

ELECTRICAL ENGINEERING DEPARTMENT

EEL860: Wireless Communications: Major Test: 3 May 2008: Time 2 hr: Max. Marks 50

Attempt all questions. Please be brief and to the point.

Q.1 Plot the power spectral density of a 4-ary signal considering that pulses can take one of the four equiprobable values ± 1 and ± 2 and the pulse shape is NRZ type.

(5)

Q.2 Consider voice transmission using BPSK signalling at a transmission rate of 2400 bps and a bandwidth efficiency of 1 bps/Hz. It is desired to increase the data rate to 19.2 kbps. If the no. of points in the signal constellation is increased until the data rate becomes 19.2 kbps while the symbol rate remains at 2400 symbols/s, determine (i) the no. of points in the constellation, (ii) BW efficiency factor of the modulation scheme (bit rate R_b / System BW W) and (iii) additional power requirement for the transmission to maintain the same transmission accuracy.

(2 + 1½ + 1½)

Q.3 Time-variant transfer function of a wide-sense stationary uncorrelated scattering (WSSUS) channel is given by

$$H(f, t) = \alpha(t) e^{j\theta(t)}$$

Does the channel exhibit frequency-selective fading or flat fading? Derive the channel impulse response $h(\tau, t)$.

Q.4 Consider a cellular system with 416 radio channels available for handling traffic. Out of these 21 channels are designated as control channels. Let the average channel holding time of a call be 3 minutes, the blocking probability during busy hour be 2%. Determine the number of calls per cell per hour. Take cluster size to be 4.

(5)

Q.5 Consider a fading channel which exhibits a Doppler frequency shift uniformly distributed between -10 Hz and 10 Hz. Determine (i) the mean Doppler shift

Q. 6(a) Explain the reason for the degradation in the performance of CDMA system with the increase in the number of users.

(b) A shift register with 16 taps is used for the generation of PN sequence in a DS-SSMA system. If the chip duration is $0.1 \mu s$, determine (i) the bit duration and (ii) the processing gain.

Q. 7 Briefly discuss diversity combining techniques (Selection, Maximal Ratio and Equal Gain). Give their merits and demerits.

(1+2+2)
(5)

Q. 8 What is the function of an equalizer in a communication system? Explain the working of Adaptive Tapped-delay Equalizer.

(5)

Q. 9 Explain the working of Alamouti code (2 TX and 1 RX)? Why this code is important for wireless communications?

(5)

Q. 10 Explain the working of Wi-Fi network. Why IEEE 802.11 b/g are more popular than IEEE 802.11a standard. Give the merits of WiMAX over Wi-Fi.
