53 (EC 403) LICR

2018

LINEAR INTEGRATED CIRCUIT

Paper : EC 403

Full Marks : 100

Time : Three hours

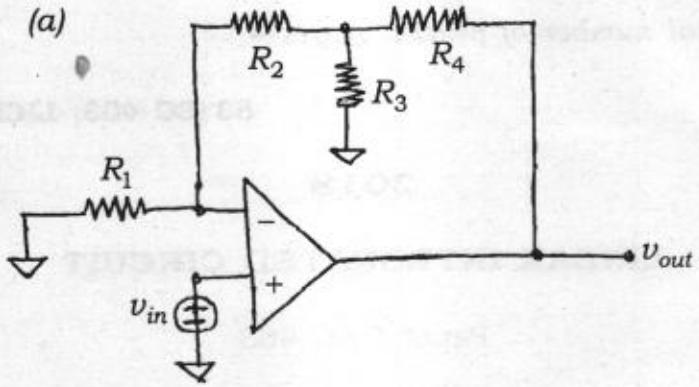
The figures in the margin indicate full marks for the questions.

Answer ***any five*** *questions from* ***seven.***

1. *(a)* Derive the expressions for differential and common mode gain, hence discuss how CMRR can be improved for a dual input balanced output differential pair. 4+4+2

   (b) What is the need of voltage bias generators and current bias generators in integrated Op-Amp circuits ? Discuss different circuits for each. 2+4+4

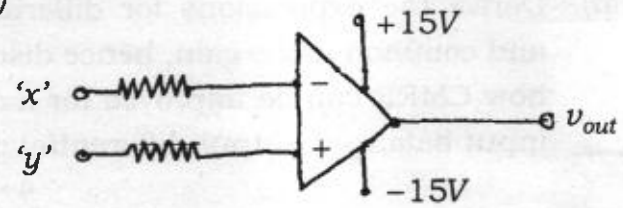
2. *(a)*



Assuming ideal op-amp, derive the expressions for the output voltage. 10

(b) Draw the internal schematic of a 741 Op-Amp (simplified), hence mention the various stages of it. 10

3. *(a)*

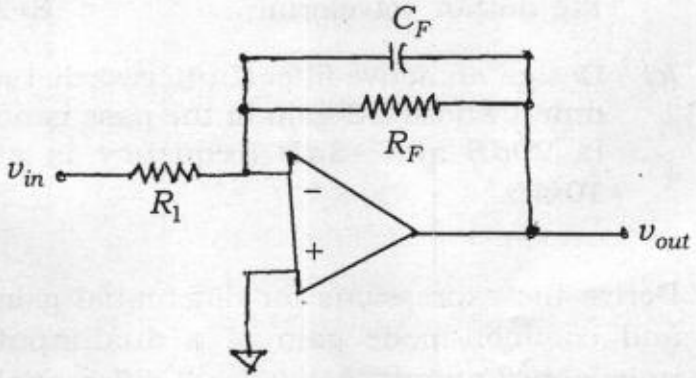


Draw the input and output waveforms, when *'x'* signifies a triangular wave of $1kHz$, $10V_{p-p}$ and *'y'* signifies a sine wave of $100Hz$, $6V_{p-p}$. 8

(b) Classify different types of multi-vibrators used for signal generation, hence discuss the generation of a square wave using a basic free-running multivibrator. 2+10

4. (a) Discuss the internal block diagram of a 555 timer and draw the circuit diagram for mono-stable mode. 8+2

(b)



Derive the expression for unity gain frequency and $-3dB$ frequency for the above circuit shown. 5+5

5. (a) Mention the different architectures of Analog-to-Digital converters and discuss briefly the SAR ADC. 2+8

(b) Discuss the key operation of a phase-locked loop with proper block diagram and waveforms. 10

6. (a) Draw model of an ideal Op-Amp and a non-ideal Op-Amp showing different important parameters. 5

(b) Describe the operation of 555 times as an astable multivibrator, hence derive the expression for the time period of the output waveform. 8+2

(c) Design an active filter (Butterworth 1st order) whose DC gain in the pass band is $20dB$ and $-3dB$ frequency is at $10kHz$. 5

7. Derive the expressions for differential gain and common-mode gain of a dual-input unbalanced output (Active load) differential pair. 10+10