

**THIS PAPER MUST NOT BE REMOVED
FROM THE EXAMINATION ROOM**

**STUDENT NAME:
STUDENT NUMBER:**

Internal Students Only

THE UNIVERSITY OF QUEENSLAND

**School of Information Technology
& Electrical Engineering**

Second Class Test – May 10, 2012

ELEC 3004 / 7312:

Signals Systems & Controls

(Exam Sort I)

CLOSED BOOK

TIME: THIRTY (30) minutes for working

FIVE (5) minutes for perusal before examination begins

ANSWER ALL QUESTIONS ON SHEET PROVIDED

QUESTIONS CARRY THE NUMBER OF MARKS INDICATED

Drawing instruments and one battery-operated or solar-powered electronic calculator may be used but NO pre-programmed material or calculator instruction booklets are allowed in the examination room.

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ELEC3004/7312 Signals, Systems, and Control

Class Quiz 2, 10th of May, 2012 – Version 1

All Questions of Equal value | Time Allowed: 30 minutes | Total marks: 10

Answer On Answer Sheet

1. Which of the following statements is true for an IIR filter?
 - (a) IIR filters generally have a linear phase response
 - (b) IIR filters have low sensitivity to coefficient quantization
 - (c) IIR filter architectures are not suitable for high pass filter designs
 - (d) All of the above are true
 - (e) None of the above is true

2. Which of the following statements is true for a zero phase FIR filter with real impulse response $h(n)$?
 - (i) The impulse response can be anti-symmetric ($h(x)=-h(-x)$)
 - (ii) The impulse response of a low pass filter can be expressed as a sum of cosine terms
 - (iii) Complex valued zeros off the unit circle occur in conjugate reciprocal quads
 - (a) Both (i) and (ii)
 - (b) Both (ii) and (iii)
 - (c) Both (i) and (iii)
 - (d) All of (i), (ii), and (iii)
 - (e) None of (i), (ii) and (iii)

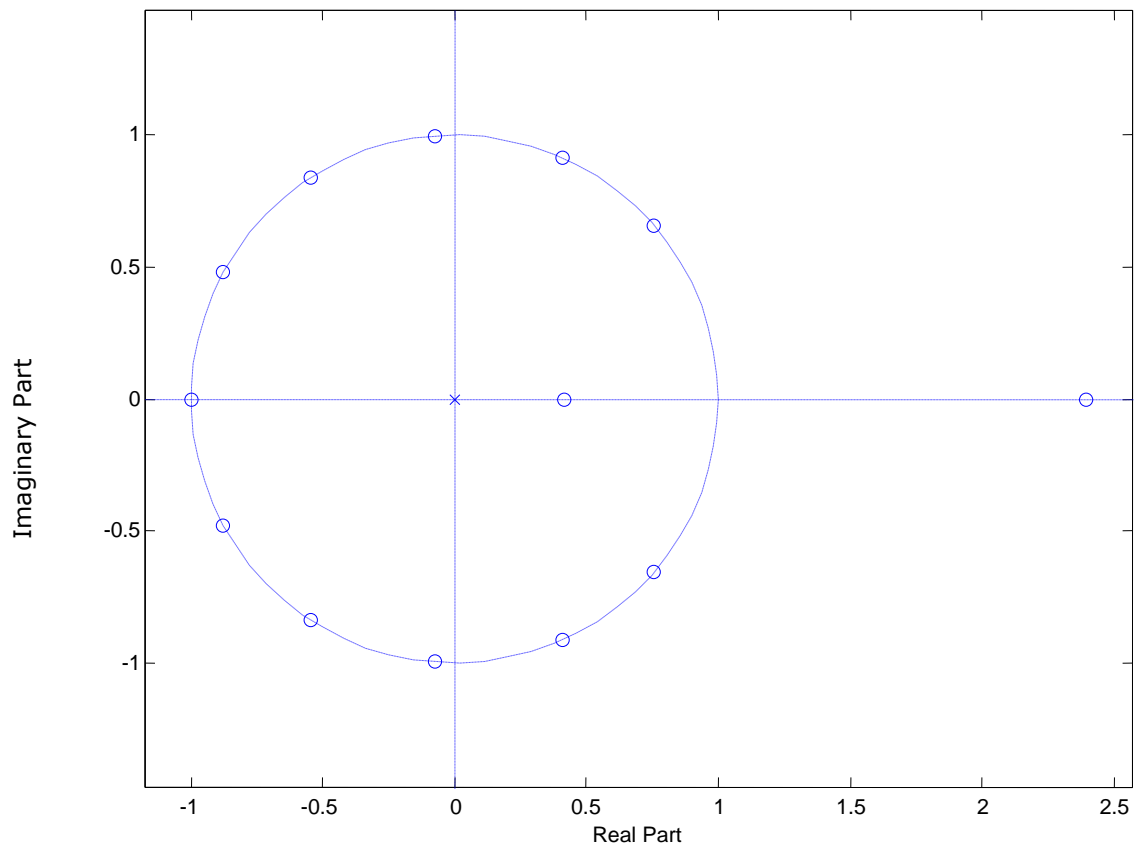


Figure 1 Pole-Zero plot of a filter

3. Consider the pole-zero diagram of the filter of Figure 1. How many taps does this filter have?
 - (a) 13
 - (b) 14
 - (c) 15
 - (d) 16
 - (e) None of the above

4. Consider the pole-zero diagram of the filter of Figure 1. What type of filter is this?
 - (a) Low Pass
 - (b) Hilbert Transformer
 - (c) Band Pass
 - (d) Band Stop
 - (e) None of the above

5. Consider the pole-zero diagram of the filter of Figure 1. How many poles does the response have?
 - (a) 1
 - (b) 7
 - (c) 14
 - (d) 15
 - (e) None of the above

6. Consider the pole-zero diagram of the filter of Figure 1? How many times does the magnitude response go to zero in the stop band?
- (a) 0
 - (b) 2
 - (c) 4
 - (d) 6
 - (e) None of the above
7. Consider an even order highpass FIR filter designed by the Parks-McClelland Method. Which of the following statements is/are true?
- (i) The impulse response is odd symmetric about the centre coefficient
 - (ii) The zeros off the unit circle occur in reciprocal conjugate pairs
 - (iii) The impulse response at the origin, $h(0)$, is zero
- (a) (i) only
 - (b) (ii) only
 - (c) (iii) only
 - (d) All of the above
 - (e) None of the above

Questions 8-10 relate to the following set of specifications for an FIR low pass filter.

Sampling Frequency = 24 kHz
 Passband Edge = 250 Hz
 Stopband Edge = 350 Hz
 Passband Ripple = 1 dB
 Stopband Attenuation > 80 dB

8. What is the best estimate of the number of multiplications per second required to process this data with a standard transverse FIR filter (based on the harris formula for filter length)?
- (a) 235,000
 - (b) 14.7 million
 - (c) 25.0 million
 - (d) 32.3 million
 - (e) None of the above
9. What is the maximum downsampling factor, M , which could be applied to the output of this filter without significant aliasing distortion?
- (a) 20
 - (b) 40
 - (c) 60
 - (d) 80
 - (e) None of the above

10. What is the best estimate of the number of multiplications per second required to process this data with a polyphase downsampling filter?
- (a) 354,000
 - (b) 467,000
 - (c) 480,000
 - (d) 523,000
 - (e) None of the above

ELEC 3004 / 7312: Quiz 2 – Answer Sheet

| Item | | |
|------|------------------|----------|
| 1 | EXAM Sort Number | I |
| 2 | LAST Name: | |
| 3 | First Name: | |
| 4 | Student #: | |

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| Question | Answer |
|---------------------|--------|
| 1.One (1) | |
| 2. Two (2) | |
| 3. Three (3) | |
| 4. Four (4) | |
| 5. Five (5) | |
| 6. Six (6) | |
| 7.Seven (7) | |
| 8. Eight (8) | |
| 9.Nine (9) | |
| 10. Ten (10) | |