Homework 1: Basics of Electrical Circuits

General Instructions: *The report should contain answers to the questions in the task and a short description of every step in your solution. It is also possible to present in a jupyter notebook format, where solution description is in the notebook. The logic of the solution to the problem and all notations should be clear. Each student has a different data for the problem. The report (word or pdf file) should be submitted by* **November 8**

Concepts Covered: *Kirchoff law, Ohm law*

Name: _____

Problem 1 [100 points]

Consider the AC electrical circuit on Fig. 1 Three loads, connected in parallel, are connected to the voltage source ($V = 16\angle 0$) via line with parameters R_{line}, X_{line}. Load parameters are. The values of parameters of line and loads can be found in table and are individual for each student. Assume frequency to be equal $50Hz$.
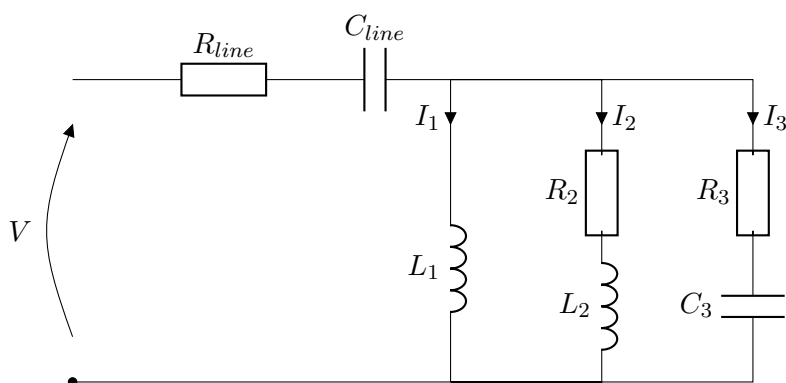

Figure 1: Circuit

	Student Name	R_{line} [Ω]	C_{line} [F]	L_1 [H]	R_2 [Ω]	L_2 [H]	R_3 [Ω]	C_3 [F]
1	Maksim Annikov	0.81	0.024	0.08	4.42	0.04	3.14	0.27
2	Bakhtiyar Kazbekov	0.68	0.021	0.11	4.17	0.05	2.95	0.17
3	Timofey Losev	0.62	0.05	0.17	4.77	0.06	3.03	0.22
4	Anna Shubnaya	0.86	0.03	0.078	4.43	0.02	3.44	0.27
5	Anastasia Sidorkina	0.81	0.034	0.09	4.35	0.06	3.21	0.24
6	Irina Yareshko	0.76	0.066	0.07	4.32	0.04	3.09	0.22
7	Arlan Zhanatbekov	0.67	0.029	0.02	4.14	0.07	2.64	0.24

(a) (**10 pt**) Write the complex impedance of every load in rectangular and polar forms.

(b) (**10 pt**) Calculate the complex equivalent impedance of the whole circuit. The whole circuit includes all 3 loads and the line.

(c) (**10 pt**) Calculate the complex current in the line.

(d) (**10 pt**) Calculate the voltage drop in the line.

(e) (**10 pt**) Calculate the complex load voltage.

(f) (**10 pt**) Calculate complex currents I_1, I_2, I_3.

(g) (**10 pt**) Calculate p.f. of every load and of the whole circuit.

(h) (**10 pt**) Calculate instantaneous currents i_1, i_2, i_3 and instantaneous voltages v_1, v_2, v_3.

(i) (**10 pt**) Calculate the apparent, real and reactive power consumed by every load.

(k) (**10 pt**) Calculate the sending apparent, real and reactive power.