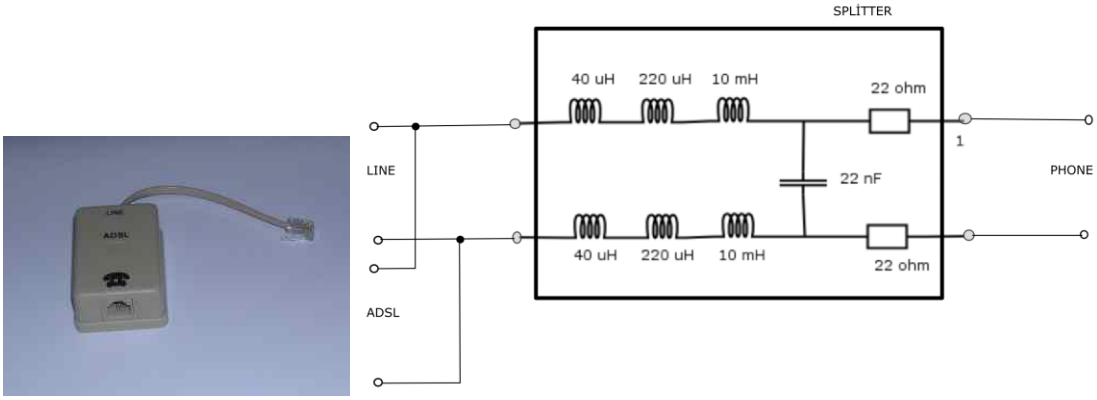
2020 – 2021 Spring, CSA, CRN:25203, Homework 6

- Assignments in PDF format are required to be uploaded to the Ninova system before the deadline. There won't be extra time for uploading the assignments.
- The students are expected to work on the solutions on their own. The points of identical or very similar looking assignments will be divided to the number of such assignments.

The band gap between 300-3400 Hertz is allocated for voice transmission on telephone lines used in homes and workplaces. On the other hand, ADSL modem devices connected to the telephone line transmit data over the 25kHz and 1,1MHz band. Since both devices are connected on the same line, the arrival of signals that are relevant to the ADSL device but irrelevant for the phone device cause disturbing noises during the conversation.

Along with ADSL modems used in homes and workplaces, manufacturers offer a device called Splitter to its users. This device and its circuit diagram are given in Figure 1. The users are required to connect the device to the telephone line that is coming to the house and the other end to be connected to the telephone device, the ADSL line is said to be connected directly to the telephone line coming to the house.



(a) (b)

Figure 1. (a) ADSL Splitter device and, (b) ADSL Splitter schematic and connections

Note: The phone can be modelled as a 600 Ohm resistor at the given band.

A. Find the transfer function of the circuit shown in the figure. (50 points)
B. Plot the transfer function using Matlab or similar program, showing the output for an input of 1 KHz, 5kHz, 25kHz, 50KHz and 100kHz sinusoidal signal. You are expected to show the gain in decibel scale. (100 points)
C. Simulate the circuit using SPICE (or similar circuit simulator) and compare your findings with that found in A and B. (150 points)
D. Based on your findings, comment on the aim of using a splitter device. (25 points)
E. Comment on how the transfer function would change for phones having different (than 600 Ohms) resistive values. (25 points)