

Total number of printed pages = 8

19/4th Sem/DECE 404



2022

### LINEAR INTEGRATED CIRCUIT

Full Marks – 100

Time – Three hours

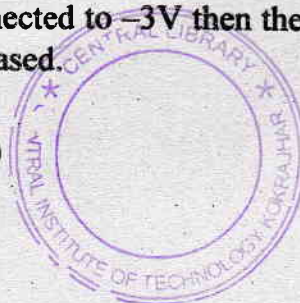
The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

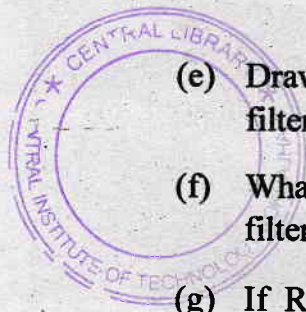
1. Fill in the blanks : 1×20=20
  - (a) Ideal operational amplifier voltage gain \_\_\_\_\_.
  - (b) Ideal operational amplifier input impedance \_\_\_\_\_.
  - (c) Ideal operational amplifier output impedance \_\_\_\_\_.
  - (d) Ideal differential output voltage of common mode signal is \_\_\_\_\_.
  - (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  $R_f = 1K\Omega$   $R_i = 100\Omega$  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  $R=10k\Omega$ ,  $C=10\mu F$  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  $R_f = 20K\Omega$ ,  $R_i = 50\Omega$ ,  $v_{in} = 20mV$ , then calculate voltage gain and output voltage as millivolt unit of a non-inverting amplifier.

2+2=4

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

$R_{c1} = R_{c2} = 5K\Omega$   $R_e = 500\Omega$   $V_{cc} = 5V$   $V_{ee} = -5V$  then calculate  $V_{out1}$  and  $V_{out}$ . 4

(c)  $A_d = 1000000$   $A_c = 0.001$  Calculate CMRR.

2

(d) Is higher value of CMRR 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.

21/19/4th Sem/DECE 404

(5)

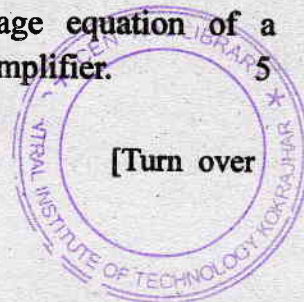
[Turn over



- (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 an 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 an 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  $v_{in1}=2\text{mV}$   $v_{in2}=400\text{uV}$  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

