Mid-Term Test#1

Analog/IC Filter Design (ELEC 441/6081)

Electrical and Computer Engineering Department

Concordia University

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Time: 75 minutes

Q.1:The circuit of Fig.1(a) has a voltage transfer function $T_1(s) = \frac{V_2(s)}{V_1(s)} = \frac{2}{s^2 + \sqrt{2}s + 1}$. The circuit changes to as in Fig.1(b) after applying a suitable impedance transformation followed by a frequency transformation.

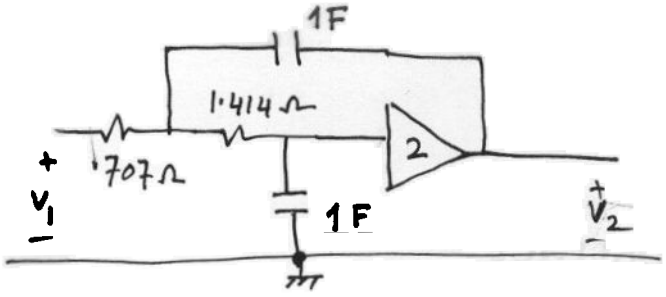

Figure 1 (a)

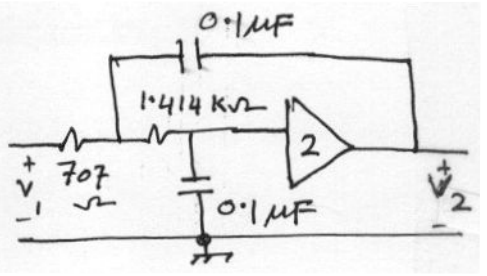

Figure 1 (b)

What is the transfer function of the circuit in Fig.1(b)?

Q.2: A band-stop filter has stop band frequencies of 4300 rad/sec and 6000 rad/sec. The pass-band frequencies are at 3500 rad/sec and 7000 rad/sec respectively. The stop-band attenuation is at least 40 dB, while the pass-band has a ripple 0f 0.5 dB.

Show how you can synthesize the transfer function of the band-stop filer (You may not have to produce the final transfer function expression).

Q.3: Using the normalized second order transfer function, $T_N(s) = \frac{0.9825}{s^2 + 1.098s + 1.103}$, design a single amplifier based second order filter having a DC gain of 5 and a pole frequency of 1000 rad/sec. The minimum design resistance has to be 1000 Ω.

Q.4: For the circuit below, show that the voltage transfer function is given by

$$\frac{V_2(s)}{V_1(s)} = \frac{Ks^2}{s^2 + s(1/R_2C_1 + 1/R_4C_3 + 1/R_4C_1 - K/R_2C_1) + 1/R_2R_4C_1C_3}$$