Electromagnetic Fields – Tutorial 01

Introduction to EM fields

#	Student ID	Student Name	Grade (10)
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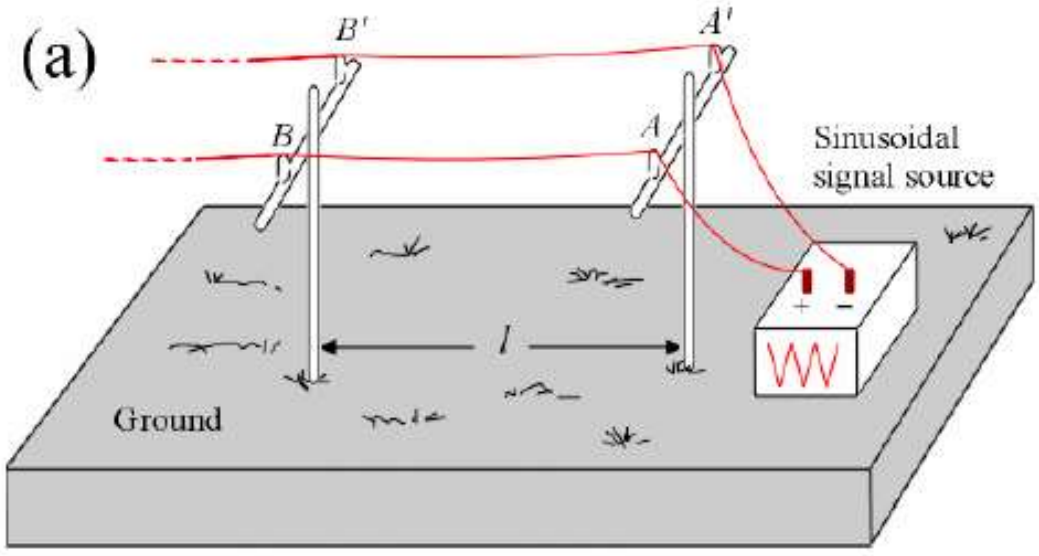
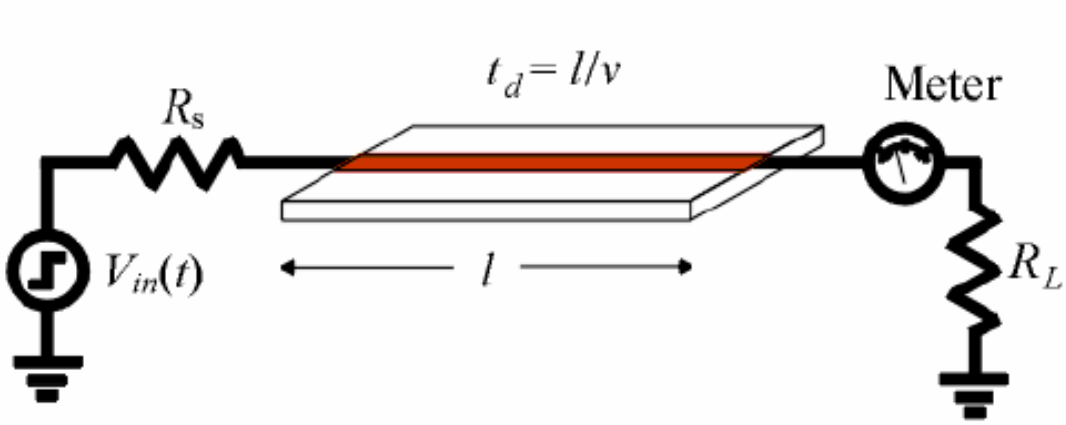
Q1	In the ACU circuits teaching laboratories, what is the linear dimension (roughly) of the electronic circuits you built on the breadboard? What is the maximum signal frequency of the function generator? Based on these two numbers, which theory (lumped or distributed circuit) will be more suitable to analyze the behavior of your circuits? Why?
Sol 1	The linear diagonal of the electronic circuits on the breadboard is 25 cm, the maximum signal frequency of the function generator 25 MHz, corresponding to a minimum wavelength of 12 m (>> 25 cm). So, lumped circuit will be sufficient to analyze the behavior of your circuits.

Q2	The power distributes grid of electric power via 50-Hz sinusoidal waves traveling in air (oscillating frequency 50 hz, refractive index n=0.9). Calculate the min length of transmission line in order to apply distributed circuit analysis on it. 
Sol 2	$T = \frac{1}{50} sec$ $td > 0.01\, T$ $td = L/V$ $td > \frac{0.01}{50} = 2.0 \times 10^{-4}\ sec$ $L = V \times td = 3 \times 10^{8} \times 0.9 \times 2.0 \times 10^{-4} = 54\ km$

Q3	Calculate the min max propagation delay inside transistor of Sio2, having refractive index n=0.7, considering that total path length of signal through the transistor is 0.5 cm 
Sol 3	$V = 0.7\ C$ $td = \frac{L}{V} = \frac{0.005}{0.7 \times 3 \times 10^8} = 2.38\ \times 10^{-11} s = 23.8\ Ps$ $tr < 2.5\ td\ \cong 53.5\ Ps$