

CBCS SCHEME



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17EC45

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024 Linear Integrated Circuits

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- With the help of basic op-amp circuit, investigate the circuit operation for assuming that $V_{CC} = +10V$, $V_{EE} = -10V$, $R_E = 4.7K\Omega$, $R_C = 6.8K\Omega$ and all transistors having $V_{BE} = 0.7V$. (08 Marks)
 - Using a 741 op-amp, design a non-inverting amplifier to have a voltage gain of 66. The input signal amplitude is to be 15mV. (06 Marks)
 - Derive the output voltage equation of a two input non-inverting summer. (06 Marks)

OR

- Define the following op-amp parameters and mention its typical value for 741 op-amp.
i) CMRR ii) PSVR iii) Slew rate iv) Input offset current. (08 Marks)
 - The difference of two input signal is to be amplified by a factor of 37. Each input has an amplitude of 50mV. Using an LF353 op-amp. Design a suitable and calculate the differential and common mode input resistances. (06 Marks)
 - Explain the biasing of a op-amp using potential divider bias with both polarity supply and also mention equation for calculating R_1 and R_2 . (06 Marks)

Module-2

- Explain the operation of a high Z_{in} capacitor coupled voltage follower and show that $Z_{in} = R_1(1 + M)$. (08 Marks)
 - Design a capacitor coupled inverting amplifier is to have a voltage gain of 50 and produces an output of 3V. The lower cut off frequency is 300Hz and load resistance is 6K Ω . Use 741 op-amp. (06 Marks)
 - Explain the operation of a current amplifier and mention its disadvantage. (06 Marks)

OR

- Explain the working principles of capacitor coupled non-inverting amplifier and write the mathematical equations for solving C_1 and C_2 . (08 Marks)
 - Design inverting amplifier is to be capacitor coupled and to have a signal frequency range of 10Hz to 1KHz. If the load resistance is 250 Ω . Use 741 op-amp with $A_V = 50$ and $V_0 = 3V$. (06 Marks)
 - Explain the working of low resistance voltage source. (06 Marks)

Module-3

- Explain the working of sample and Hold circuit using op-amp. (08 Marks)
 - Using a 741 op-amp with a supply of $\pm 12V$, design a phase shift oscillator to have an output frequency of 3.5KHz. (06 Marks)
 - Discuss the working principles of analog multiplier and mention its applications. (06 Marks)

OR

- 6 a. Design an inverting Schmitt trigger circuit using 741 op-amp with a $\pm 18V$ supply to have $UTP = 1.5V$ and $LTP = -3V$. Assume silicon diode with $V_F = 0.7V$ and $R_1 = 27K\Omega$. (08 Marks)
- b. Explain the working of Wein bridge oscillator using op-amp. (06 Marks)
- c. Prove that $V_0 = \frac{-KT}{q} \ln\left(\frac{V_{in}}{V_{ref}}\right)$ of a log amplifier. (06 Marks)

Module-4

- 7 a. Explain the working of first order active low pass filter and also write the design equations. (08 Marks)
- b. Design a second order active high pass filter to have a cutoff frequency of 12KHz. Use a 715 op-amp with $I_{B(max)} = 1.5\mu A$. (06 Marks)
- c. Draw the functional block diagram of 723 regulator and mention the function of each element. (06 Marks)

OR

- 8 a. What are the Four important characteristics of 3 – terminal IC regulator and explain it. (08 Marks)
- b. Design an adjustable regulator from the 7810 regulator to get an output of 15V. Assume $I_{R1} = 50mA$ and $I_Q = 4.2mA$. (06 Marks)
- c. Explain the operation of Narrow Bandpass filter. (06 Marks)

Module-5

- 9 a. Draw the block diagram of PLL and mention functions of each block. (08 Marks)
- b. What output voltage would be produced by a DAC whose output range is 0 to 10V and whose input binary are : i) 10 ii) 0110 iii) 1011100. Assume $R_F = R = 1k\Omega$. (06 Marks)
- c. Design an Astable multivibrator using 555 timer to provide output frequency of 1KHz and duty cycle of 60%. Assume $C = 0.1\mu F$. (06 Marks)

OR

- 10 a. Explain the operation of a successive approximation ADC. (08 Marks)
- b. Define the following parameters of PLL :
i) Lock in Range
ii) Capture Range
iii) Pull-in time. (06 Marks)
- c. Design a monostable multivibrator using 555 Timer with pulse width of 0.25m sec. Derive the equation required for designing a multivibrator. Assume $C = 0.1\mu F$. (06 Marks)

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