CBCS SCHEME

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17EC45

# Fourth Semester B.E. Degree Examination, July/August 2021
## Linear Integrated Circuits

Time: 3 hrs. Max. Marks: 100

***Note: Answer any FIVE full questions.***



1 a. With a neat circuit diagram and relevant equations, explain the basic op-amp circuit. **(07 Marks)**

b. Define the following terms as applied to an op-amp and mention their typical values for IC741: (i) CMRR (ii) Slew rate (iii) PSRR (iv) Input offset voltage **(08 Marks)**

c. Show that $V_{O_{CM}} = \frac{V_{i_{CM}}}{CMRR} \times A_V$ **(05 Marks)**

2 a. Explain the operation of direct coupled non inverting amplifier. Mention the design steps. **(07 Marks)**

b. Explain the working of a three input inverting summer amplifier and show how it can be modified into averaging circuit. **(08 Marks)**

c. For the op-amp circuit shown in Fig.Q2(c), calculate the gain.

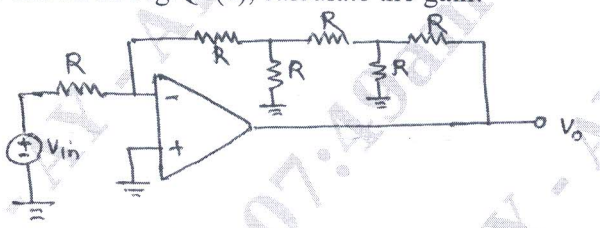


Fig.Q2(c) **(05 Marks)**

3 a. With a neat circuit diagram, explain the operation of high input impedance capacitor coupled non inverting amplifier. **(09 Marks)**

b. A capacitor coupled voltage follower circuit is to be designed to have a lower cut-off frequency of 120 Hz. The load resistance is 8.2 KΩ and the op-amp used has a maximum bias current of 600 nA. Design a suitable circuit. Calculate the new cut-off frequency when the load resistance is changed to 4.7 KΩ. **(06 Marks)**

c. Explain the operation of capacitor coupled inverting amplifier using single polarity supply. **(05 Marks)**

4 a. With a neat circuit diagram, explain the operation of instrumentation amplifier. **(09 Marks)**

b. Design a low resistance voltage source to provide an output of 8V using 741 op-amp with ±15V supply and maximum output current is to be 60 mA. Use a suitable Zener diode. For 741 op-amp $I_{B_{(max)}} = 500$ nA. **(06 Marks)**

c. Explain how a fullwave precision rectifier is implemented using Halfwave rectifier and a summer. **(05 Marks)**

5 a. With a neat circuit diagram, explain the operation of inverting Schmitt trigger circuit. **(08 Marks)**

b. Explain the working of Wien bridge oscillator using op-amp. **(06 Marks)**

c. Design a capacitor coupled Zero Cross Detector (ZCD) using 741 op-amp having $I_{B_{(max)}} = 500$ nA and minimum signal frequency of 500 Hz. the supply voltage are ± 12V. **(06 Marks)**

6 a. Draw an op-amp sample and hold circuit. Sketch the signal, control and output waveforms and explain the operation of the circuit. **(08 Marks)**

b. Explain the operation of logarithmic amplifier using op-amp. **(06 Marks)**

c. Design a RC phase shift oscillator to have an output frequency of 3.5 kHz using 741 op-amp with a supply voltage of ±12V. **(06 Marks)**

7 a. List the advantages and limitations of Active filters. **(06 Marks)**

b. Explain the operation of First order low pass filter using op-amp and mention the design steps. **(08 Marks)**

c. A single stage band pass filter is to be designed using 715 op-amp. The center frequency is to be 3.3 kHz with a passband approximately 50 Hz on each side. Determine the suitable component values. For 715 op-amp choose $I_{B(max)} = 1.5\ \mu A$. **(06 Marks)**

8 a. With a neat circuit diagram, explain the working of voltage follower series regulator. **(06 Marks)**

b. Explain the functional block of 723 general purpose regulator. **(08 Marks)**

c. Design an adjustable regulator using IC7810 regulator to get an output voltage of 15 V and 25 mA. Given Quiscent current = 4.2 mA. **(06 Marks)**

9 a. With a neat block diagram, explain the operation of Phase Locked Loop (PLL). Also define: (i) Pull in time (ii) Lock range (iii) Capture range for a PLL **(08 Marks)**

b. Explain the working of 3-bit R-2R Ladder types DAC. **(06 Marks)**

c. What output voltage is produced by a DAC whose output range is 0 to 10V and whose input binary is :
(i) 10 (for a 2 bit DAC)
(ii) 0110 (for a 4 bit DAC)
(iii) 10111100 (for a 8 bit DAC) **(06 Marks)**

10 a. With a neat functional diagram, explain the operation of monostable multivibrator using 555 timer and obtain the expression for its pulse width. **(08 Marks)**

b. With a neat block diagram, explain the working of successive approximation type ADC. **(06 Marks)**

c. A 555 timer Astable multivibrator has $R_A = 2.2\ K\Omega$, $R_B = 6.8\ K\Omega$ and $C = 0.01\ \mu F$. Calculate $T_{high}$, $T_{Low}$, free running frequency and duty cycle. Draw the circuit. **(06 Marks)**

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