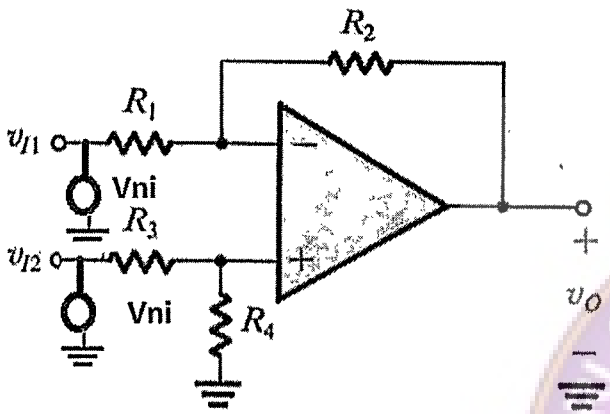


[This question paper contains 12 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5805 **K**

Unique Paper Code : 2512012302

Name of the Paper : Analog Electronics II

Name of the Course : **B.Sc. (H) Electronics (CORE)**

Semester : III (Under NEP UGCF Mode)

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are **seven** questions in all, out of which you have to attempt any **five** questions.
3. **All** questions carry equal marks.
4. **First** Question is Compulsory.

1. (a) Draw and explain the circuit of a voltage follower. (3)

(b) For an integrator with R = 100 kΩ, C = 0.1 μF, and = 2V DC for 10 ms, find $V_0(t)$. (3)

(c) Find the value of the components to be used in a monostable multivibrator which to be used as a divide-by-2 frequency network. The frequency of the input trigger signal is 4kHz. (3)

(d) Explain the following parameters of Operational Amplifier: (3)

(i) Input Offset Voltage

(ii) Supply Voltage Rejection Ratio

(iii) Slew Rate

(e) Calculate the frequency of oscillation for a phase shift oscillator with R = 10 kΩ and C = 0.01 μF. (3)

(i) Determine the Upper Threshold Voltage and the Lower Threshold Voltage.

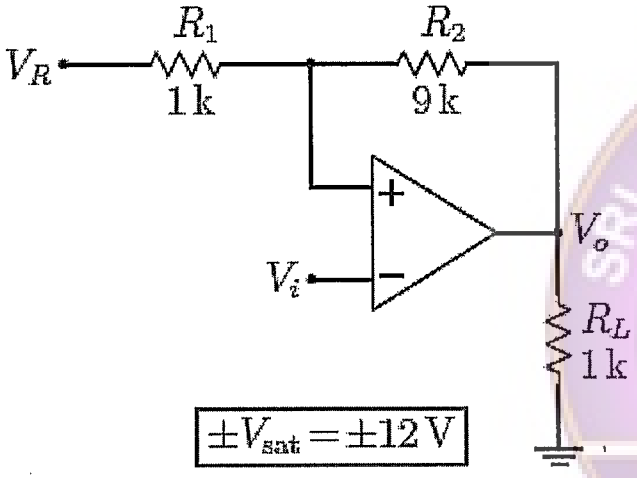
(ii) Calculate the hysteresis width.

(iii) Sketch the input-output characteristic curve indicating threshold points.

(b) Describe the working principle of an astable multivibrator. How can the duty cycle of an astable multivibrator be made 50%? (6)

(c) What is the significance of CMRR? Given $R_2=R_4=10$ KΩ, $R_3=R_1=1$KΩ, $V_{I1}-V_{I2}=V_d=5$mV sine wave at 1 KHz, Vni = 2mV at 50 Hz. Calculate the output voltage at 1 KHz. Also find the amplitude of the induced noise voltage at 50 Hz. Op-amp is 741 with CMRR=90dB. (6)

7. (a) An inverting Schmitt Trigger as shown below is implemented using an operational amplifier with the following parameters: (6)



Saturation voltages V_{sat} = ±12 V,

R_1 = 1kΩ, R_2 = 9kΩ,

Reference input V_R = ±2 V

(f) An inverting summing amplifier has the following parameters

R_f = 10 kΩ, R_1 = R_2 = 20 kΩ, V_1 = 2V, V_2 = 1V. Find its output. (3)

2. (a) The following specifications are given for dual input balanced output 6 differential amplifier- R_c = 2.2 KΩ, R_E = 4.7 KΩ, R_{in1} = R_{in2} = 50Ω, V_{cc} = 10V, $-V_{EE}$ = −10 V, β_{ac} = β_{dc} = 100 and V_{BE} = 0.715 V

(i) Determine Icq and Vceq

(ii) Determine the voltage gain

(iii) Determine input and output resistance

(iv) Determine the output voltage if V_{in1} = 50 mV peak to peak at 1 KHz and V_{in2} = 50 mV peak to peak at 1 KHz.

(v) What is the maximum peak to peak output voltage without clipping. (6)

(b) D erive closed loop gain, input resistance, output resistance and bandwidth for non-inverting amplifier with negative feedback. (6)

(c) Explain the need of negative feedback in op-amp based amplifiers on the basis of the transfer characteristics. List the important characteristics of an ideal op- amp. (6)

3. (a) Why are integrators preferred over differentiators in analog computation? Derive the transfer function of a basic op-amp based differentiator. Discuss the disadvantages of the basic differentiator and how are they improved? (6)

(b) Design a practical integrator circuit for gain limiting frequency fa =1 KHz. Draw the output voltage waveform if the input is a sine wave with a peak-to- peak amplitude of 5 V at 2 kHz. Discuss the limitations of a basic integrator. (6)

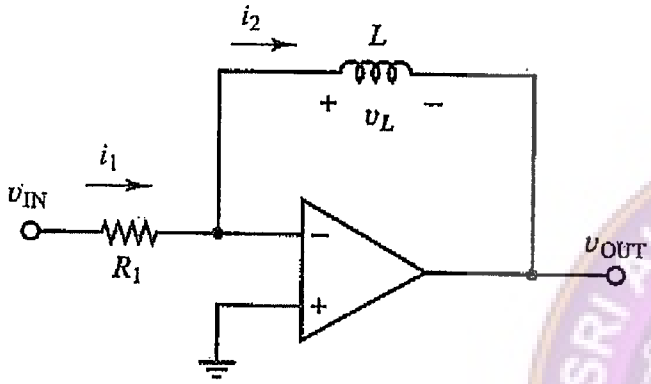
(c) What are active filters? What do you understand by the order of an active filter? Draw the magnitude response of Band Pass Filter, Band Reject Filter and All Pass Filter. Design a first order Butterworth LPF of gain 4 and cut off frequency of 5 KHz. (6)

6. (a) Explain the working of the Wien bridge oscillator with the help of a schematic and a waveform. How is it different from the phase shift oscillator? (6)

(b) Design a square wave generator to generate a wave of frequency 1.2KHz and show the values of each component on the circuit. (6)

(c) Using a schematic, explain the working of the Triangular wave generator. What factors determine the slope of the triangular wave? (6)

5. (a) Calculate the output voltage Vo of the operational amplifier circuit as shown in the figure. (6)

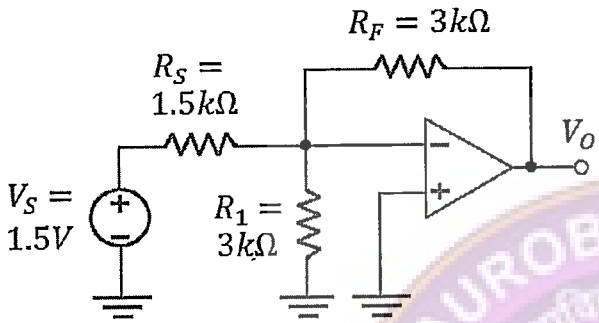


(b) What are the factors on which V_{ooT} of an op-amp depends? Derive its governing equation pertaining to I_{io}. For the closed loop inverting amplifier circuit, Rf=10KΩ, R1=1KΩ, op-amp is MC1536 with Vio=7.5mV max, Iio=50nA max, Ib=250nA max. Calculate V_{ooT}. Design additional network to reduce Vio and bias current. Assume power supply voltage is ±10V. (6)

(c) Discuss the impact of frequency on the gain-bandwidth product of an operational amplifier. What are its practical implications? Determine the cutoff frequency for unity-gain op-amp based amplifier with f_t = 1 MHz. (6)

4. (a) Assume an inverting op-amp with a gain of –10 has a max slew rate of 1 V/μs and is driven by a sinusoidal input with a peak of 1V. At what input frequency will the output start to show slew rate limitation? Show the effect on the output waveform if the sinusoidal input has a peak of 1.5 V for the same gain and slew rate. (6)

(b) (i) Calculate the output voltage Vo of the operational amplifier circuit as shown in the following figure. (6)

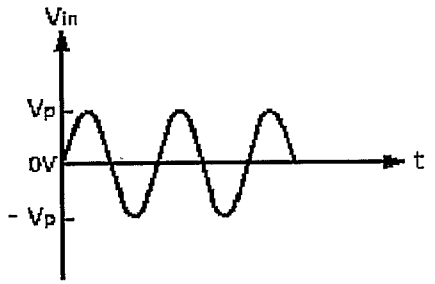


(ii) If the output required is

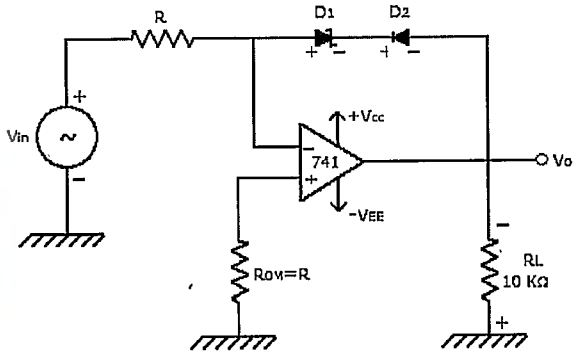
$$V_0 = -(3\ V_1 - 4\ V2 + V_3)$$

and R_f is 1 KΩ, draw the required circuit with appropriate components?

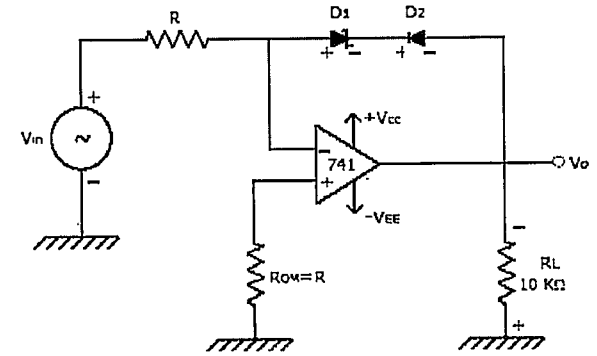
(c) What are the characteristics of an op-amp based comparator? Discuss the limitation. Draw the output of the following circuit for the given input. (6)



(i)



(ii)



P.T.O.