Total number of printed pages = 8

19/4th Sem/DECE 404

2022

LINEAR INTEGRATED CIRCUIT

Full Marks – 100

Time – Three hours

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

Answer any *five* questions.

1. Fill in the blanks : 1×20=20

   (a) Ideal operational amplifier voltage gain ———.

   (b) Ideal operational amplifier input impedance ———.

   (c) Ideal operational amplifier output impedance ———.

   (d) Ideal differential output voltage of common mode signal is ———.

   (e) Ideal operational amplifier CMRR value is ———.

[Turn over

(f) Oscillator is a ——— feedback application of Operational amplifier.

(g) Comparator is a ——— loop application of Operational amplifier.

(h) High pass filter rejects frequencies lower than ——— frequency.

(i) Cut-off frequency is the frequency where normalized gain drops to ——— percentage.

(j) Low pass filter passes frequencies lower than ——— frequency.

(k) Minimum differential input voltage required to force differential output of practical differential amplifier is called input ——— voltage.

(l) For sustained oscillation effective phase shift around the close loop should be equal to ———.

(m) For sustained oscillation, magnitude of loop gain should be ———.

(n) For a pn junction if p side is connected to –1V and n side is connected to –3V then the junction is ——— biased.

(o) Infinite impedance could be replaced by ——— circuit.

(p) Zero impedance could be replaced by ——— circuit.

(q) Frequency of a DC signal is ———.

(r) Impedance of a capacitance is ——— at infinite frequency.

(s) If input differential voltage is 10mV, differential voltage gain is 100000. Then differential output voltage is ———V.

(t) If Rf = 1KΩ Ri=100Ω then voltage gain of a inverting amplifier is ———.

2. (a) What do you understand by filter in electronic circuit ? 2

(b) Draw the circuit diagram of a low pass passive filter. 2

(c) Derive the output voltage equation of a passive low pass filter. 3

(d) Draw the circuit diagram of a low pass active filter. 2

(e) Draw the frequency response of a low pass filter. 3

(f) What are the advantages of using active filter ? 2

(g) If R=10kΩ, C=10uF then calculate cut-off frequency in kilo hertz unit of a low pass filter. 2

(h) Draw the frequency response of a band pass filter. 2

(i) Draw the circuit diagram of a high pass passive filter. 2

3. (a) What do you understand by oscillator in electronic circuit ? 2

(b) Do you need to apply any input signal to oscillator circuit ? 1

(c) Draw and describe RC phase shift oscillator. 3+3=6

(d) $\beta = 0.005$ calculate A for sustained oscillator. 1

(e) Draw the circuit diagram of a Op-amp comparator and explain the working principles. 2+8=10

4. (a) If Rf = 20KΩ, Ri = 50Ω, vin = 20mV, then calculate voltage gain and output voltage as milivolt unit of a non-inverting amplifier. 2+2=4

(b) For a differential amplifier if both the inputs are grounded :

Rc1=Rc2=5KΩ Re=500Ω Vcc=5V Vee = –5V then calculate Vout1 and Vout. 4

(c) Ad =1000000 Ac = 0.001 Calculate CMRR. 2

(d) Is higher value of CRRR is better ? Explain your answer. 3

(e) Derive the output voltage equation of a Op-amp Integrator. 5

(f) Plot output voltage of a Op-Amp integrator if you apply a DC input to the circuit. 2

5. Write down whether the following statements are True / False : 1×20=20

(a) Integrated circuit means using single wafer during fabrication of components.

(b) Common mode noise will be cancelled out for a differential output of a differential amplifier.

(c) Common mode rejection ratio of an ideal differential amplifier is 0.

(d) Operational amplifier uses Differential amplifier at it's final stage.

(e) Negative feedback may be used to stabilize operational amplifier.

(f) Open loop gain of operational amplifier is very high.

(g) If a DC input is applied to a integrator then expected output is ramp.

(h) For oscillation to happen close loop gain should be equal to 1.

(i) If a DC ramp input is applied to a differentiator then expected output is constant.

(j) For oscillation close loop effective phase difference should be equal to 180.

(k) At resonant frequency gain of the circuit is maximum.

(l) Comparator circuit uses negative feedback.

(m) Integrated circuit occupies lesser space than discrete circuit.

(n) Wein bridge oscillator generates square wave signal.

(o) Power amplifier is being used at final stage of operational amplifier.

(p) High pass filter rejects all frequency above cut-off frequency.

(q) Input impedance of an ideal operational amplifier is infinite.

(r) Input impedance of an ideal operational amplifier is 0.

(s) If a DC input is applied to a integrator then expected output is ramp.

(t) Comparator circuit uses positive feedback.

6. (a) Draw the circuit diagram of a weighted resistor type DAC and explain the functions of the same. 4+7=11

(b) Draw the circuit diagram of a Op-amp voltage follower. 2

(c) Derive the output voltage equation of a summing Operational Amplifier. 5

(d) For a two input inverting summing amplifier if vin1=2mV vin2=400uV then calculate output voltage. 2

7. (a) Draw the circuit diagram of a Differential Amplifier and explain the function of it. 3+5=8

(b) Explain Op-Amp data sheet parameters. 12