Ain Shams University
Faculty of Engineering
Mechatronics Dept.

Undergraduate Studies
ECE 334 - Electronic Circuits
Spring 2016

Course Project

Class-A Audio Amplifier

1.0 PROJECT DESCRIPTION

After learning the theory of operation of Bipolar-Junction transistor (**BJT**); one can use this device as an amplifier to magnify any type of electrical signal.

The BJT is used quite often in audio system and sound amplifications. Sound signals need to be amplified enough to be able to supply speakers.

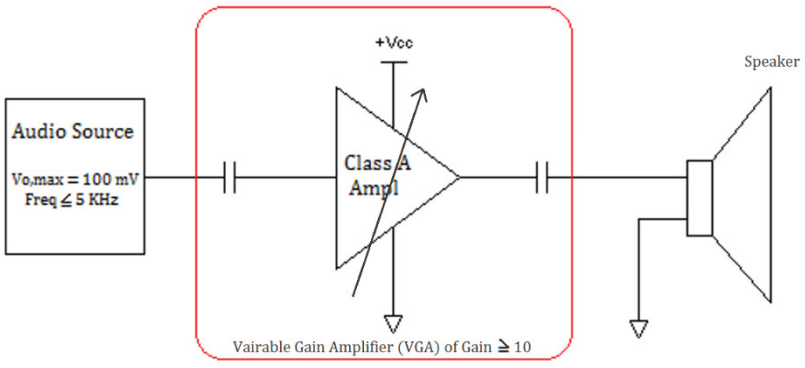
In this project it is required to design a "Class-A audio amplifier" with variable gain to amplify an audio signal.

2.0 PROJECT REQUIRMENTS

This section summarizes all project requirements in the following points:

- Design a Class-A audio amplifier using BJT transistors. Make sure that the inputs & outputs of the circuit are AC coupled.
- The amplifier should provide at least a gain of 10x with variable gain (Gain $\geq$ 10); which is sufficient to amplify an audio signal of magnitude 0.1V to 1V at frequency of ($f_{Source} \leq$ 5 KHz) which is considered the average audio frequency range. The amplified signal is connected to a speaker of low input impedance (8 Ω - 180 Ω). Having such low R_{Load} should not affect the amplifier functionality. The figure below shows the desired system.
- The available DC supply is 9V only, and the maximum drawn current should not exceed 15 mA for the entire circuit.
- The design should not introduce distortion to the signal. The output signal should not be clipped by any means in order to provide clean sound to the speakers.
- Design the circuit on papers first; then simulate the circuit on Multisim tool. Make sure that the designed circuit behaves as expected on the simulator.
- Buy the necessary components needed to build your circuit on a bread-board.

Students can be divided into groups of **<u>3 students</u>** (not more or less); each group should deliver all requirements stated in section 3.



3.0 DELIVERABLES

In this project, students should deliver:

- A printed report that contains the chosen circuit topology, hand analysis, circuit simulation on Multisim. The simulated results should be nearly similar to the simulated results. All necessary plots such as the (load-line, input signal, output signal … etc.) should be included in the report.
- All problems & solutions that were faced during the design & implementation phase should be stated.
- A breadboard with a fully functioning class A audio amplifier will be tested inside the lab. Groups should design the circuits outside the lab first (Using Multimeters, 9 V Batteries, .. etc.) and make sure that the DC operating point is at an acceptable range. Once the circuit is implemented & working, students will be allowed to test it inside the lab.
- TAs will check the operation of the circuits inside lab. The amplifier should be also tested on a real mic & speakers. Note that speakers can have low impedances ~ 8 Ω.
- Circuits are then laid out on Multisim (Ultiboard) & soldered neatly on a PCB.
- The final section in the report should include the "simulated" + "measured" results (Pictures of CRO input/output waves in lab). A comparison should be done between both results.
- Finally, a suitable conclusion/summary of work should be included at the end of the report.

The final report & the measured data will affect your grades; so each group should be keen on doing their best.

The project is divided into timed milestones that are summarized below. Students should strictly follow these deadlines or else you could lose project grades.

Project Deadlines & Grading Percentages:

- Saturday April 9th (Week 8): Teams formed and sent in an online google sheet. **[0%]**
- Thursday April 14th (Week 9): Initial design with simulations done and submitted in reports. **[15 %]**
- Thursday April 21st (Week 10): Students receive feedback on their designs from TAs and then they implement breadboard designs and test them in lab. **[15 %]**
- Thursday April 28th (Week 11): Students implement on PCB and test the circuits in lab. **[15 %]**
- Thursday May 5th (Week 12): Final report submitted. **[15 %]**
- Thursday May 12th (Week 13): Live demo of project in labs. **[40 %]**