EEL 430 SELECTED TOPICS MAJOR MM 35 MAY 2007

*Note: (i) Answer all parts at the same place (scattered answers will **not** be graded).*
(ii) Write assumptions wherever made.
Good Luck !

1. Ranging and Positioning using UWB [10]

(a) A certain implementation of a UWB system uses 1 GHz of bandwidth. What is the best possible special resolution it can deliver? Substantiate mathematically [5].

(b) What is the difference between ranging and positioning? Explain in maximum 5 sentences. [5]

2. MRC-RAKE for UWB [10]

(a) Based on channel measurements, the impulse response of an indoor UWB channel is modeled as (time in nanoseconds)

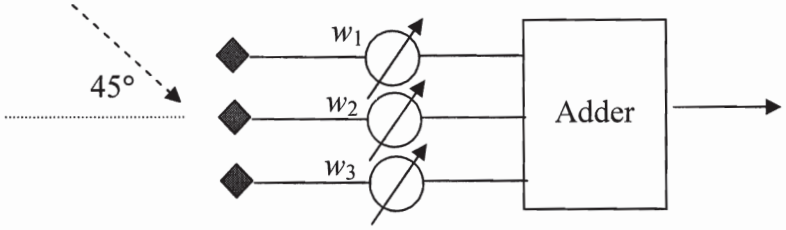
$$h(t) = 0.5\delta(t)e^{-j(\pi/4)} + \delta(t-1)\,e^{-j(\pi/2)} \quad (1)$$

Suppose we wish to implement the MRC- RAKE (2 fingers) receiver for the channel given by (1). What is the rake receiver output $w(t)$ when the received signal $r(t)$ is processed through it. Assume that an impulse was transmitted. [5]

(b) What is the rake receiver output $w(t)$ if EGC is used? [5]

3. Smart Antenna for UWB [15]

Suppose we have a simple smart antenna system with three antenna elements in the array, working in the band 1.0 – 1.5 GHz. The separation between the elements is $\lambda/2$ where λ corresponds to the wavelength of the center frequency.



(a) What should be the weights w_1, $w_2$and w_3 so that the antenna array looks at 45°angle? [5]
(b) What should be the weights w_1, $w_2$and w_3 so that the antenna array looks at 0° angle where the desired user is located and, at the same time, rejects an interferer located at - 45° ? [10]

♠♠♠

-RB