BIRLA INSTITUE OF TECHNOLOGY AND SCIENCE, PILANI

SECOND SEMESTER 2017-2018

EEE F431 MOBILE TELECOMMUNICATION NETWORKS

Mid-Semester Test (Open Book)

March 10, 2018

DURATION: 90 min **Max. Marks: 60**

Note: Assume and state typical values if not given. Do mention Figure/Equation number of textbook (TB) or reference book (RB#), if applied.

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1. (a) A receiver in an urban cellular radio system detects a 0.3 mW signal at d = d0 = 1 meter from the transmitter. In order to mitigate co-channel interference effects, it is required that the signal received at any base station receiver from another base station transmitter which operates at the same channel must be below -90 dBm. A measurement team has determined that the average path loss exponent in the system is n = 2.8. Determine the major radius of each cell if a seven-cell reuse pattern is used.
(b) What is the major radius if a four cell reuse pattern is used?

2. (a) A total of 27 MHz of bandwidth is allocated to a particular FDD Cellular telephone system that uses two 25 KHz simplex channels to provide full duplex voice and control channels. Assume each cell phone user generates 0.12 E of traffic. Assume Erlang B system is used. Find the number channels in each cell for a fur-cell reuse system. If each cell is to offer capacity that is 88% of perfect scheduling, find the maximum number of users that can be supported per cell where omnidirectional antennas are used at each base station. What is the blocking probability of the system when the maximum numbers of users are available in the user pool?
(b) If each new cell now uses 120° sectoring instead of omnidirectional for each base station, what is the new total number of users that can be supported per cell for the same blocking probability? If each cell covers 6 square km, then how many subscribers could be supported in an urban market that is 36 × 36 sq. km. for the case of omnidirectional and for the case of 120° sectored antennas?

3. (a) In a two-ray ground reflected model assume that $\theta_{\Delta} < 6.261$ rad for phase cancellation reasons. Assume receiver height of 2.2 m and requirement that $\theta_i < 4.5°$, determine minimum allowable values for T-R separation distance and height of the transmitter antenna. Assume carrier frequency is 1800 MHz.
(b) A general design rule for microwave links is 60 % clearance for the first Fresnel zone. For a 4 km link at 2.5 GHz, what is the maximum first Fresnel zone radius? What clearance is required for this system?

4. (a) If the base band message has a bit rate of 50 kbps and is modulated by an RF Carrier using BPSK, answer the following: Find the range of value required for rms delay spread of the channel such that the received signal is a flat fading signal.
(b) If the modulation carrier frequency is 2.45 GHz, what is the coherence time of the channel assuming a vehicle speed of 50 km per hour? Is the channel fast or slow fading? How many bits are sent while channel appears static?
