LESSON 1

- Intro to 'lumped elements' and AC linear circuits
- Complex numbers review and phasors representation
- Circuits topology review (KCL,KVL,serie/parallel)
- Complex impedance (*Ohm*'s law) for resistors, inductors, and capacitors
- Voltage and current divider
- *Thevenin*'s theorem (w/ voltage divider example)
- Two-port networks, input/output impedance
- RC Low-pass filter (transfer function's module and phase calculation, cut-off frequency, time constant)

Practice: Lab #1 – part 1 (~1h)

LESSON 2

- Review of input/output impedance
- *Impedance bridging* (voltage signal maximization $R_{in} \gg R_{out}$)
- Complex power in sinusoidal regime (active and reactive power)
- *Impedance matching*: maximum active power transfer theorem ($Z_L = Z_G^*$)
- *Intrinsic noise*: thermal noise, shot noise, flicker noise (1/f)
- *Interference noise*: capacitive coupling, magnetic coupling, ground loops

Practice: Lab #1 – part 2 (~2h)

LESSON 3

- Intro to 'distributed elements' circuits and transmission lines
- Telegraph equations - lossless case and sinusoidal regime
- Wave equation solution and characteristic impedance Z_0
- Velocity of propagation/delay, lossy case, complex propagation constant
- Calculation of Z_{in} for a transmission line of length l terminated by Z_L
- Reflection coefficient Γ and standing waves (SWR) as a function of Z_L, Z_0
- Relevant cases:
    - *line impedance matching* $Z_L = Z_0$,
    - $Z_L = 0$ (short circuit),
    - $Z_L \to \infty$ (open circuit),
    - $l = n\frac{\lambda}{2} \to Z_{in} = Z_L$

Practice: Lab #2 (~1.5h)