Code No: D6109, D6509 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.TECH II - SEMESTER EXAMINATIONS, APRIL/MAY 2012
PROPAGATION MODELS FOR WIRELESS COMMUNICATIONS
(COMMON TO COMMUNICATION SYSTEMS, WIRELESS & MOBILE COMMUNICATIONS)

Time: 3hours **Max. Marks: 60**

Answer any five questions
All questions carry equal marks

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1. (a) Describe the free space propagation model and deduce the expression for received power.
   (b) A receiver is located 10 km away from a 50 W transmitter. The carrier frequency is 900 MHz, the free space propagation is assumed. The gain of the transmitting antenna is unity, and the receiver antenna gain is 2. Find
   (i) the power at the receiver,
   (ii) the magnitude of the electric field at the receiving antenna,
   (c) The R.M.S voltage applied to the receiver input assuming that the receiver antenna has a purely real impedance of 50 ohms and is matched to the receiver.

2. (a) Discuss about single knife-edge diffraction that affects the received signal in the downlink.
   (b) A receiver is made up of three main elements: a pre-amplifier, a mixer and an IF amplifier with a noise figure of 3 dB, 6 dB, and 10 dB respectively. If the overall gain of the receiver is 30 dB and the IF amplifier gain is 10 dB, determine the minimum gain of the pre-amplifier to achieve an overall noise figure of no more than 5 dB.

3. Explain about indoor propagation models with respect to personal wireless communication systems.

4. Describe in detail about different types of correlated shadowing in terms of their statistical characterization and their effects on the performance of the system.

5. (a) State and explain the following parameters:
   (i) Coherence Time
   (ii) RMS delay spread
   (iii) Power delay profile.
   (b) Determine the proper spatial sampling interval required to make small scale propagation measurements which assume that consecutive samples are highly correlated in time. How many samples will be required over 10m travel distance if the carrier frequency is 1900 MHz, and velocity of the mobile is 50 m/s. How long would it take to make these measurements, assuming they could be made in real time from moving vehicle? What is the Doppler spread for the channel?

6. (a) Explain the term ‘Megacells’ and their formation in detail.
   (b) List out the statistical mobile channel models and describe each model with its application.

7. (a) What is RAKE receiver? Derive the SNR expression at the output of a RAKE receiver. Assume that cross-correlation and auto-correlation properties of the code used in the system is ideal.
   (b) Assume a four branch diversity is used where each branch receives and independent Rayleigh Fading signal. If the average SNR is 20 dB, determine the probability that the SNR will drop below 10 dB. Compare this case of a single receiver without diversity.

8. Write the following:
   (a) Signal Sampling issues
   (b) Outdoor and indoor measurements.

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