

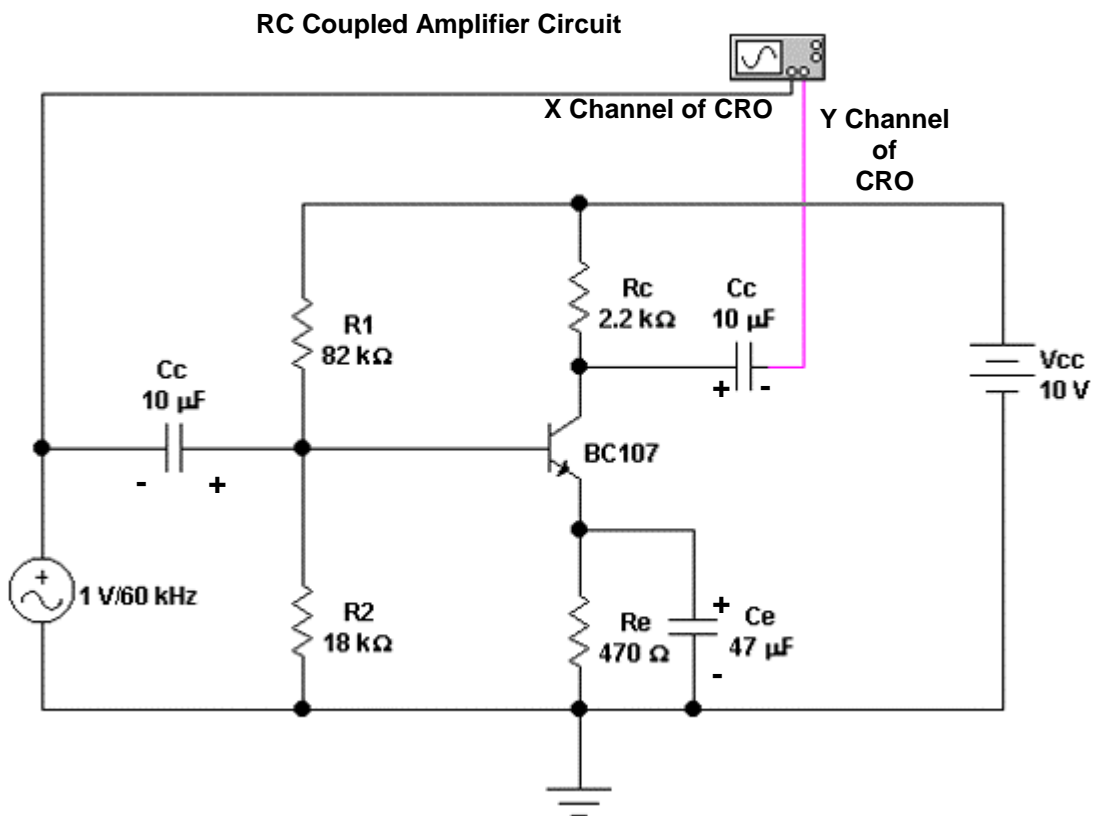
## R-C Coupled Amplifier

Aim: To plot the frequency response, determine the bandwidth and gain bandwidth product and to measure the input and output resistance.

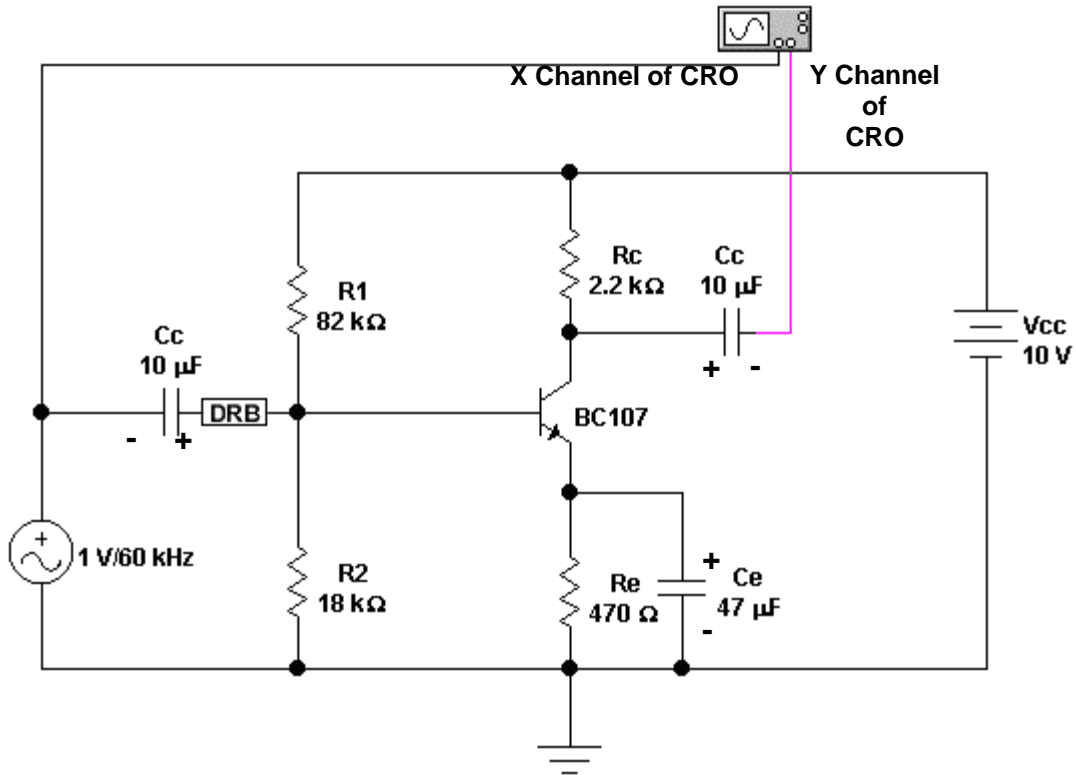
Apparatus required:

- a) Voltage source 10V
- b) BJT BC147
- c) Resistors  $2\text{K}\Omega$ ,  $82\text{K}\Omega$ ,  $18\text{K}\Omega$ ,  $470\Omega$
- d) Capacitors  $47\mu\text{F}$ ,  $10\mu\text{F}$
- e) AFG
- f) CRO.

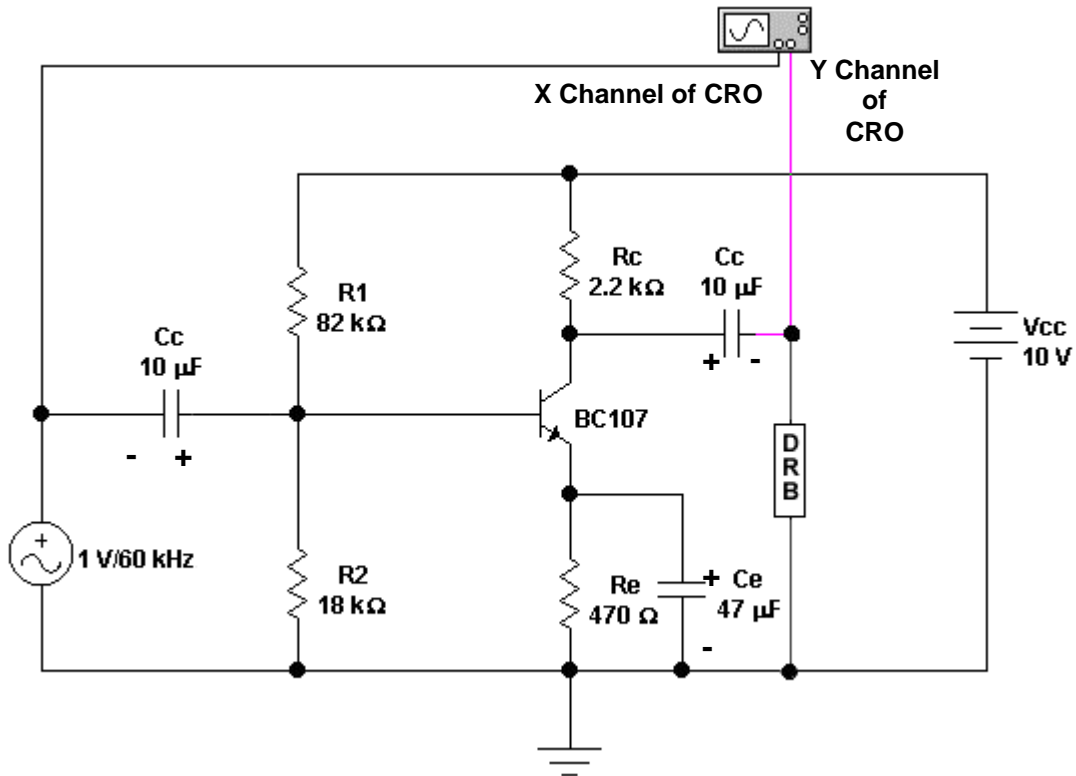
Circuit Diagrams:



## Circuit to find input resistance



## Circuit to find output resistance



Design:

Given :  $V_{cc} = 10V$

$V_{ce} = V_{cc}/2 = 5V.$

Let  $V_e = 1V$ , (Assume  $V_e = (1/10) * V_{cc}$ , i.e.  $0.1V_{cc}$ )

$I_c = 2 \text{ mA}$

The current through the emitter is approximately equal to the current through the collector. Therefore  $I_e \approx I_c = 2\text{mA}$ .

$R_e = V_e / I_c = 500 \Omega.$  (Use  $470\Omega$ ).

From the o/p loop we have

$V_{cc} - I_c R_c - V_{ce} - V_e = 0.$

Therefore  $R_c = 2K\Omega.$

Use transistor BC147 / 6,  $\beta$  for which = 200.

Current through the base =  $I_b = I_c / \beta = 2\text{mA} / 200 = 10\mu \text{ A}.$

Let the current through the resistance  $R_1$  be  $I_1 = 10I_b = 0.1 \text{ mA}.$

Let the current through the resistance  $R_2$  be  $I_2 = 9I_b = 0.09\text{mA}.$

Voltage across  $R_2 = V_2 = V_{be} + V_e = 0.7 + 1 = 1.7V.$

$R_2 = 1.7V / 0.09\text{mA} = 18.88k\Omega.$  (Use  $18K\Omega$ ).

From the i/p loop

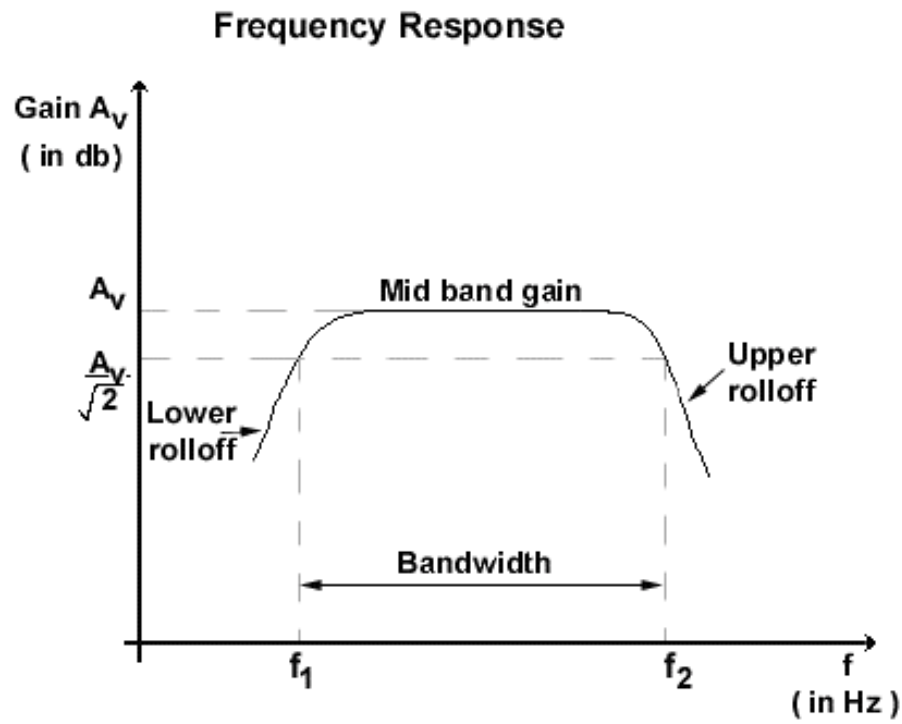
$V_{cc} - I_1 R_1 - 1.7 = 0.$

$R_1 = (10 - 1.7) V / 0.1\text{mA} = 83 \text{ K}\Omega.$  (Use  $82 \text{ K}\Omega$ ).

$C_c = 10\mu\text{F}$      $C_e = 47\mu\text{F}.$

The transistor SL100 can also be used. If it is used,  $\beta$  changes to 50 & the design changes correspondingly.

Expected Curve:



Procedure:

Step 1: Rig up the circuit and check for the dc conditions i.e. whether the measured values of  $V_{ce}$  and  $I_c$  match the values you have assumed.

Step 2: Apply a small signal of 2mV with a frequency of 1KHz and observe the output on the CRO and adjust till the output is distortionless and amplified by the expected gain value.

Step 3: Find the maximum signal handling (M.S.H.) capacity. This can be done as follows. Increase the input signal slowly so that the output signal just starts clipping. Reduce the input slightly and note down the M.S.H. of the amplifier.

Step 4: Set the frequency to 100KHz and note down the output voltage on the CRO.

Step 5: Vary the frequency in suitable steps and note down the output voltage. Repeat this till 1MHz.

Step 6: Plot the freq. response on a semilog sheet and find out the bandwidth.

Step 7: The following steps must be followed to find out the input resistance.

- With the previous set up fix the DRB between the AFG and the junction of  $R_1$  &  $R_2$ . Set the value of the DRB to 0.
- Apply a 1V, 1KHz signal at the input and observe the output.
- Gradually increase the value of the DRB till the output becomes half the input value. This reading on the DRB gives the input impedance.

Step 8: The following steps must be followed to obtain the output impedance of the amplifier.

- With the previous set up insert the DRB across the output and keep its value at the highest possible.
- Apply a 1V, 1KHz signal at the input and observe the output.
- Now slowly decrease the value of the DRB till the output becomes half the input value. This reading on the DRB gives the output impedance of the amplifier.

Result: a) The freq. response is plotted and the bandwidth =  
b) The input impedance =  
c) The output impedance =