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| Course Number Section  Modern/Integrated Circuit Filter Design ELEC 441/6081 W |
| Examination Date Time # of pages  Mid-Term Test#2 March 22, 2006 70 minutes 2 |
| Instructor(s)  Dr. R. Raut |
| Crib-sheet with hand-written formula on two sides of a A-sized paper allowed. |
| Special Instructions: (Read very carefully)  Attempt **ALL** questions  Show all steps clearly in neat and legible handwriting.  Students are required to return question paper together with exam booklet(s). |

Q.1: Design the L,C,R all-pole low-pass ladder filter with Butterworth response having fc=1 kHz, and which produces an attenuation of 25 dB/Octave in the stop-band. The load resistance is 100 Ω.

Q.2: Using a cascade of first-order and second-order gm-C filter sections, design the following:

1. A third-order low-pass filter with maximally flat magnitude characteristic, having Ap=3 dB and DC gain of 30.

Q.3: Figure 3 below is known as the Bainter band-reject biquad. Derive the transfer function Vo/Vs.



Figure: 3

Q.4: Perform pre-warping on the notch and the pole frequencies in the transfer function  , and derive the associated Switched Capacitor Filter (SCF) transfer function H(z), using bilinear transform. Use a sampling frequency of 8 kHz. What will be the response of the SCF at (a) DC, and (b)  rad/sec?