53 (EC 403) LICI

2019

LINEAR INTEGRATED CIRCUITS

Paper : EC 403

Full Marks : 100

Time : Three hours

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

*Answer **any five** questions.*

1. *(a)* Describe the operation of an Inverting Schmitt Trigger circuit and draw its voltage transfer characteristics. 6+2

   (b) An Op-Amp can work as voltage-current converter (Grounded load). Explain and derive proper expression. 7

   (c) Write a short note on compensation techniques. 5

Contd.

2. *(a)* Why Digital-to-analog converters are important in signal processing ? Draw the circuit diagram for weighted resistor DAC and derive expression for output voltage. 2+8

(b) Derive the voltage gain for a dual input, unbalanced output (Active-current mirror load) in differential mode. 10

3. *(a)* A comparator can operate as a PWM signal generator. Explain with circuit diagram and proper waveforms. 8

(b) A common collector amplifier can work as a level shifter. Justify. 4

(c) Describe the operation of phase-locked loop (PLL) with its various blocks. 8

4. *(a)*

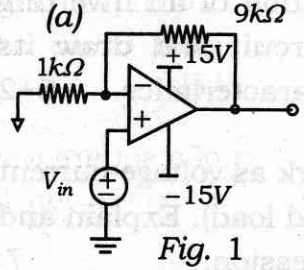

Fig. 1

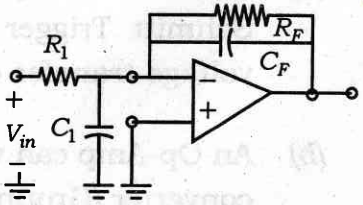

Fig. 2

If an input signal $0{\cdot}5V_{p\text{-}p}\ sin(2\pi\times1000t)$ is applied to the above circuit ; then draw the input and output waveform. If the input is changed $4\,V_{p\text{-}p}\ sin(2\pi\times1000t)$; then draw the output waveform. [*Fig.* 1]. 2+2

(b) Derive the transfer function for the circuit shown in *Fig.* 2. 4

(c) Derive the differential and common mode gain for the following circuit, hence find the expression for CMRR. 10+2

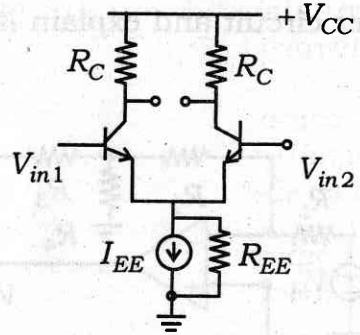

Fig. 3

5. *(a)* Design an active Butterworth (1st order) LPF with passband gain $60dB$ and stopband frequency *2kHz.* 5

(b) Describe the operation of a square wave generator and write the expression for time period. 10

(c) Explain the operation of logarithmic amplifier using Op-Amp with proper circuit diagram. 5

6. *(a)* Mention the importance of All-pass filters ; draw the circuit diagram and derive its transfer function and expressions for phase. 2+2+4+2

(b) Draw the internal block diagram of 555 timer circuit and explain its operation. 4+6

7. *(a)*

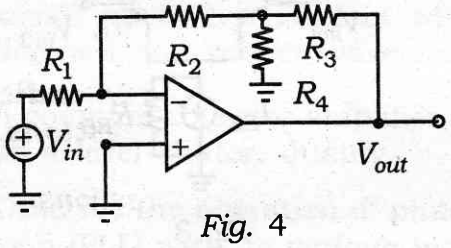

Fig. 4

Derive the expression for output voltage for *Fig.* 4. 8

(b) Define the following terms in relation to Op-Amp V_{10} and I_{10}, SR, PSRR. 4

(c) Draw the Class AB output stage in a typical 741 Op-Amp and explain its operation and (VTC) voltage transfer characteristics. 8