COMM.RF.200 Introduction to RF Electronics, Fall 2021

1. (a) Explain two alternatives to represent *complex numbers*: *coordinate form* (rectangular form) and *polar form*.

   (b) What is *Euler*'s formula, how is it related to complex numbers?

   Give an example of how and where to utilize it.

   (c) Simplify

      i. $\frac{2+i}{5-3i} = \frac{2+j}{5-3j}$

      ii. $\frac{15\angle 45°}{3\angle 90°}$

2. (a) What are the impedances of ideal capacitor and ideal inductor? How do they vary as function of frequency? (We revisit this question in problem 3.)

   (b) In which cases you can use impedances; try to state conditions for using impedances.

   (c) Consider series and parallel RLC circuits.

      i. State condition(s) when the circuit is at resonance.

      ii. Determine expression of resonance frequency in both cases. What is the impedance value at resonance?

3. Look at the datasheet of an inductor (see "Course Material" -> "Component Data" -> "epcos inductors.pdf"). Consider 10μH inductor.

   (a) Look at the table on page 5 (see page 4 for definition of the terms). What could you conclude about the inductor's behaviour from it?

   (b) Use $Q = \frac{\omega L}{R}$ to get an estimate of AC resistance of the component. Any differences to data given in the sheet. (Q denotes quality factor which is typically given in datesheets.)

   (c) Look at the graph $\|Z\|$ vs. f on page 7. What could you conclude from it?

   (d) Consider the 4700μH, what do you think about its I_R–value.