LMC ELECTRONICS

Ph. 09760096161

11/10/25/1-A, RAM NAGAR, NAWAL GANJ,
NUNHAI ROAD, AGRA-282006

- Read instruction manual carefully.
- The graphical variations shown are exemplary and the numerical values may differ.
- Connect the circuit step by step as written in the procedure.
- Check the circuit again carefully before switching ON the power supply.

OPERATING INSTRUCTIONS MANUAL FOR THE STUDY OF SINGLE STAGE R-C COUPLED COMMON EMITTER AMPLIFIER WITHOUT & WITH FEEDBACK

MODEL: LMC-138

Connection leads Red-9 & Black-3 (2mm)

OBJECT: - To study the single stage R-C coupled common emitter amplifier without and with feedback.

APPARATUS: - Experimental board and digital multimeter.
Connection leads Red-9 & Black-3 (2mm).

THEORY: - Feedback is a process of taking a part of output signal and feeding it back to the input circuit through a network. This changes the net input voltage and hence the output of the amplifier is improved. The negative feedback is more advantageous than positive feedback because it improves frequency response and stabilizes the gain.

The circuit of R-C Coupled feedback amplifier is shown in the figure. There is an emitter bypass capacitor C_E, which provides same effective input to the amplifier as the signal applied by the source. This bypass capacitor is used across R_E (emitter resistor) for stabilizing dc bias. But when the bypass capacitor is removed the negative current feedback is applied to the amplifier circuit. When the capacitor C_E is open the ac emitter current flows through R_E resulting in a voltage drop. This voltage drop is in phase opposite to that of applied input signal voltage. This negative feedback reduces the output voltage of the amplifier but the bandwidth is increased.

CIRCUIT DIAGRAM: -

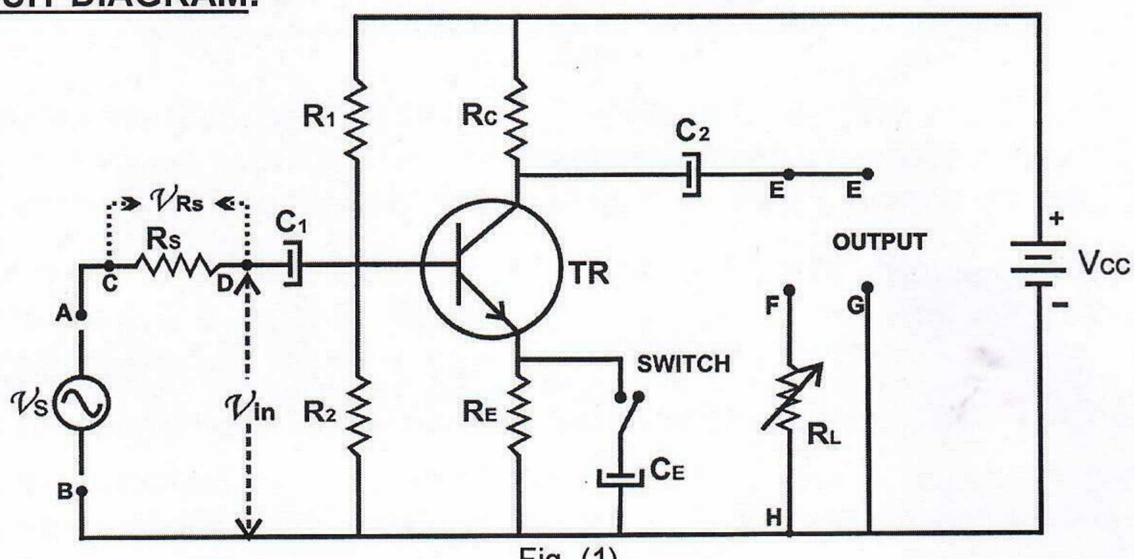
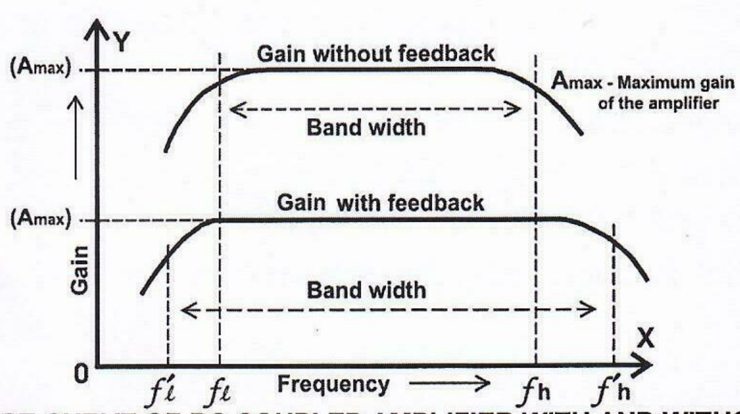


Fig. (1)



FREQUENCY RESPONSE CURVE OF RC COUPLED AMPLIFIER WITH AND WITHOUT FEEDBACK

PROCEDURE: - Proceed to study the amplifier in following steps:

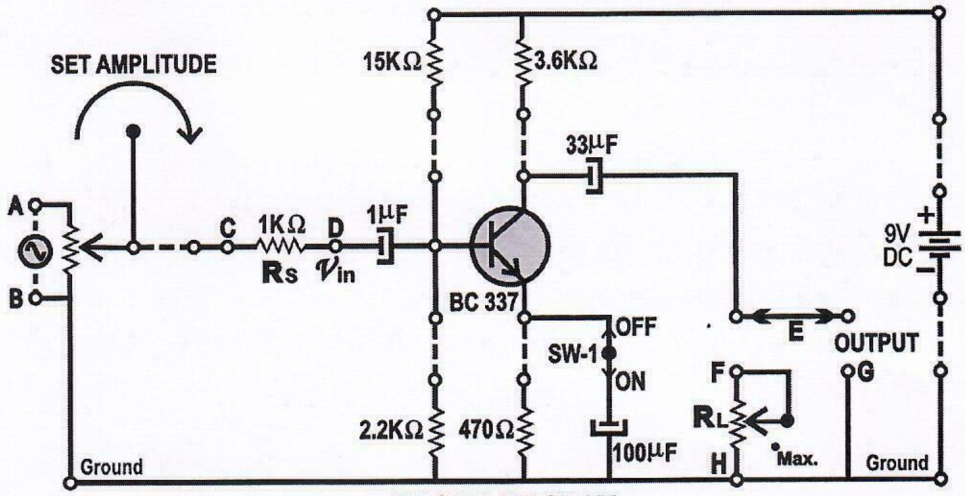
STEP (A):- The frequency response of the amplifier with feedback & without feedback.

STEP (B):- The input impedance (Z_{in}) & output impedance (Z_{out}) of the amplifier at 1kHz frequency:

- **Keep power switch in off position.**
- **Remove all the connections, if any, on the exp. board.**

STEP (A):- The frequency response of the amplifier with feedback & without feedback.

1. The oscillator and the AC milli voltmeter are given on the experimental board. Connect terminals A-A, B-B(ground). Connect terminals 1-1, 2-2, 3-3, 4-4, 5-5, 6-6 and 7-7. Do not connect terminals E-F.



CIRCUIT DIAGRAM

2. Keep switch (SW-1) in ON position. The switch (SW-1) ON means capacitor (C_E) connected to ground (without feedback amplifier) and OFF means capacitor (C_E) disconnected (with feedback amplifier). **Switch on the power.**

3. Set oscillator at 1 kHz frequency and connect AC milli voltmeter across output terminals E & G(ground). Adjust output voltage (V_O) at 6V by using set amplitude pot and record it. V_O **= 6 V.**

NOTE: To measure below 500 mV readings, use meter range switch (SW).

4. Now connect AC millivoltmeter between point D (**V_{in}**) & ground terminal. Measure and record input voltage (**V_{in}**) in mV by pressing the meter range switch **(SW)**. Keep this value of V_{in} constant in subsequent measurements at different frequency steps.

   V_{in} = ... mV = ... V

5. (i) Set frequency at 50 Hz. Adjust V_{in} at the value determined in step (4). Measure & record output voltage in table (1) as $V_{O(\text{with CE})}$ =...V by connecting AC millivoltmeter across output terminals.

   (ii) Switch off SW-1 and again measure & record output voltage in table (1) as $V_{O(\text{without CE})}$ =...V

   (iii) Now switch on SW-1 for next frequency step.

6. Repeat step (5) for other frequency steps given on the exp. Board.

7. Take $\log_{10} f$ = ... for each frequency step.

8. Calculate voltage gain ($A_{(with\ CE)}$ & $A_{(without\ CE)}$) and the corresponding decibel (dB) voltage gain ($A_{dB(with\ CE)}$ & $A_{dB(without\ CE)}$) for each frequency step by following pairs of relations in both cases:

$$A_{(with\ CE)} = \frac{V_{O(with\ CE)}\ (volt)}{V_{in}\ (volt)} \qquad A_{dB(with\ CE)} = 20\log_{10} A_{(with\ CE)}$$

$$A_{(without\ CE)} = \frac{V_{O(without\ CE)}\ (volt)}{V_{in}\ (volt)} \qquad A_{dB(without\ CE)} = 20\log_{10} A_{(without\ CE)}$$

Table (1): Record of observations and calculated values

Sl. no.	V_{in} volt	f Hz	$\log_{10} f$ -	output voltage		voltage gain		dB gain	
				$V_{O(with\ CE)}$	$V_{O(without\ CE)}$	$A_{(with\ CE)}$	$A_{(without\ CE)}$	$A_{dB(with\ CE)}$	$A_{dB(without CE)}$

9. Use table (1) to plot the frequency response of amplifier and to analyse it. Take $\log_{10} f$ on x-axis and A_{dB} on y-axis in both cases (with feedback and without feedback). Plot the variation graphically. The typical variation is shown in fig (2).

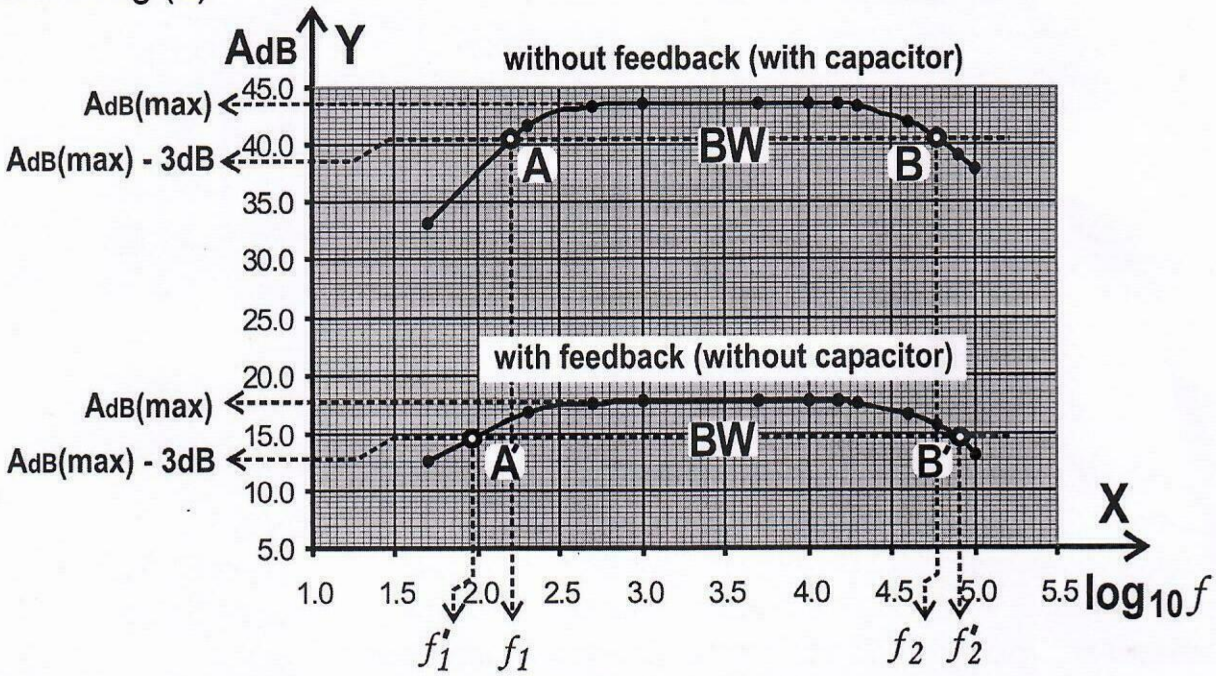


Fig.(2) Frequency response curve of amplifier ($\log_{10} f$ versus $A_{dB(with\ CE)}$) without feedback and ($\log_{10} f$ versus $A_{dB(without\ CE)}$) with feedback.

10. Record the values of $A_{dB(max)}$ from the plotted graph. Now label dotted lines for dB values = $A_{dB(max)}$ – 3dB in respective cases. These lines say cut the curve at points A & B. Mark $\log_{10} f_1$ for A & $\log_{10} f_2$ for B on both curves.

Take the antilog of $\log_{10} f_1$ & $\log_{10} f_2$ to get the values of **lower & higher cut off frequencies f_1 and f_2** respectively in both cases, i.e.

$$f_1 = \log_{10}^{-1}(\log_{10} f_1); \quad f_2 = \log_{10}^{-1}(\log_{10} f_2)$$

Calculate the band width (BW) of both amplifiers by following relation:

$$BW = f_2 - f_1 = \ldots kHz$$

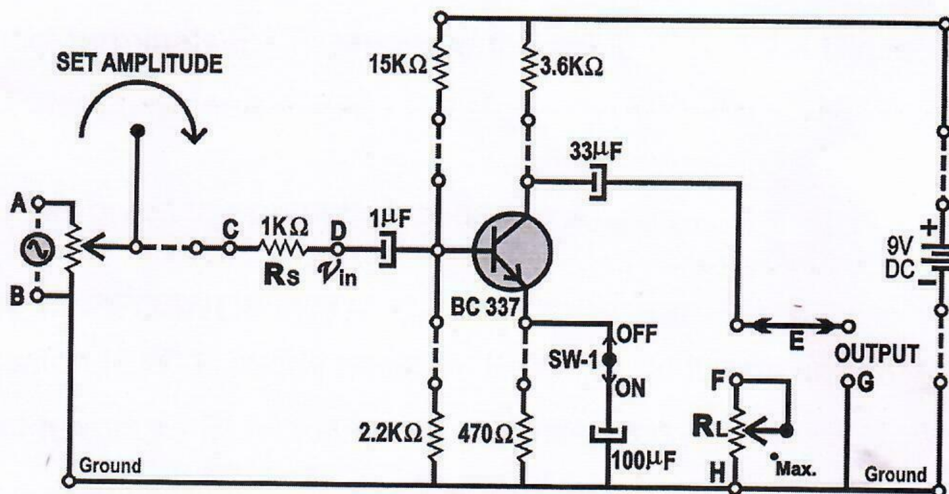
RESULTS:- Record the results in following table for the both cases separately and compare the results.

Constant value of V_{in} = … mV									
Without feedback					**With feedback**				
$A_{dB(max)}$	**Half power point $A_{dB(max)}$ -3dB**	**Lower cutoff (f_1) Hz**	**Higher cutoff (f_2) kHz**	**BW ($f_2 - f_1$) kHz**	**$A_{dB(max)}$**	**Half power point $A_{dB(max)}$ -3dB**	**Lower cutoff (f_1) Hz**	**Higher cutoff (f_2) kHz**	**BW ($f_2 - f_1$) kHz**

STEP (B):- The input impedance (Z_{in}) & output impedance (Z_{out}) of the amplifier at 1kHz frequency:

- **Keep power switch in off position.**
- **Remove all the connections, if any, on the exp. board.**

1. The oscillator and the AC milli voltmeter are given on the experimental board. Connect terminals A-A, B-B(ground). Connect terminals 1-1, 2-2, 3-3, 4-4, 5-5, 6-6 and 7-7. Do not connect terminals E-F.



CIRCUIT DIAGRAM

2. Keep switch (SW-1) in ON position. The switch (SW-1) ON means capacitor (C_E) connected to ground (without feedback amplifier) and OFF means capacitor (C_E) disconnected (with feedback amplifier). **Switch on the power.**

NOTE: To measure below 500 mV readings, use meter range switch (SW).

3. Set oscillator at 1 kHz frequency and connect AC milli voltmeter across output terminals E & G(ground). Adjust output voltage ($V_{O(with\ CE)}$) at 6V by using set amplitude pot and record it, $V_{O(with\ CE)}$ **= 6V** and also record output voltage ($V_{O(without\ CE)}$) keeping SW-1 in OFF position without C_E. $V_{O(without\ CE)}$ **= …mV =…V**.
4. Now connect AC millivoltmeter between point D (V_{in}) & ground terminal. Measure and record input voltage (V_{in}) in mV by pressing the meter range switch **(SW)**.

$$V_{in} = \ldots mV = \ldots V$$

5. Measure voltage between terminals C & D by connecting AC milli voltmeter across terminals C & D and note it as $\mathcal{V}_{RS}$ in volt. Note the value of resistor between terminals C & D as R_S in ohm.

$$\mathcal{V}_{RS} = \ldots mV = \ldots volt \qquad R_S = \ldots\ k\Omega = \ldots\Omega$$

Calculate input current i_{in} by relation, i.e. $i_{in}(ampere) = \dfrac{\mathcal{V}_{RS}(volt)}{R_s(ohm)} = \ldots A = \ldots \mu A$

Calculate input impedance Z_{in} by relation, i.e. $Z_{in}(ohm) = \dfrac{\mathcal{V}_{in}(volt)}{i_{in}(ampere)} = \ldots\Omega = \ldots k\Omega$

OUTPUT IMPEDANCE WITHOUT C_E

6. Keep switch (SW-1) in OFF position. Keep R_L at its maximum position. Connect terminals E - F to include variable load resistance R_L. Vary R_L so that output voltage becomes half ($\mathcal{V}_{o(without\ CE)}$ / 2).

7. Disconnect terminals E - F. Measure the value of R_L by a Digital Multimeter (DMM) across terminals F - H.

This gives the output impedance $Z_{out(without\ CE)} = R_L = \ldots\ k\Omega$

OUTPUT IMPEDANCE WITH C_E

8. Keep switch (SW-1) in ON position. Keep R_L at its maximum position. Connect terminals E - F to include variable load resistance R_L. Vary R_L so that output voltage becomes half ($\mathcal{V}_{o(with\ CE)}$ / 2).

9. Disconnect terminals E - F. Measure the value of R_L by a Digital Multimeter (DMM) across terminals F - H.

This gives the output impedance $Z_{out(with\ CE)} = R_L = \ldots\ k\Omega$

RESULTS: (1) Input impedance $Z_{in} = \ldots\ k\Omega$

(2) Output impedance with feedback $Z_{out(without\ CE)} = \ldots\ k\Omega$

(3) Output impedance without feedback $Z_{out(with\ CE)} = \ldots\ k\Omega$