Question No. **1** is **compulsory.**

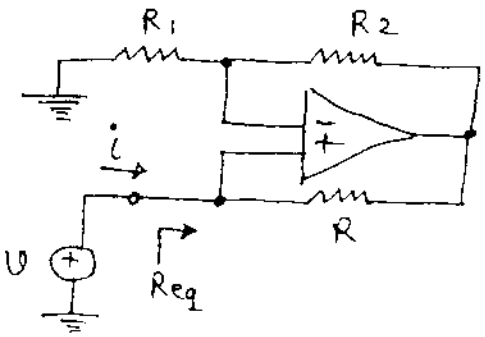
- Attempt any **four** questions from remaining **six**.
- Assume **suitable data** if **required** and **state** it **clearly**.
- **Figures** to the **right** indicate **full** marks.

Any **four** :— 20

a) Design a linear combination circuit using Op-amp to get—

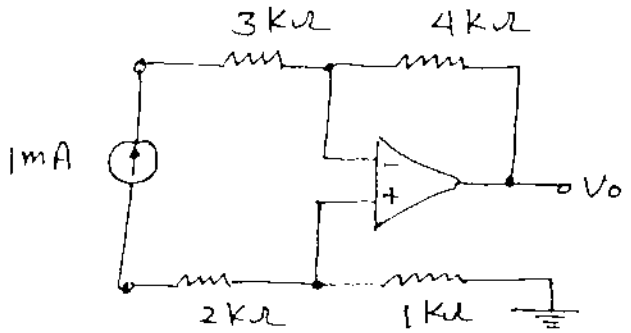
$V_0 = -2V_1 - 8V_2 - V_3$ with $R_{in} \geq 20\ k\Omega$ at all inputs and all Resistances $\leq 200\ k\Omega$.

b)

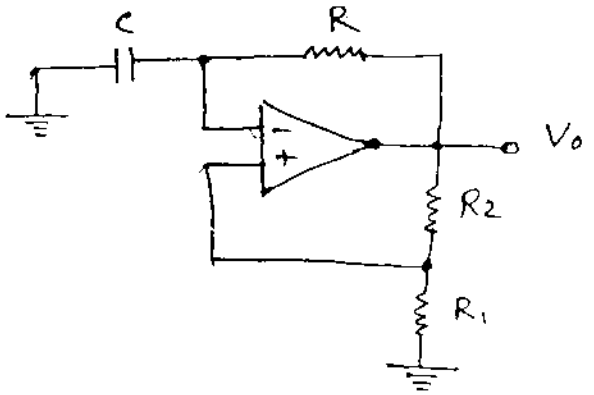


Find $\frac{U}{i}$ = Req.

c) Find V_N and V_P and V_0

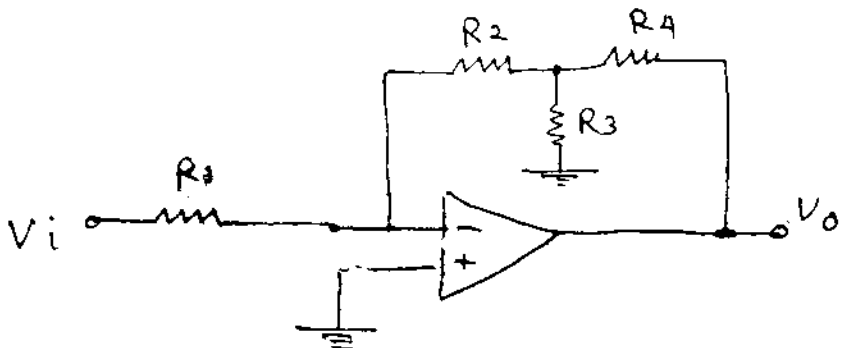


d)

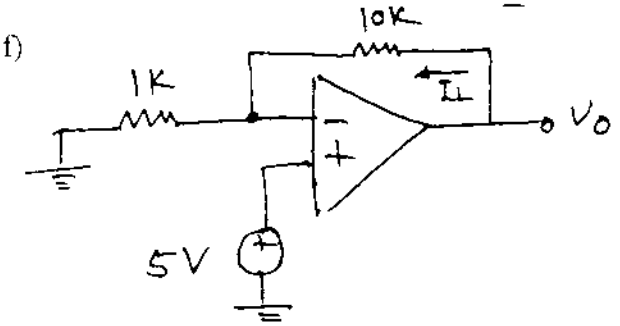


Draw the wave form of the output voltage and derive equation for frequency of V_0.

e) Determine $\frac{V_0}{V_i}$ for the circuit below :—



(f)



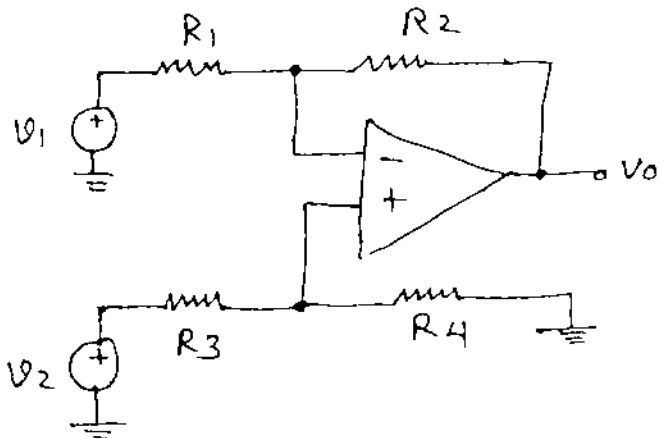
For the circuit shown in the above **figure** find current I_L. If now 10 kΩ resistance is replaced by 20 kΩ find I_L. Assume $\pm V_{sat} = \pm 13$ V.

2. Draw circuit diagram of Low-pass KRC filter. Derive expression for transfer function and convert it in to the following form : $H_{LP}(jw) = \dfrac{K}{1-(w/w_0)^2 + (jw/w_0)Q}$

Find values of K, W_0 and Q by comparing derived expression with above expression. Design the same Low-pass KRC filter using equal component design using $f_0 = 1$ KHz and Q = 5. What is its dc gain ?

3. (a) In the circuit shown below let $R_1 = R_3 = 10$ kΩ and $R_2 = R_4 = 100$ kΩ assuming perfectly matched resistors, find V_0 for each of the following input voltage pairs :—

(v_1, v_2) = (0·1 V, - 0·1 V)
= (4·9 V, 5·1 V) and (9·9 V, 10·1 V)



Now repeat part a with resistors mismatched as follows : R_1 = 10 kΩ, R_2 = 98 kΩ, R_3 = 9·9 kΩ and R_4 = 103 kΩ. Comment.

(b) Draw and explain the circuit diagram to generate square and triangular waveform using Op-amp. Derive expression for frequency and comment about range of frequency.

4. (a) Give different specifications of Instrument Amplifier. Draw 1A using 3 Op-amps of derive the expression for output voltage. Explain output offset technique in such amplifier.

(b) Design a schmitt trigger circuit with following requirements : UTP = + 5 V, LTP = – 1 V. Assume Op-amp is powered with ± 14 V and reference to be added is $V_{Ref.} = -2$ V.

5. (a) Draw functional diagram of PLL IC 565 and explain the following terms along with the working of this PLL.

(i) Free running frequency (ii) Capture range (iii) Lock range.

(b) List out the specifications of Digital to Analog converter (DAC) and explain with circuit diagram any one technique of D to A conversion.

6. (a) Explain how a missing pulse can be detected using IC 555.

(b) Design a phase shift oscillator with f_0= 1 KHz. How to adjust the peak-to-peak output voltage

7. Write short notes (any **four**) :—

(a) Peak Detector Circuit.
(b) Precision Rectifier.
(c) Waveform Generator IC 8038.
(d) Composite Amplifier.
(e) Dominent Pole and Miller compensation.
(f) Sample and Hold Circuit.