2021

ELECTRONICS — HONOURS

Paper : CC-8

(Operational Amplifiers and Applications)

Full Marks : 50

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 four*** from the rest.

1. Answer ***any ten*** : 1×10

(a) For an op-amp having differential gain Av and common-mode gain Ac the CMRR is given by

(i) Av + Ac (ii) Av/Ac

(iii) (Av/Ac) + 1 (iv) Ac/Av.

(b) With zero volts on both inputs, an op-amp ideally should have an output

(i) equal to the positive supply voltage (ii) equal to the negative supply voltage

(iii) equal to zero (iv) equal to CMRR.

(c) SMPS stands for

(i) sample-mode power supply (ii) simple-mode power supply

(iii) switched-mode power supply (iv) source-mode power supply.

(d) A certain noninverting op-amp has R_i of 1kΩ and R_f 100 kΩ. the closed-loop voltage gain is

(i) 100,000 (ii) 1000

(iii) 101 (iv) 100.

(e) A voltage follower

(i) has a voltage gain of 1 (ii) works in non-inverting mode

(iii) value of feedback resistance is 0 (iv) exhibits all of these.

(f) The op-amp can amplify

(i) a.c. signals only (ii) d.c. signals only

(iii) both a.c. and d.c. signals (iv) neither d.c. nor a.c. signals.

(g) Which filter type is called a flat-flat filter?

(i) Cauer filter (ii) Butterworth filter

(iii) Chebyshev filter (iv) Band-reject filter.

(h) the input stage of an op-amp is usually a

(i) differential amplifier (ii) class B push-pull amplifier

(iii) CE amplifier (iv) swamped amplifier.

(i) Current cannot flow to ground through

(i) a d.c. ground (ii) an a.c. ground

(iii) a virtual ground (iv) an ordinary ground.

(j) An ideal op-amp requires in infinite bandwidth because

(i) Signals can be amplified without attenuation

(ii) Output common-mode noise voltage is zero

(iii) Output voltage occurs simultaneously with input voltage changes

(iv) Output can drive an infinite number of device.

(k) A square wave can be generated using

(i) Adder (ii) Instrumentation Amplifier

(iii) Active Filters (iv) Schmitt Trigger.

(l) What is the duty cycle of the output of an astable multivibrator?

(i) 50% (ii) 100%

(iii) 75% (iv) 55%.

2. (a) Mention the ideal characteristics of the op-amp.

(b) Why practical op-amp characteristics deviate from the ideal one?

(c) Draw the circuit configurations of the 'dual input-balanced output' differential amplifier and the 'dual input-unbalanced output' differential amplifier. 3+2+(2½+2½)

3. (a) What are meant by input offset voltage and input offset current?

(b) Define slew rate.

(c) If the input frequency to an op-amp is 1MHz and the peak value of the output sine wave is 10V, then find the slew rate?

(d) What is the supply voltage rejection ratio? (2+2)+2+2+2

4. (a) Why open-loop op-amp is generally not used in the linear application?

(b) Draw the required circuit and derive the expression of the output voltage for the below-mentioned op-amp configurations :

(i) Summing Amplifier

(ii) Difference Amplifier

(iii) Differentiator. 2+(3+3+2)

5. Draw and explain the operation of an op-amp as a first order low-pass filter. What is meant by cut-off frequency? 4+4+2

6. (a) What are meant by sinusoidal and relaxation oscillators?

(b) Give examples of op-amp based sinusoidal and relaxation oscillators.

(c) Draw the circuit of the op-amp based phase shift oscillator and explain its operation.
(2+2)+(1+1)+(2+2)

7. (a) What is a multivibrator?

(b) Differentiate between astable and monostable multivibrator.

(c) Draw the circuit of the astable multivibrator and explain its operation. Also, find the frequency of operation. 2+2(2+2+2)

8. (a) What are meant by IC 78xx and IC 79xx? What is the main difference between them?

(b) Why filters are needed in electronic circuits?

(c) Draw the frequency vs gain curve for (i) high-pass filter, (ii) low-pass filter, (iii) band-pass filter and (iv) band-reject filter.

(d) What is the use of all-pass filter? 3+2+4+1
