Government College of Engineering, Amravati

(An Autonomous Institute of Government of Maharashtra)

Fourth Semester B. Tech.
(Electronics and Telecommunication)

Winter – 2014

Course Code: ETU402

Course Name: Analog Circuits

Time: 2 hr. 30min. **Max. Marks: 60**

Instructions to Candidate

1) All questions are compulsory.
2) Assume suitable data wherever necessary and clearly state the assumptions made.
3) Diagrams/sketches should be given wherever necessary.
4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
5) Figures to the right indicate full marks.

1 **Solve the following questions** 12M

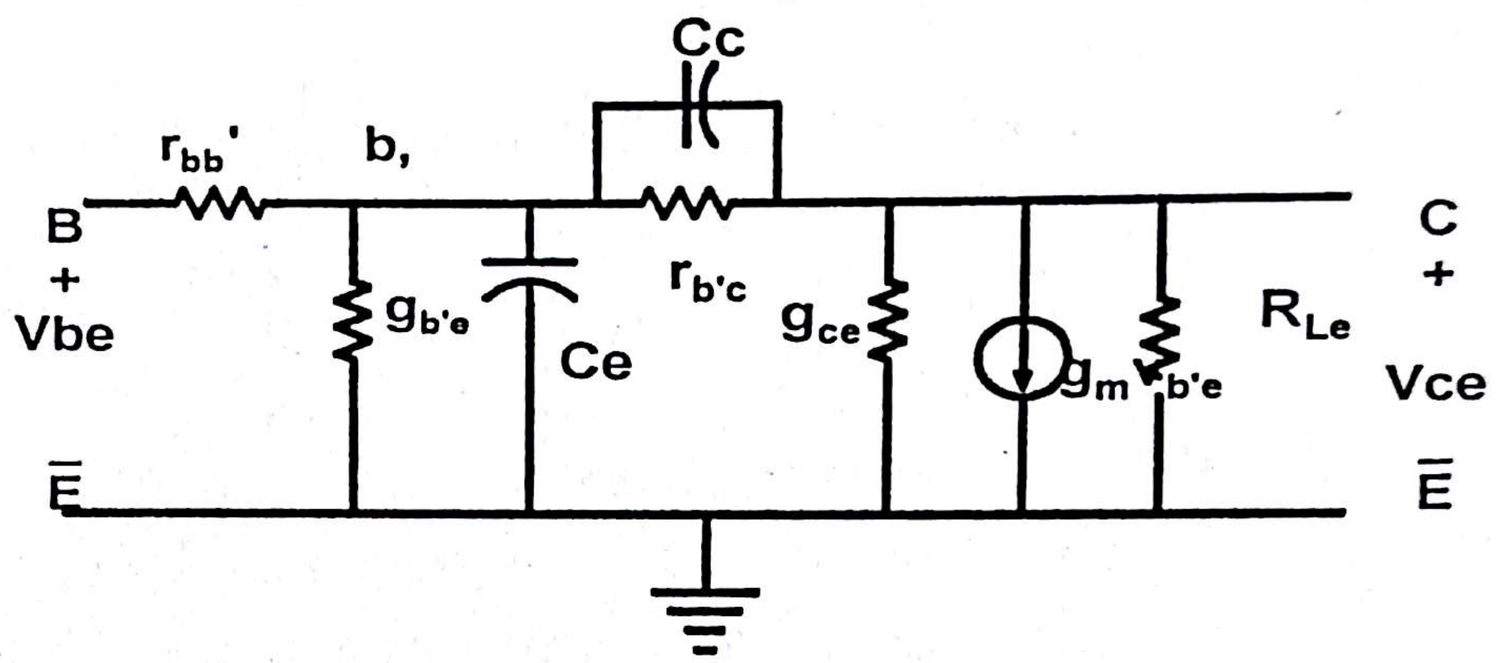
(a) What is feedback in amplifiers? Derive the expression for the closed-loop gain of the amplifier with (i) positive feedback (ii) negative feedback.

(b) A negative feedback of $\beta = 0.002$ is applied to an amplifier of gain 1000.Calculate the change in overall gain of the feedback amplifier if the internal amplifier is subjected to a gain reduction of 15%.

(c) Define desensitivity factor D. Give its significance in negative feedback amplifier.

2 Solve any two from the following questions. 12M

(a) Identify the circuit shown in figure. Design a approximate equivalent circuit and prove that Ai =0.707 of its low frequency value for h_{fe}.



(b) Write a short note on validity of high frequency model. Find the base width of silicon pnp transistor whose figure of merit is 450MHz.Diffusion length of holes is $15cm^2/sec$.

(c) Design a simplified circuit for calculating the CE current gain with resistive load and prove that

$$Ai = -hfe/\sqrt{[1 + \left(\frac{f}{fh}\right)^2]}?$$

12M

3 Solve any two from the following questions.

(a) Explain the effect of emitter bypass capacitor on low frequency response of common emitter configuration and discuss the pole-zero plot of gain.

(b) Design high frequency T model for common base

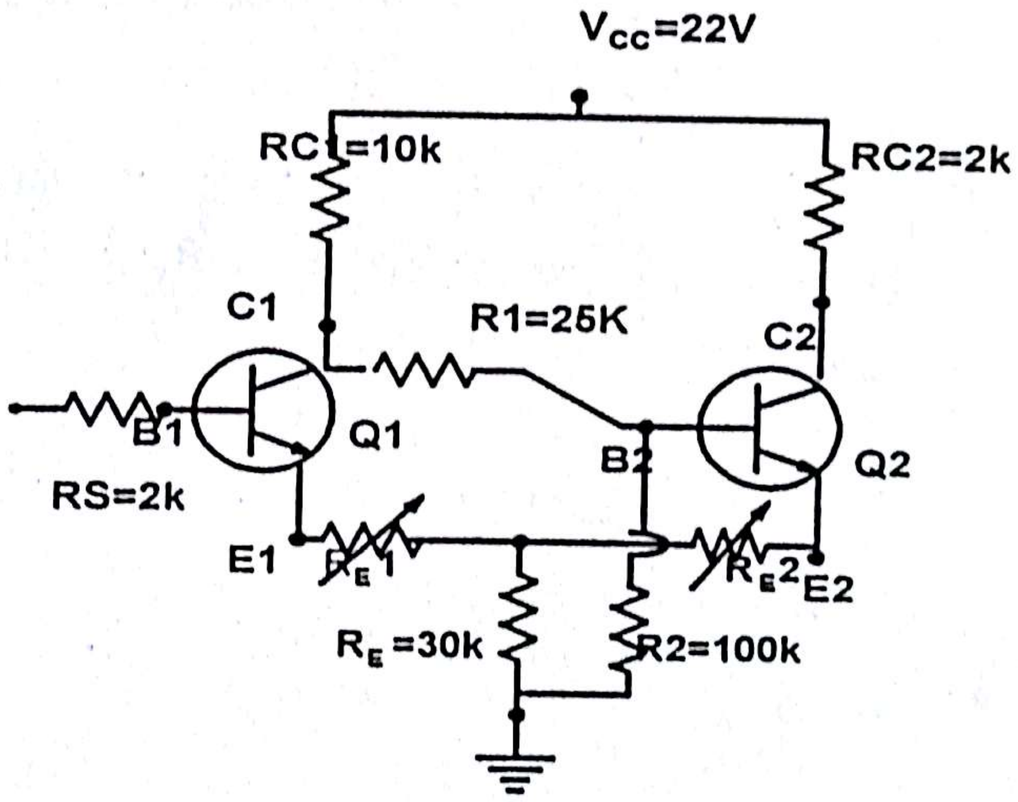
configuration? Also explain its common base short circuit current frequency response?

12M

(c) A BJT has h_{ie}= 6K,and h_{fe}=224 at Ic=1mA with F_T =80MHz and $C_{b'e}$=12pF.Determine (i) g_m(ii) $r_{b'e}$ (iii) $r_{bb'}$ and (iv) $C_{b'e}$ at room temperature and a collector current of 1mA.

4 **Solve the following questions.**

(a) A Schmitt trigger with Ge transistors having hfe =40 is shown in figure .The circuit parameters are Vcc=22V,Rs=2Km,Rc1=10K,Rc2=2K,R1=25K,R 2=100K and R_E = 30K.Find (i)UTP(V1),(ii) LTP(V2),(iii)R_E1 to eliminate hysteresis ,and (iv)R_E2 to eliminate hysteresis. 8M



12M

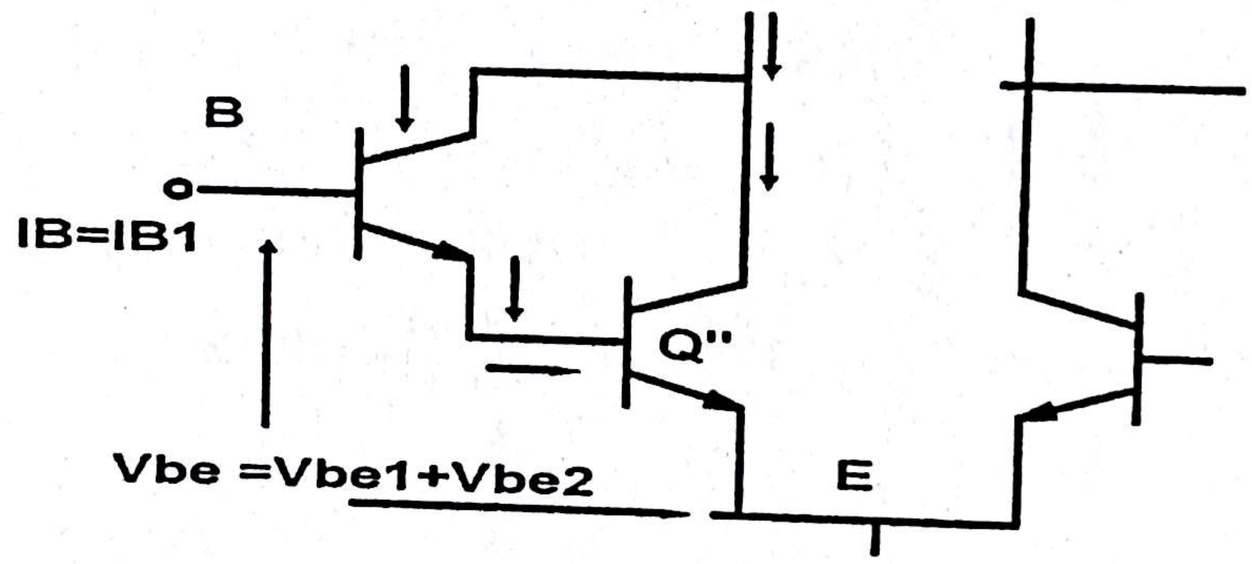
(b) With the help of neat circuit diagram and waveforms, explain the working of astable multivibrator. 4M

5 **Solve any two from the following questions.** 12M

(a) For the current mirror shown in figure, Determine

R so that Io =100μA.

(b) The following figure shows the differential amplifier with the circuit which is used for improving the input parameters, identify the circuit and derive the current gain?



(c) Derive the equation for collector current of differential amplifier and discuss the transfer characteristics of it.

Government College of Engineering, Amravati

(An Autonomous Institute of Government of Maharashtra)

Fourth semester B. Tech. (Electronics and Telecommunication.)

Summer – 2014

Course Code: ETU402 **Course Name: Analog Circuits**

Time: 2 hr. 30min. **Max. Marks: 60**

Instructions to Candidate

1) Assume suitable data wherever necessary and clearly state the assumptions made.
2) Diagrams/sketches should be given wherever necessary.
3) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
4) Figures to the right indicate full marks.

1		**Solve the following questions**	**12M**
	(a)	Derive an equation for the voltage gain of an amplifier that uses series voltage negative feedback.	
	(b)	Draw the circuit diagram of voltage series feedback amplifier and derive the expression for input and output impedance	
	(c)	In a negative feedback amplifier A=100,ß=0.02 and input signal voltage is 40 mV. Determine (i) Voltage gain with feedback (ii) Feedback factor (iii) Feedback voltage (iv) Output voltage.	
2		**Solve any two from the following questions**	**12M**
	(a)	Give the validity condition of Giacoletto model and prove that $\mathbf{h_{ie} = r_{bb'} + r_{b'e}}$ assuming $\mathbf{r_{bb'} << r_{b'e}}$.How does $\mathbf{h_{ie}}$ vary with $\mathbf{I_c}$?	

(b) Design a simplified circuit for calculating the CE current gain with resistive load and prove that

$$Ai = -hfe/\sqrt{[1 + \left(\frac{f}{fh}\right)^2]}?$$

(c) Design high frequency T model for common base configuration? Also explain its common base short circuit current frequency response.

3 **Solve the following questions** **12M**

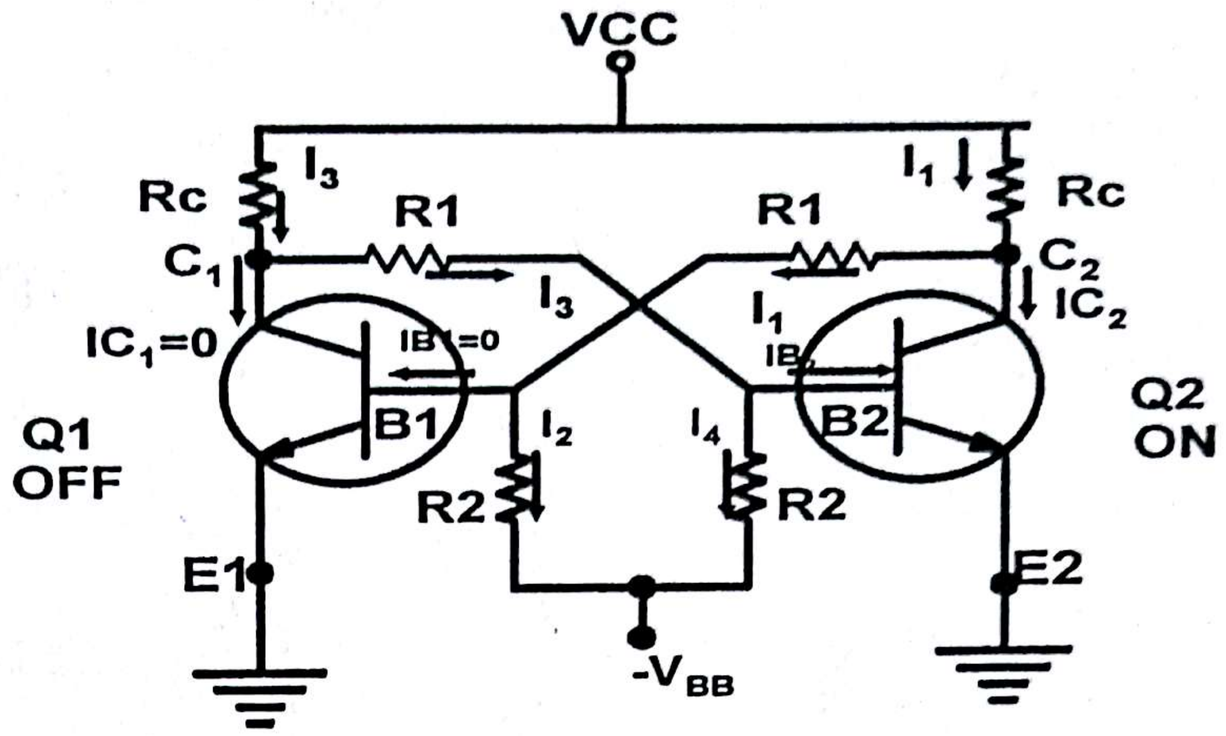
(a) A BJT has h_{ie}= 6K,and hfe=224 at at Ic=1mA with F_T =80MHz and $C_{b'e}$=12pF.Determine (i) g_m(ii) $r_{b'e}$ (iii) $r_{bb'}$ and (iv) $C_{b'e}$ at room temperature and a collector current of 1mA.

(b) Design a high frequency equivalent circuit for an emitter follower with bypass capacitor and also design a frequency response for it

4 **Solve any two from the following questions** **12M**

(a) Draw the circuit diagram of an astable multivibrator .Justify that it is a two stage RC coupled amplifier using feedback. How does it generate a square wave?

(b) Silicon transistor with h_{fe}(min) equal to 20 are available .If $V_{CC} = V_{BB}$ = 12V,determine all the parameters for the circuit shown in figure



(c) What is mean by triggering the binary? Explain unsymmetrical triggering of bistable multivibrator through a unilateral device (diode).

5 **Solve any two from the following questions** **12M**

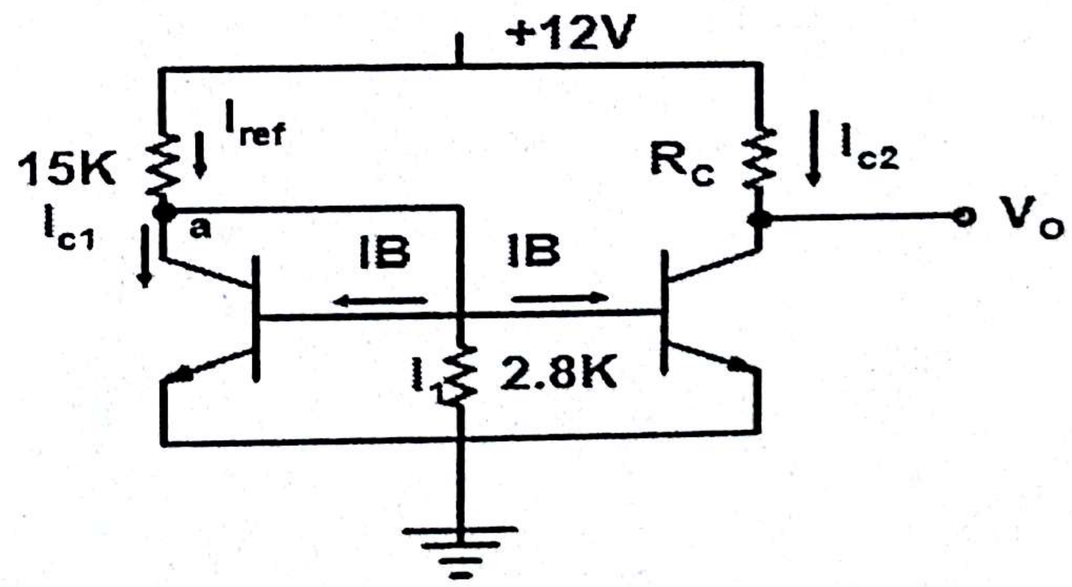
(a) Discuss the method for increasing input resistance of differential amplifier and derive the required equation.

(b) Draw and explain a hybrid π model and equivalent small signal equivalent model of differential amplifier. Derive its differential mode gain, common mode gain and calculate CMRR for it.

(c) For the circuit shown in figure

(a) Determine I_{C1} and I_{C2}

(b) Find R_C so that $V_0 = 6V$. Assume $\beta = 200$.



Government College of Engineering, Amravati

(An Autonomous Institute of Government of Maharashtra)

Fourth semester B. Tech. (Electronics and Telecommunication)

Summer – 2013

Course Code :ETU402 **Course Name : Analog Circuits**

Time : 2 hr.30min. **Max. Marks : 60**

Instructions to Candidate

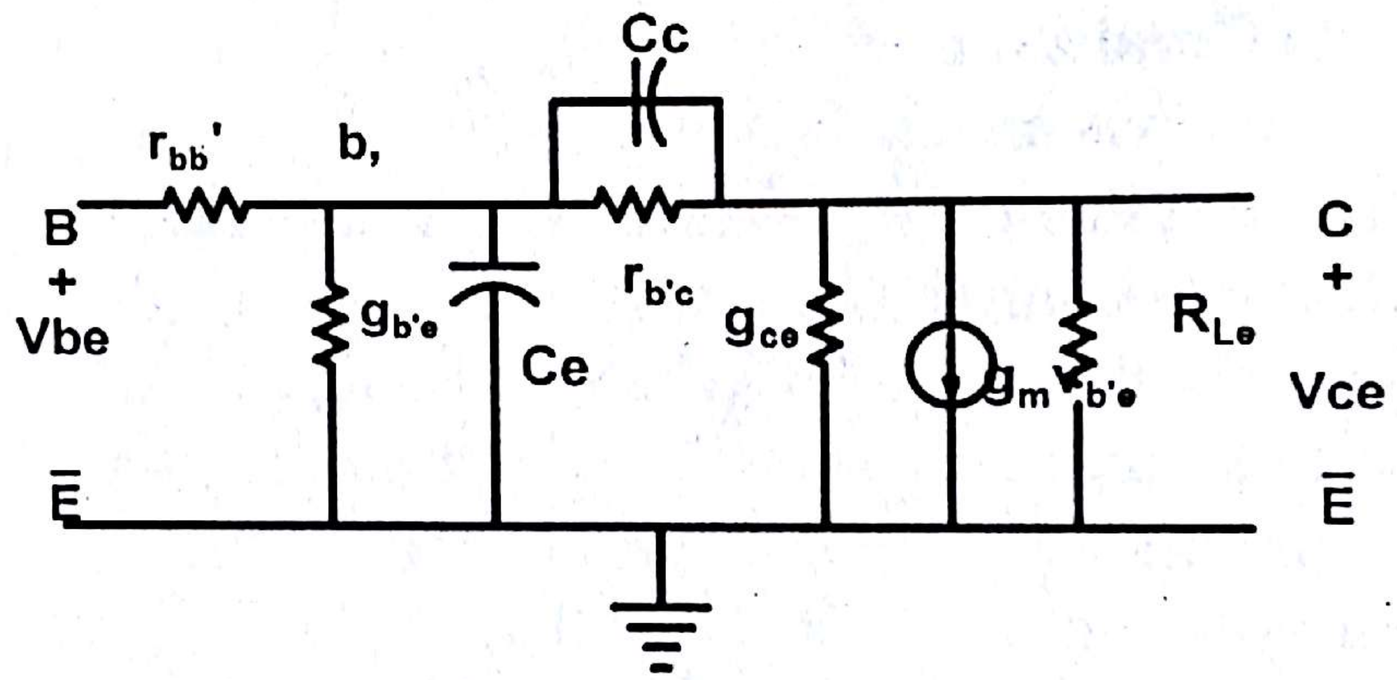
1) All questions are compulsory.
2) Assume suitable data wherever necessary and clearly state the assumptions made.
3) Diagrams/sketches should be given wherever necessary.
4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
5) Figures to the right indicate full marks.

1 (a) Explain the concept of feedback and discuss the following terms with circuit diagram. **5m**
(i)Signal source (ii)feedback Network
(iii)sampling network (iv)comparator network
and (v) transfer gain

(b) Discuss the general characteristics of feedback amplifier in detail. **5m**

(c) If input of 0.028V peak to peak is given to an open loop amplifier, it gives fundamental frequency output of $36V_{pp}$ but it is associated with 7% distortion **5m**
(i)If the distortion is to be reduced to 1%how much feedback has to be introduced and what will be the required input voltage?
(ii)If 1.2% of Vo is feedback and input is maintained at the same level, what will be the output voltage?

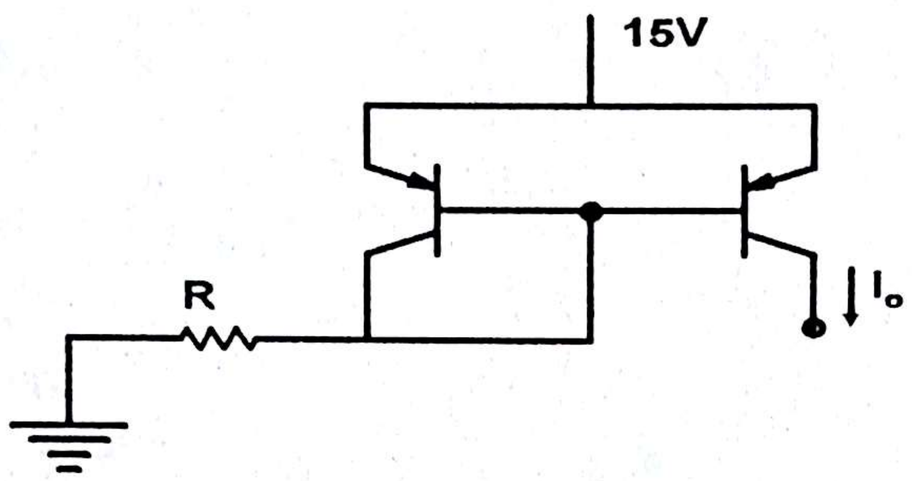
2	(a)	Derive the expression for common emitter short circuit current gain as a function of frequency and hence define the α and ß cut-off frequencies.	**5m**
	(b)	Derive the relationship between low frequency h-parameters and high frequency hybrid-π parameters for transistor in common emitter configuration.	**5m**
	(c)	Identify the circuit shown in figure. Design a approximate equivalent circuit and prove that Ai =0.707 of its low frequency value for h_{fe}.	**5m**



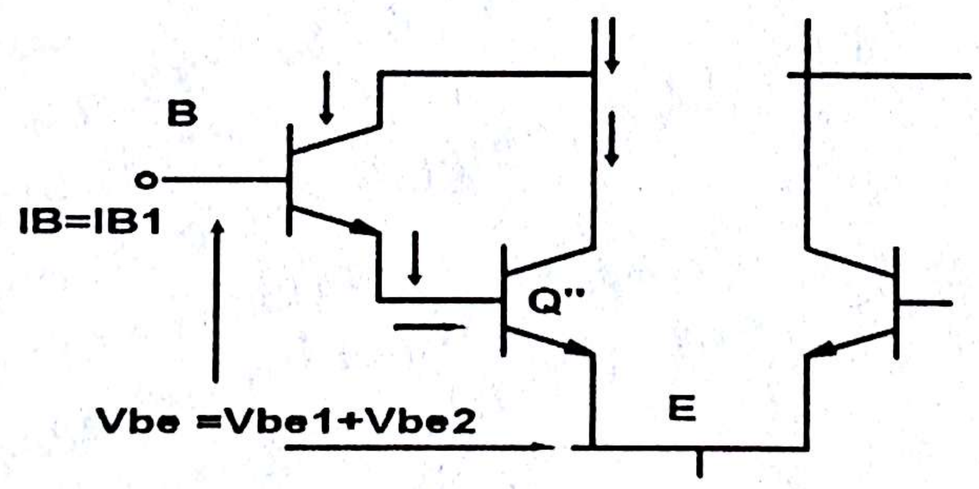
3	(a)	Explain the effect of emitter bypass capacitor on low frequency response of common emitter configuration and discuss the pole-zero plot of gain.	**6m**
	(b)	Derive the equation of source resistance for a single stage transistor amplifier response and discuss gain bandwidth product for it.	**6m**
4	(a)	(i)Write a short note on commutating capacitor. What are the other names of commutating capacitor?	**5m**
		(ii)What do you mean by self bias binary? What is the effect of single power supply on the performance of the binary?	**5m**
		OR	
	(b)	The self bias bistable multivibrator uses silicon transistors with $h_{fe(min)}$=20.The junction voltage	**10 m**

and I_{CBO} may be neglected. Design the circuit subject to the condition V_{cc}=18V,R1=R2, $IC_{(max)}$=10mA.The base current of ON transistor twice the minimum base current, and V_{BE} of the OFF transistor is equal to -1V.

5 (a) i)For the current mirror shown in figure, Determine R so that Io =100μA. **4m**



ii)The following figure shows the differential amplifier with the circuit which is used for improving the input parameters, identify the circuit and derive the current gain? **4m**



OR

(b) Derive the equation for collector current of differential amplifier and discuss the transfer characteristics of it. **8m**

Government College of Engineering, Amravati

(An Autonomous Institute of Government of Maharashtra)

Fourth Semester B. Tech.

(Electronics and Telecommunication.)

Summer Term – 2013

Course Code :ETU402 **Course Name : Analog Circuits**

Time : 2 hr.30min. **Max. Marks : 60**

Instructions to Candidate

1) All questions are compulsory.
2) Assume suitable data wherever necessary and clearly state the assumptions made.
3) Diagrams/sketches should be given wherever necessary.
4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
5) Figures to the right indicate full marks.

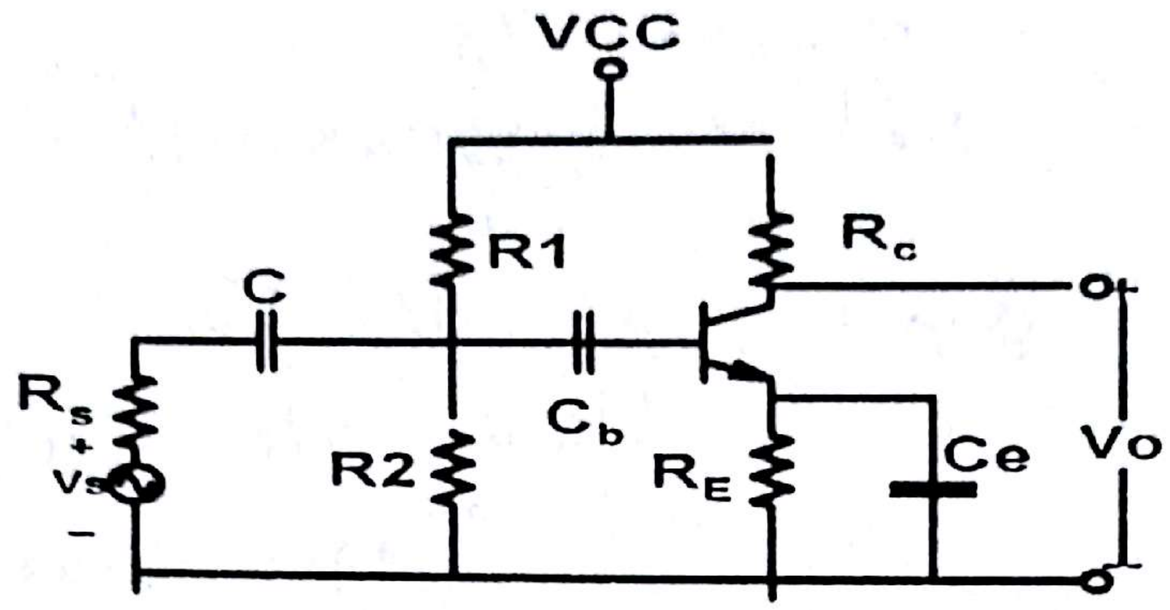
1 (a) An amplifier has a midband gain of 100 and 5m bandwidth of of 200kHz.
i) What will be the new bandwidth and gain if 5% of negative feedback is introduced?
ii) What should be the amount of feedback if bandwidth is to be restricted to1MHz?

(b) Draw a feedback amplifier in block diagram form. Identify each block and state its function. 5m

(c) Draw a sketch to illustrate the principle of voltage series feedback and briefly explain. List the major effects of negative feedback on an amplifier. 5m

2 (a) Derive the expression for the two capacitances associated with high frequency model of transistor. Give the validity condition of Giacoletto model. 5m

(b) Design a high frequency equivalent circuit for 5m following figure and also design frequency response for it.



(c) Design high frequency T model for common base configuration? Also explain its common base short circuit current frequency response. 5m

3 (a) Design an approximate equivalent circuit and high frequency response for calculating the short circuit CE current gain without resistive load. Also discuss parameter F_T and its measurement. 6m

(b) Design a CE short circuit current frequency response? Also prove that $F_T=F\alpha.\alpha_0$. 6m

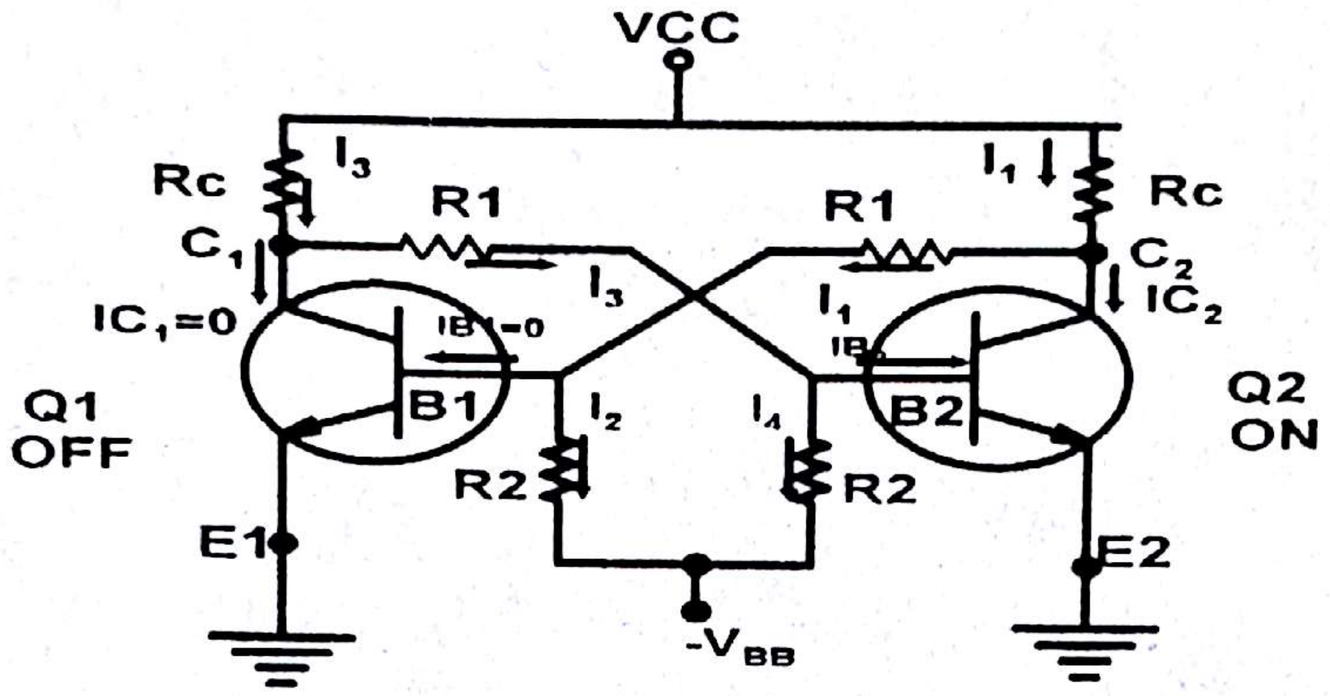
4 (a) i) Silicon transistors with hfe(min)=20 are available. If Vcc=V_{BB} =10V,design the bistable multivibrator. 6m

ii) What do you mean by loading of a binary? What are the effects of performance of binary? 6m

OR

(b) A fixed bias binary shown in figure uses n-p-n silicon transistors with hfe=20.The circuit parameters are V_{cc}= 12V,V_{BB}=3V, Rc=1k,R1=5K,R2=10k Vce(sat)=0.4V And Vbe(sat)=0.8V.(i)Find stable state voltages and currents.(ii) What is the maximum load the multivibrator can drive still maintaining one 12m

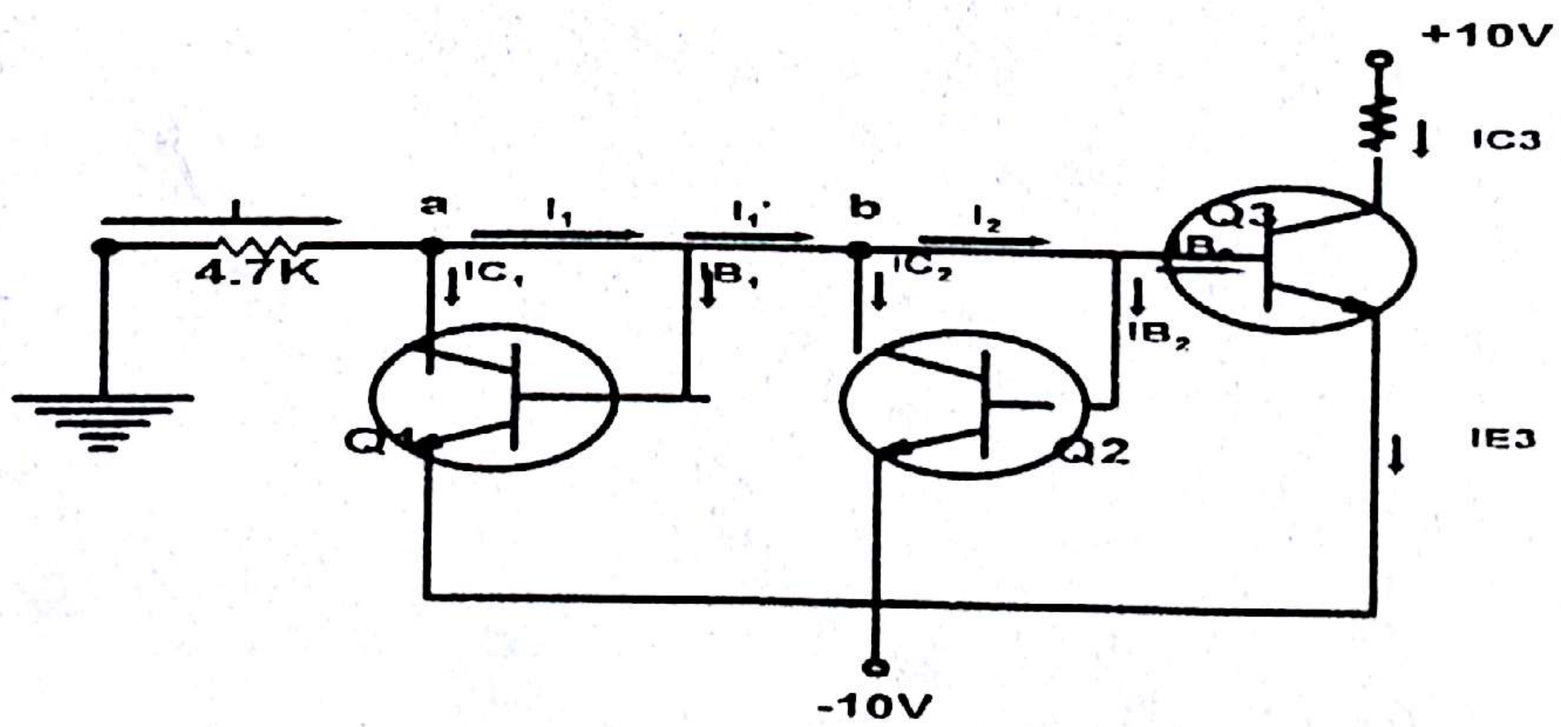
transistor in saturation and other in cut-off?(iii)What is maximum reverse saturation current I_{CBO} tolerated so that neither of transistor in cut-off?(iv)If the initial value of I_{BO} is 10mA at room temperature ,what is the maximum temperature at which the device remains OFF?



5 (a) 3m

i)Figure shows a modified current mirror circuit. Determine the emitter current in transistor Q3,if ß=100 and Vbe=0.75V.

.



3m

ii) Design a hybrid π model and equivalent small signal equivalent model for calculating differential mode gain and common mode gain of differential amplifier. Also calculate CMRR for it.

OR

(b) Explain the method for increasing input resistance of differential amplifier and derive the required equation. 6m

Government College of Engineering, Amravati

(An Autonomous Institute of Government of Maharashtra)

Fourth Semester B. Tech.

(Electronics and Telecommunication)

15004056

Summer – 2017

April 18

Course Code: ETU402

Course Name: Analog Circuits

Max. Marks: 60

Time: 2 hrs. 30min.

Instructions to Candidate

1) All questions are compulsory.
2) Assume suitable data wherever necessary and clearly state the assumptions made.
3) Diagrams/sketches should be given wherever necessary.
4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
5) Figures to the right indicate full marks.

1. Solve any two from the following.

(a) An amplifier without feedback gives fundamental output 36V with 7% second harmonic distortion; when the input is 0.028V. **6**

i) If 1.2% of the output is feedback into the input in a negative voltage series feedback, what is the output voltage?

ii) If the fundamental output is maintained at 36V but the second harmonic distortion is reduced to 1%, what is the input voltage?

(b) Explain general characteristics of negative feedback amplifier in detail. **6**

(c) List the steps required to carry out the analysis of a feedback amplifier in brief and hence explain the current series feedback amplifier. **6**

Contd..

a feedback amplifier in brief and hence explain the current series feedback amplifier. 6

2. **Solve any two from the following.**

(a) The base width of a germanium PNP transistor is 5 microns. At room temperature and for a dc emitter current of 2mA, determine i) emitter resistance, ii) alpha cut off frequency, iii) emitter diffusion capacitance and iv) base transit time. 6

(b) Given the following transistor measurements made at I_c = 5mA, V_{ce} = 10V and at room temperature, h_{fe} = 100, h_{ie} = 600Ω, A_{ie} = 10 at 10 MHz, C_c = 3pF. Find f_B, f_T, C_e, $r_{b'e}$ and $r_{bb'}$ 6

(c) Write notes on: i) Gain bandwidth product
ii) Variation of hybrid π parameters 6

3. (a) Explain the working of two stages RC coupled amplifier with its circuit diagram, frequency response, advantages & disadvantages and applications. 6

(b) Derive the expression for n stage CE cascaded amplifier with respect to voltage gain, current gain, input impedance, output impedance and power gain. 6

4. **Solve any two from the following.**

(a) Explain UJT relaxation oscillator along with its waveforms across resistor and capacitor and hence derive the expression for frequency of that. 6

(b) List the drawbacks in current mirror circuit and hence explain modified current mirror circuit to overcome the drawbacks in detail. 6

(c) Explain different methods employed for triggering a bistable multivibrator. 6

5. (a) In circuit diagram shown in figure-1, V_{CC} = +12V, 6

V_{BB} = -12V; R_C = 10kΩ, R_E = 10kΩ, R_B = 20kΩ.

i) Determine output voltage if transistors Q_1 and Q_2 are identical with $\beta_{dc} = 75$.

ii) Determine the base currents and base voltages.

iii) Determine base current and base voltages if transistors Q_1 and Q_2 are identical except for β_{dc}. Transistor Q_1 has $\beta_{dc} = 60$ and Q_2 has $\beta dc = 80$.

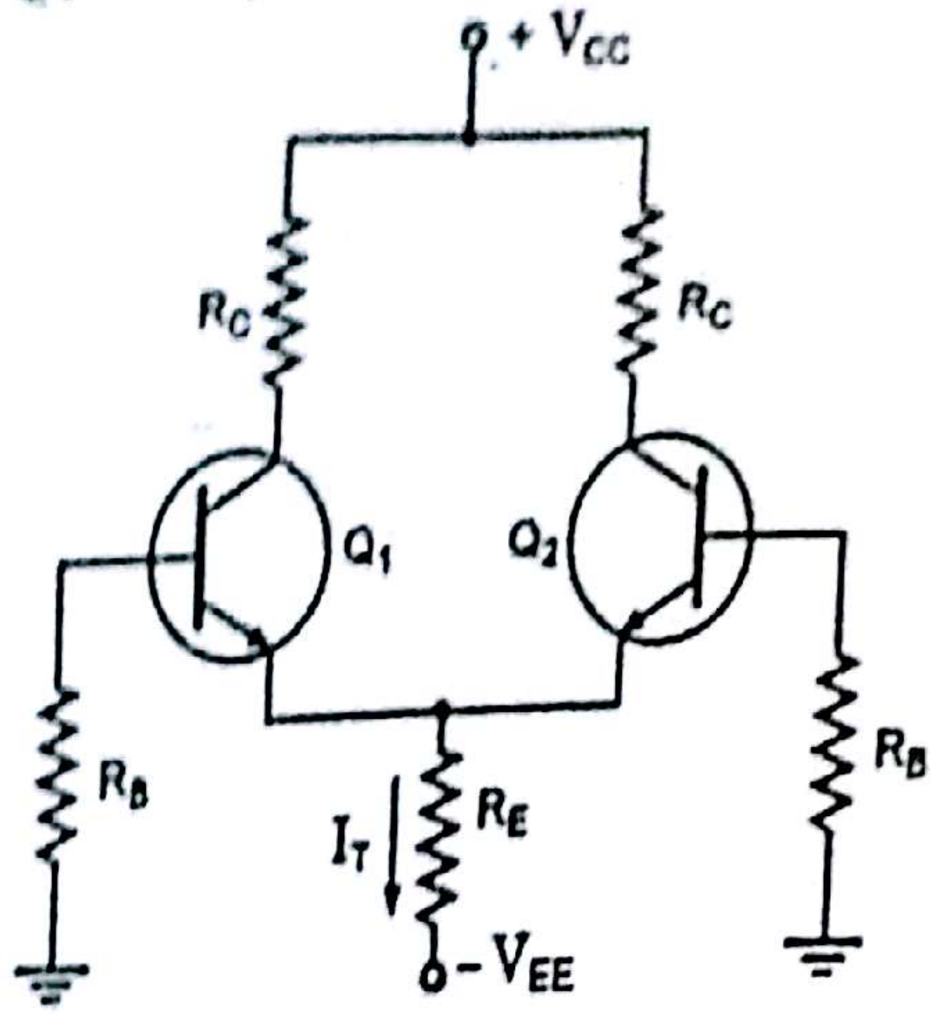


Figure-1

6

(b) For the BJT monostable multivibrator circuit shown in figure-2, show that the element values gives the required biasing under normal and triggered conditions. Also determine the amplitude and saturation of the current pulse in load resistance. (h_{fe} for transistors used is 60.)

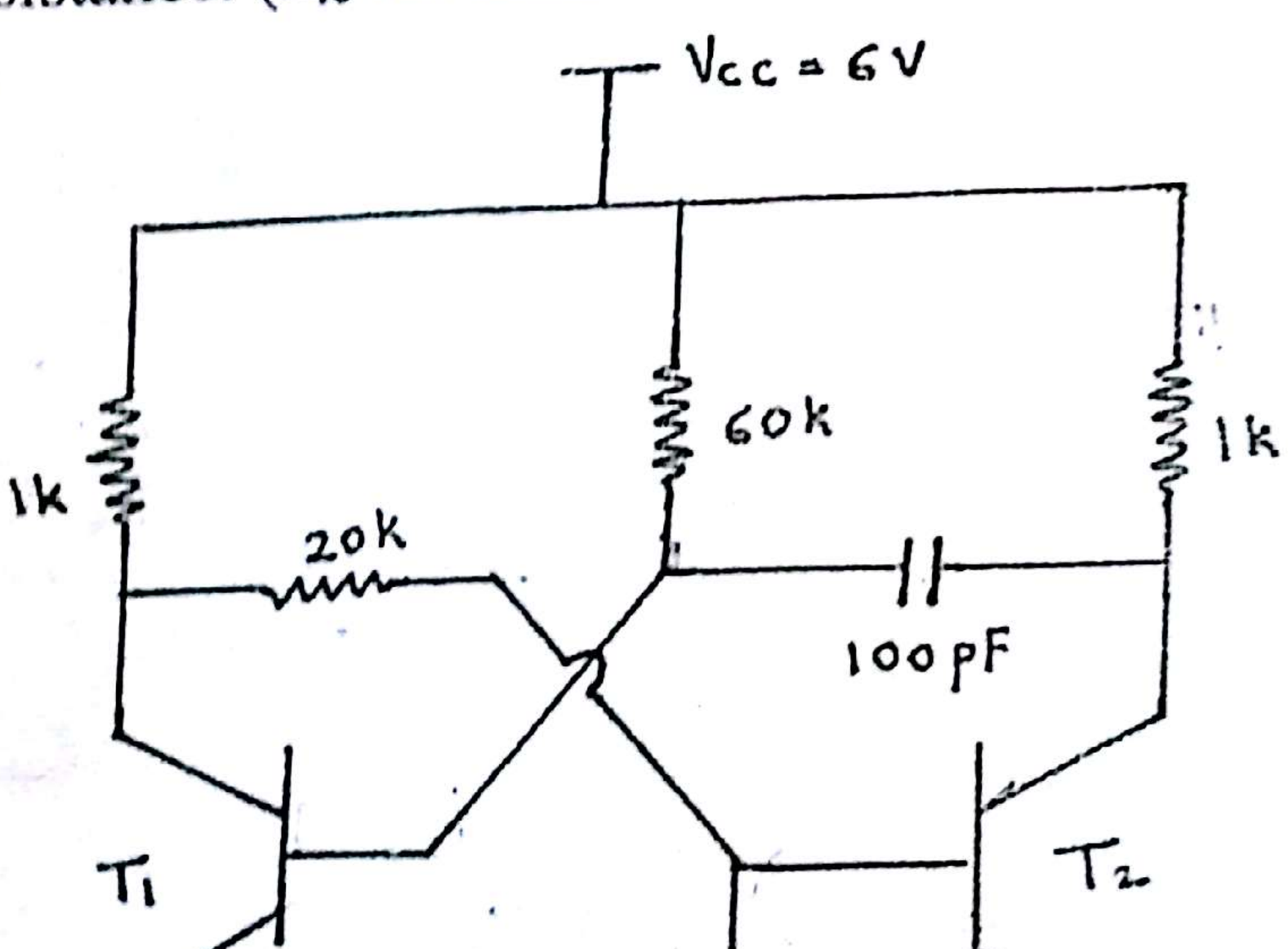


Figure-2