FYSE302 Electronics I (part B)
Final exam 21.5.2010
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1. Briefly define/explain:
   a. Root-mean-square value (RMS) (1 p.)
   b. Series resonance (1 p.)
   c. Half- and full-wave rectification (1 p.)
   d. Dynamic range of an amplifier (1 p.)
   e. Active high-pass filter based on an operational amplifier (Draw a circuit and sketch the Bode plot for the magnitude of the transfer function). (2p)

2. Define the transfer function v_o/v_s as a function of frequency for the circuit in figure 1, where v_o and v_s are the complex amplitudes for the voltages across the resistance $[v_o(t)]$ and the signal generator $[v_s(t) = V_m \cos(\omega t)]$, respectively. Draw the Bode plots for both the magnitude and the phase, when L = 200 mH and R = 500 Ω. For what the circuit can be used for?

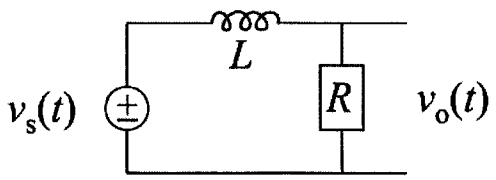

figure 1.

3. Define the transfer function U_2/E for the circuit in figure 2.
   $R_2 = 9R_1$, $R_1 = 1\ \Omega$, $R = 1\ \Omega$, $C = 1$ F.

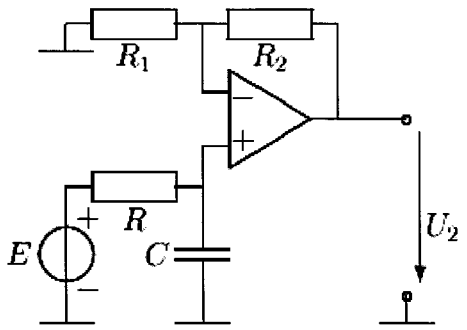

figure 2.

Turn the page!

4. Define a) the operation point (collector current I_C and collector-to-emitter voltage V_{CE}) and b) the AC-voltage amplification at center-frequency range for the common-emitter amplifier in figure 3. What determines the amplification? Typical values for the transistor parameters are: $h_{fe} \approx \beta = 250$, $h_{ie} \approx r_\pi = 5\ k\Omega$, $V_{BE} = 0{,}7$ V.

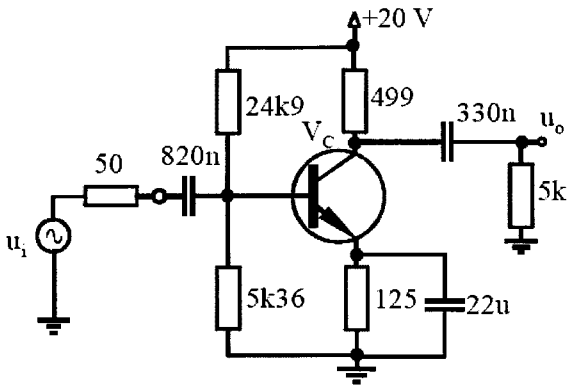

figure 3.

5. The system is represented by the following equations:

$$V_5=BV_3$$
$$V_2=V_1-V_4$$
$$V_3=AV_2$$
$$V_4=CV_3,$$

where A, B and C are the transfer functions for the different blocks in the system and V_i:s are the signals at different points in the system. Draw the block diagram and define the total transfer function $G_{TOT}=V_5/V_1$ for the whole system.