain briefly its operation. Give the logic circuit and truth table for an octal-to-binary simple encoder with active-low inputs. **(13)**

b. What do you mean by a priority encoder? Can such a circuit be used to take care of the draw-back of the simple circuit explained in part **(a)** above? **(3)**

Q.7 a. What circuit is commonly used to improve the stability of the conversion process in an ADC? Draw a simplified diagram of such a circuit and briefly explain its features. **(10)**

b. What are the advantages and disadvantages of Dual-slope ADCs? Comment on their major application. **(6)**

Q.8 a. With the help of a block schematic diagram and neat wave forms, explain a clocked J-K flip-flop that is triggered by the positive – going edge of the clock signal. **(10)**

b. What is an asynchronous counter? Why is it so called? Based on its operation, it is commonly referred to as what? What do you mean by 'MOD Number' as applied to an asynchronous counter? **(6)**

Q.9 a. What is the type of MOSFET used in CMOS logic family? Mention the advantages and disadvantages of CMOS. With a neat sketch for illustration, briefly describe the basic CMOS NOR gate. **(10)**

b. How does a static RAM cell differ from a dynamic RAM cell? What are the main drawbacks of dynamic RAM compared to a static RAM? List the advantages of dynamic RAM compared with static RAM. **(6)**