

KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS
Electrical Engineering Department
EE-416 Analog Filter Design
Instructor: Dr. Hussain Alzaher
Exam-I (061)

Name:

I.D.#

Serial #:

- 1) (a) Design a Bessel-Thomson filter to provide 200- μ s delay over a frequency band of 3 kHz. The delay error must be less than 4%.
(b) Realize the filter using Sallen-Key biquad sections.

2) (a) Use two first order filters with ideal op-amps to design a circuit to realize the given function.

$$\frac{V_o}{V_i} = \frac{(s+100)(s+400)}{(s+200)(s+200)}$$

(b) Determine the limitations and errors caused when a real op-amp with $\omega_t = 2\pi 1 \text{ Mrad/sec}$ is used.

(c) Draw the bode plot for part (a) and sketch the response of part (b).

- 3) Design Delyiannis-Friend filter to realize a bandpass with $f_0=4.5\text{kHz}$, $Q=9$ and midband gain of 26dB.
- (b) Analyze the effects of the finite gain-bandwidth products in the design assuming a real op-amp with $\omega_t=2\pi 1\text{Mrad/sec}$ is used.