ENGINEERING & MANAGEMENT EXAMINATIONS, DECEMBER – 2006
ELECTRONIC SYSTEM DESIGN
SEMESTER – 3

Time : 3 Hours]   [Full Marks : 70

The figures in the margin indicate full marks.

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

Answer Question No. 1 and any 4 questions from the rest.

1.   Choose the correct answer from the given alternatives in each of the following questions :   10 × 1 = 10

   a)   A differentiator converts a triangular wave to

   i)   linear ramp   ii)   constant D.C. voltage

   iii)   square wave   iv)   sawtooth wave.

   b)   A differential amplifier is used at input stage of any operational amplifier, to ensure

   i)   high CMRR   ii)   wide bandwidth

   iii)   high slew rate   iv)   high open loop gain.

   c)   The peak inverse voltage for full-wave rectifier is

   i) V_m ii) $2V_m$

   iii) V_m / π iv) $2V_m / \pi$.

   d)   An ideal operational amplifier is

   i)   voltage controlled current source

   ii)   current controlled voltage source

   iii)   current controlled current source

   iv)   voltage controlled voltage source.

e) A filter used after rectification in power supply is

  i) high-pass filter   ii) low-pass filter

  iii) all pass filter   iv) bandpass filter.

f) The gain required for sustained oscillation in Wien-bridge oscillator is

  i) 29   ii) 1·5

  iii) 3   iv) none of these.

g) A bistable multivibrator has

  i) no stable state   ii) only one stable state

  iii) two stable states   iv) none of these.

h) A linear integrator with an input of square wave provides at the output

  i) Triangular wave   ii) Ramp

  iii) Sharp pulses   iv) none of these.

i) The function of a linear voltage regulator is to

  i) minimise the change in voltage at any load condition

  ii) reduce the ripple at the output voltage

  iii) reduce the voltage fluctuation due to sudden change in load

  iv) supply constant current at all load condition.

j) A transconductance amplifier has a gain of 20 m A/V. For an input signal of 50 mV peak to peak, the peak to peak output current is

  i) 1 mA   ii) 0·4 A

  iii) 1 Amp   iv) none of these.

2. a) Draw the circuit and explain the operation of a square wave generator.

  b) Draw the circuit diagram for a differential amplifier using op-amps for a voltage gain of 10. Choose the resistances accordingly.

  c) Explain the role of an instrumentation amplifier in industry with the help of suitable block diagrams.   5 + 5 + 5

3. a) Draw the simulation diagram using analog computers for the differential equation

$$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 8y = 3e^{-2t} \text{ for } y(0) = -1, \frac{dy}{dt}(0) = 1.$$

   b) Draw and explain the function of an Antilog converter.   10 + 5

4. a) Draw the circuit diagram of a Schmitt trigger using op-amp. Explain the role of hysteresis and indicate the parameters to adjust this property in comparator.

   b) Draw the circuit diagram for an astable multivibrator using 555 I.C. (Timer). Derive the expression for frequency of the output waveform.   (4 + 3) + (3 + 5)

5. a) Draw the circuit diagram for a bandpass filter. Derive its resonant frequency and bandwidth in terms of circuit parameters.

   b) Design a circuit using single operational amplifier to provide an output

$$V_0 = -0.3\,V_1 + 0.2\,V_2 + 0.5\,V_3$$

   Where V_1, V_2, V_3 are all less than the power supply voltage.   15

6. Write short notes on any *three* of the following :   3 × 5

   a) V to F converter.

   b) Analog signal multiplier.

   c) Input and output offset voltage of op-amp.

   d) Passive filters

   e) Current mirror.

7. a) Draw the circuit diagram of a monostable multivibrator and sketch the relevant waveforms. Derive expression for the ON time.

   b) Draw the circuit diagram for a linear voltage regulator using amplifier and Zener diode. Determine the regulation in terms of the gain of the amplifier.

                                                      (5 + 3) + (5 + 2)