FYSE302 Electronics I (part B)
Final exam 28.5.2010
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1. Briefly define/explain:
   a. Common Mode Rejection Ratio or CMRR (1 p.)
   b. Parallel resonance (1 p.)
   c. Passive high-pass filter (Draw a circuit and the Bode plot for the magnitude of the transfer function). (2 p.)
   d. Zener-diode and its use as a voltage regulator (2 p.)

2. Calculate the voltage U in the circuit in figure 1.
   $E = 10\angle 0°$, $\omega = 100$ rad/s, $R_1 = 5\Omega$, $R_2 = 20\Omega$, $L = 100$mH ja $C = 1$mF.

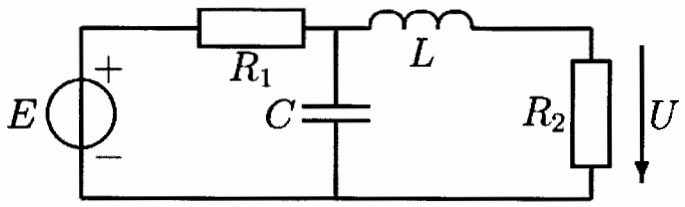

figure 1

3. Define the transfer function $U_2/E\ (j\omega)$ for the circuit in figure 2. What happens: (1) at low frequencies, (2) high frequencies?
   $R_1 = 10$ kΩ, $R_2 = 100$ kΩ, $R_3 = 100$ kΩ, $C_1 = 1$ µF, $C_2 = 0.1$ µF.

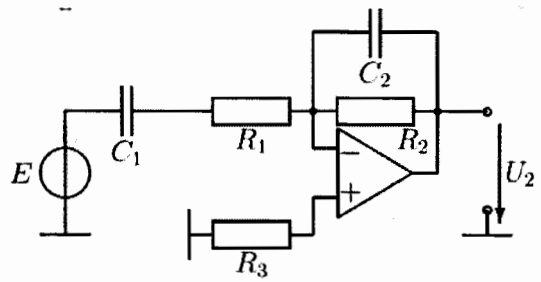

figure 2.

Turn the page!

4. In figure 3a) there is a amplifier circuit based on a npn-type bipolar transistor. The corresponding small-signal model is presented in figure 3b).

   a. Explain what is a small-signal model? And what it is used for? What are the different elements in figure 3b) (r_π, C_π, etc.) representing? Is something missing in the picture?

   b. Define the amplification $A = V_O/V_S$ at low frequencies (i.e. C_{C1} and C_{C2} are considered more significant than the other capacitors). Assume that $R_B >> r_\pi$. Explain qualitatively what happens to the amplification at center-frequency range and at very high frequencies, and why is it so.

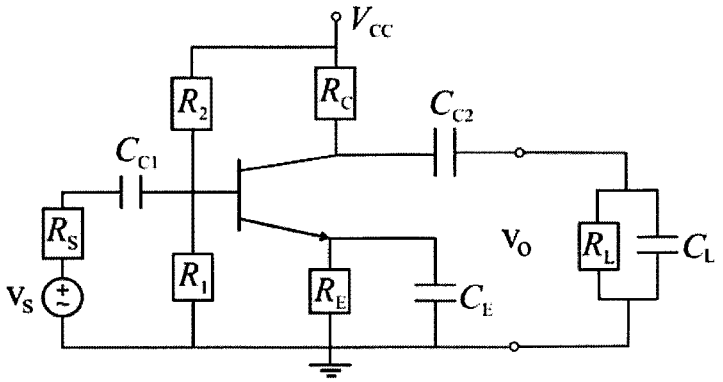

figure 3 (a)

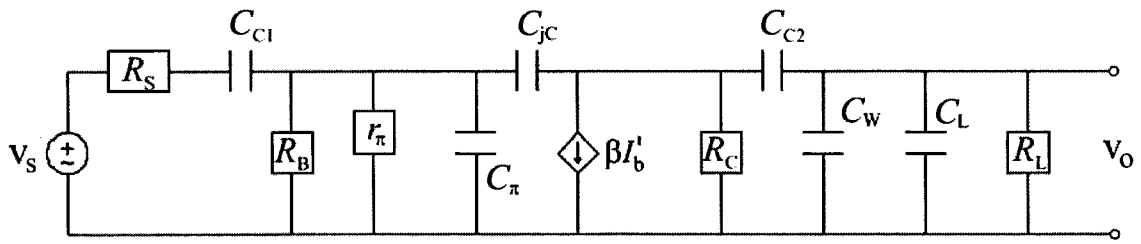

figure 3 (b)

5. A system is represented by the following equations:

$$V_2 = A\,V_1$$
$$V_3 = V_2 - DEV_6$$
$$V_4 = B\,V_3$$
$$V_5 = V_4 + EV_6$$
$$V_6 = CV_5,$$

where A, B, C, D and E are the transfer functions for the different blocks of the system. V_i:s represent the signals at different locations in the system. Draw the block diagram and define the total transfer function $G_{TOT} = V_6/V_1$ for the whole system.