2024

Linear Integrated Circuits and Systems

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. a) Compare the features of single ended vs differential signaling for electronic systems.   [6]

   b) Derive the expression for the output voltage of the following circuit (Fig 1 a) and plot the graph of Vin~vs~Vout.   [8]
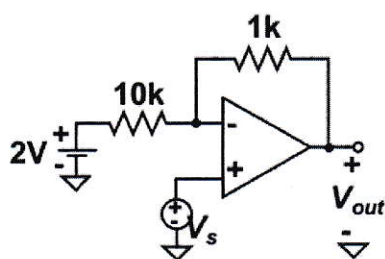

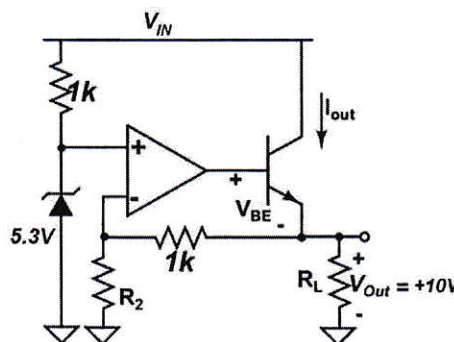Figure 1 a   Figure 2 b

   c) Draw the circuit diagram of the precision rectifier. Explain it's operation, plot: the input, output voltage and output of op-amp and the voltage transfer characteristics.   [6]

2. a) For the voltage regulator circuit shown in Fig 1. (b), the line voltage $V_{IN} = 20V \pm 20\%$ and regulated output voltage V_{OUT} is shown. Find the value of the resistor R2, and also the maximum power appearing across the Q1 transistor. Q1has $V_{BE} = 0.7V$ and high value of β.   [6+4]

   b) Draw the circuit diagram of a Anti-log amplifier with op-amp and derive the expression for the output voltage and mention it's applications in signal processing.   [10]

3. a) Describe the operation of a Schmidtt Trigger circuit with waveform and transfer characteristics. Mention the advantages of it with normal comparators.   [8]

   b) Draw the design flow of electronic system.   [4]

   c) Draw the circuit diagram of square wave generator in astable mode with an   [8]

op-amp. Find the expression for the frequency.

4. a) Describe the operation of saturated precision rectifier for first quadrant operation with proper circuit diagram and plot the voltage transfer characteristics. [2+4 =6]

   b) Draw the design flow of electronic system. [6]

   c) Determine the output waveform from a true integrator for the input waveform as shown, which is governed by the equation: $Vout(t) = \int_0^t Vin(t) + Vout(0)$. Assume capacitor is initially relaxed. [8]
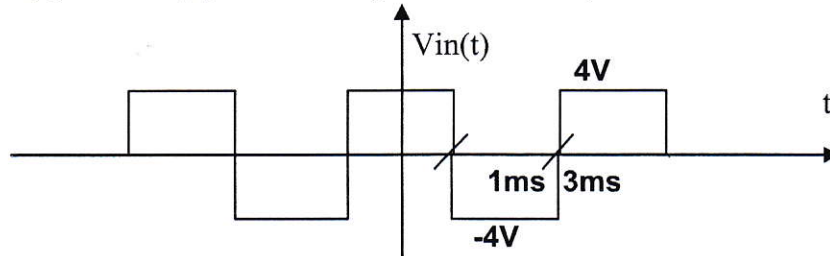

5. a) What do you mean by offset voltage? Mention the causes of offset in op-amp. Find the expressions for the input offset voltage of a differential pair. [2+2+6]

   b) Find the values of the output voltage, Io, IL, Rin, Rout for the circuit shown here. [10]
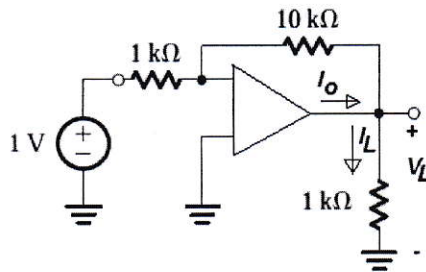
6. a) Draw the time domain waveforms: $v_n(t), v_P(t), v_{out}(t)$, of the circuit diagram shown below Fig. (a) and plot the voltage transfer characteristics, when it is driven by an input: $Vin(t) = 4V \cos 2000\pi t$. [8]
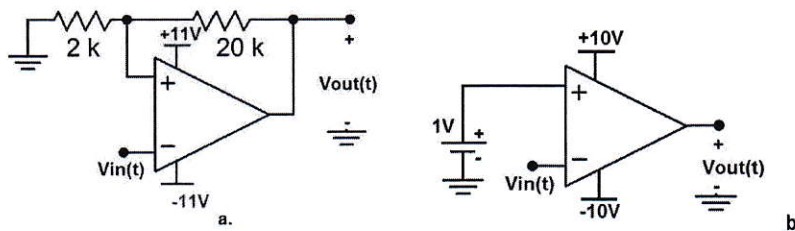
   b) Draw the circuit diagram of a VCVS with infinite input impedance. Find the expression for the output of circuit, if the input analog signal is $Vin(t) = 3\cos 50\pi t + 1.5\sin 300\pi t - 3.5\cos 100\pi t$ and $R_f = 3k\Omega$, $R_1 = 1k\Omega$. [2+6]

   c) Draw the output of the circuit above Fig (b) and find the duty cycle of the output, while input is 5Vpeak 1kHz *sine* wave. [4]