

Exercises for Experimental Physics 3 – IPSP

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Exercise Sheet 3 (WS 2010/11)

Date of Issue to Students: Oct. 28th 2010

Date of Submission: Nov. 4th 2010

Submission Place: Marked mailbox next to room 302 (Linnestr. 5)

Submission Time: 11:00 a.m. at the submission day noted above

Please note: Write your name and matriculation number on EACH sheet of paper. Only submit the calculations and results for exercise 1-3, exercise 4 will be discussed during the instruction classes.

Exercises:

1. A circuit consists of a large electromagnet that has an inductance of 50.0 H and a resistance of 8.00 Ω , a dc 250-V power source and an open switch – all connected in series. How long after the switch is closed is the current equal to (a) 10 A, and (b) 30 A. (4 Points)
2. A circuit consists of a coil that has a self-inductance equal to 5.00 mH and an internal resistance equal to 15.0 Ω , an ideal 12.0-V battery and an open switch – all connected in series (Figure 1), At $t = 0$ the switch is closed. Find the time when the rate at which energy is dissipated in the coil equals the rate at which magnetic energy is stored in the coil. (6 Points)
3. A 5.0- μ F capacitor is charged to 30 V and is then connected across an ideal 10-mH inductor. (a) How much energy is stored in the system? (b) What is the frequency of oscillation of the circuit? (c) What is the peak current in the circuit? (5 Points)
4. The circuit shown in Figure 2 is a *trap filter*. (Assume that the output is connected to a load that draws only an insignificant amount of current.) (a) Show that the trap filter acts to reject signals in a band of frequencies centered at $\omega = 1/\sqrt{LC}$. (b) How does the width of the frequency band rejected depend on the resistance R?

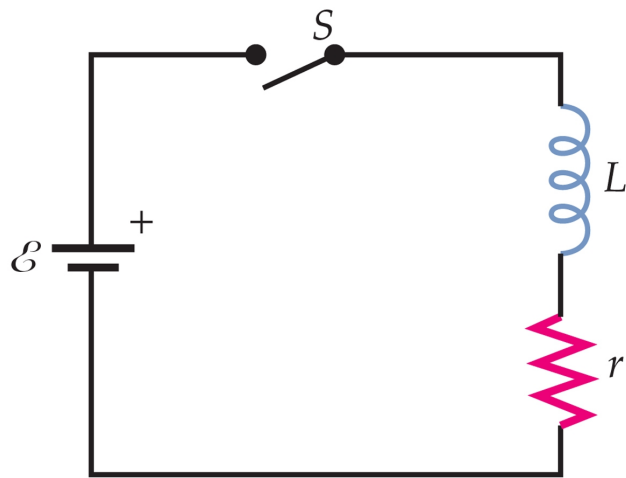


Figure 1: Exercise 2

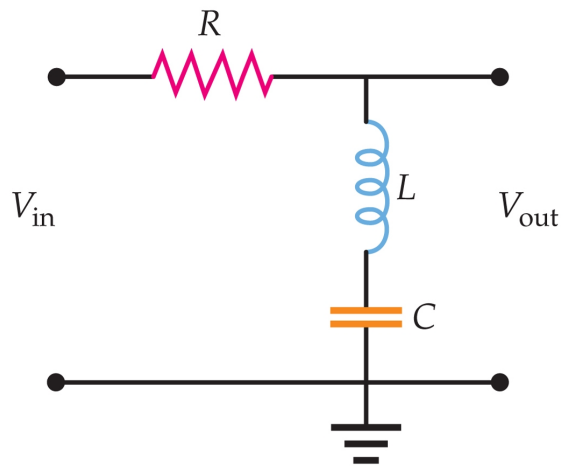


Figure 2: Exercise 4