10EC086

M.Tech. Degree Examination, Dec.2014/Jan.2015
Wireless Communications

Time: 3 hrs.

Max. Marks:100

Note: *Answer any FIVE full questions.*

1 a. Briefly describe the basic mechanics that govern the electromagnetic waves, emphasizing which are relevant to wireless communications. **(08 Marks)**

   b. Define:
      i) d^{-2} and d^{-4} power loss in wireless communications.
      ii) Fresnen-Kirchhoffs-Diffraction parameter and diffraction loss. **(06 Marks)**

   c. Given the following geometry (Fig.Q.1(c)). Determine the loss due to knife edge diffraction: **(06 Marks)**
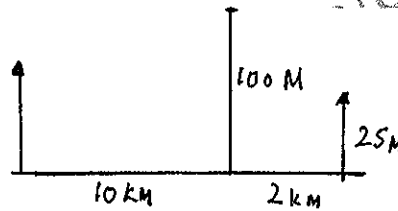

Fig.Q.1(c)

2 a. What is the need to model wireless channels? **(02 Marks)**

   b. Briefly describe the following methods used in modeling wireless channels:
      i) Stored impulse response method of modeling.
      ii) Deterministic method of modeling.
      iii) Stochastic method of modeling.
      Name some of the important channel models that are derived from these methods. **(09 Marks)**

   c. Differentiate time-invariant and time-variant two path models. **(04 Marks)**

   d. Derive the equation for the time-variant-multipath channel model interms of time-variant attenuation and propagation delay. **(05 Marks)**

3 a. Define the following terms related to multipath:
      i) Power delay profile.
      ii) First arrival delay.
      iii) Mean excess delay.
      iv) RMS-delay spread.
      v) Maximum excess delay. **(12 Marks)**

   b. Calculate mean excess delay, RMS delay and the mean excess delay (10dB) profile. Given in Fig.Q.3(b). Estimate the 50% coherence band width of the channel. **(08 Marks)**
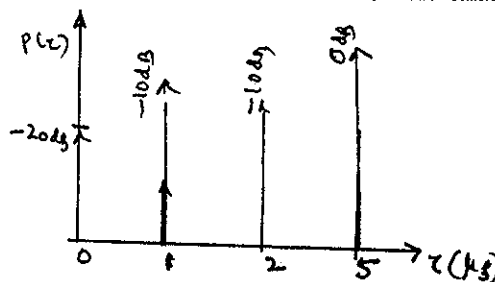

Fig.Q.3(b)

4 a. What is the difference between attenuation and fading? **(02 Marks)**

b. State various factors influencing large scaling fading and small scaling fading. **(04 Marks)**

c. Differentiate the following:
   i) Flat fading and frequency selective fading.
   ii) Slow fading and fast fading.
   iii) Coherence band width and coherence time. **(09 Marks)**

d. A radio channel is characterized by multipath spread of 5 milliseconds and a doppler spread of 0.1Hz. Determine: Coherence bandwidth and coherence time. If a signal is transmitted over this channel with a band width of 50Hz, State:
   i) Whether the channel is flat of frequency selective.
   ii) Whether the channel is slow or fast. **(05 Marks)**

5 a. Explain briefly the modeling of Rayleigh fading channel. **(04 Marks)**

b. Compare in brief, Rayleigh, Recian and Nakagami fading channel models. **(06 Marks)**

c. In a Rayleigh fading distribution, what is the probability that the signal powder is 20dB, 6dB and 3dB down the relative mean power? **(06 Marks)**

d. A vehicle receives a 910 MHz transmission while travelling at a constant velocity for 15 seconds. The average fade duration for a Rayleigh fading signal level 10dB. Below the RMS level is 1 millisecond. How FAR does the vehicle travel during 15 seconds duration? Assume that the local mean remans constant during travel. **(04 Marks)**

6 a. Differentiate macro diversity and micro diversity. **(02 Marks)**

b. Briefly explain the different diversity technique used. In wireless mobile system. **(08 Marks)**

c. What do you mean channel state information (CSI)? State its importance. **(04 Marks)**

d. In a Religh-Fade-Time-Diversity situation, calculate the probability of error for signal to noise ratio (SNR) of 23dB. If $L = 5$, what will be the 'BER' improvement. **(06 Marks)**

7 a. How does MIMO techniques differ from smart antennas? **(04 Marks)**

b. Define spatial multiplexing. **(04 Marks)**

c. Write the channel matrix for the MIMO system. **(04 Marks)**

d. Show that there is a logarithmic increase in capacity with the number of elements when the transfer functions are identical and linearly increases when the transfer functions are different in a MIMO system. **(08 Marks)**

8 a. How 'OFDM' is achieving the objectives of a MIMO? Explain the principle. **(10 Marks)**

b. What is V-Blast and how does it work to give reliable wireless communication? What is nulling and cancelation process? **(06 Marks)**

c. What are the draw back of D-blast? **(04 Marks)**

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