CBCS SCHEME

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15EC46

Fourth Semester B.E. Degree Examination, Jan./Feb. 2023
Linear Integrated Circuits

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Draw the basic op-amp internal circuit diagram. Identify the terminals and explain the circuit operation. **(06 Marks)**

b. Sketch the op-amp voltage follower circuit with voltage divider providing bias to one input terminal. Show the various currents and explain how the resistor values are selected. **(06 Marks)**

c. An op-amp circuit with closed loop gain of 100 has common mode output of 5μV when the common mode input is 5mV. Calculate the common mode rejection ratio. **(04 Marks)**

OR

2 a. Explain the following parameters of op-amp and give its ideal and typical values :
i) PSRR ii) Input offset voltage iii) Slew rate. **(06 Marks)**

b. Sketch a two-input op-amp inverting summing amplifier, and explain its operation. Derive the equation for output voltage in terms of the inputs. Design a summing amplifier to give the direct sum of two inputs, each ranging from 0.1 to 1V. **(06 Marks)**

c. A simple inverting amplifier has $R_1 = 8.2K\Omega$ and $R_2 = 270\Omega$. Determine the voltage gain calculate the new resistance value for R_2 to give gain of –60. **(04 Marks)**

Module-2

3 a. Sketch the circuit of a high input impedance capacitor coupled non-inverting amplifier, and explain its operation. **(06 Marks)**

b. Draw the circuit of adjustable positive voltage source using op-amp and zener diode. Explain the circuit operation and derive the expression for output voltage. **(06 Marks)**

c. Design a capacitor coupled voltage follower using 741 op-amp. The lower cut off frequency should be 50Hz, and the load resistance is 3.9KΩ. **(04 Marks)**

OR

4 a. Draw the circuit of capacitor coupled difference amplifier, and explain its operation. Also explain how to determine the values of the capacitors. **(06 Marks)**

b. Sketch the circuit of non-saturating half-wave precision rectifier. Draw the input and output waveforms and explain the operation of the circuit. **(06 Marks)**

c. Design a current amplifier to have a gain of 10. The maximum input current is 1mA, the load resistance is 100Ω, and the supply voltage is ± 15V. **(04 Marks)**

Module-3

5 a. Draw the circuit of inverting op-amp Schmitt trigger, and explain its operation. Define UTP and LTP, and sketch the typical input and output waveforms. **(06 Marks)**

b. Sketch the Zener diode peak clipper circuit with adjustable output voltage limit. Explain the circuit operation and write the equations for the upper and lower limits of output voltage. **(06 Marks)**

c. Design an op-amp differentiator to produce 5V output when the input changes by 1V in 100μs. **(04 Marks)**

OR

6 a. Draw the circuit diagram of op-amp sample and hold circuit. Sketch the signal, control and output voltage waveforms, and explain the circuit operation. **(06 Marks)**

b. Draw and explain the circuit of logarithmic amplifier using single op-amp. Derive the expression for output voltages. **(06 Marks)**

c. Design a practical integrator circuit to produce a triangular output waveform having 4V peak-to-peak amplitude, and input of ±5V, 500Hz square wave. Use c = 0.1μF. **(04 Marks)**

Module-4

7 a. Draw the circuit of a first order low-pass filter and explain the circuit operation with frequency response curve. Discuss the role of op-amp in the circuit. Choosing R = 120KΩ, design a first-order low-pass filter to have cutoff frequency of 1.2KHz. **(08 Marks)**

b. What is a voltage regulator? Draw the circuit of series regulated power supply using discrete components and explain the working. Design a regulator using IC7805 to supply a current of 1A to a 10Ω load. **(08 Marks)**

OR

8 a. Draw the circuit of single stage band-pass active filter and explain its operation. Design a band-pass filter to have unity voltage gain and pass-band from 300Hz to 30KHz. Select C_2 = 1000pF. **(08 Marks)**

b. Draw the functional block diagram of IC723 general purpose regulator and explain its working. Show how a simple low positive voltage regulator can be constructed using this IC. **(08 Marks)**

Module-5

9 a. Draw the functional diagram of 555 Timer and explain its operation as monostable vibrator. **(08 Marks)**

b. Draw the circuit of 3-bit R-2R ladder DAC, and explain its operation. Derive the expression for output voltage, by drawing its equivalent circuit, and taking the binary inputs as 100 and 001. **(08 Marks)**

OR

10 a. With a neat block schematic, explain the different blocks of a PLL. Explain lock-in range, capture range and pull-in time. **(08 Marks)**

b. Draw the functional block diagram of successive approximation ADC and explain its operation with an example. Suppose the clock frequency is 4 MHz, what is the conversion time for an 8-bit ADC? **(08 Marks)**

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