**Code: 13A04802** **R13**

B.Tech IV Year II Semester (R13) Regular Examinations April 2017

**ADVANCED 3G & 4G WIRELESS COMMUNICATIONS**

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

**PART – A**

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Write the expressions for the impulse response of a multipath propagation channel and base band received signal at a mobile receiver.

(b) If BER of $10^{-6}$ is to be achieved from a wireless communication system, what is the required SNR in dB?

(c) State the terms: (i) Doppler spread. (ii) Coherence bandwidth.

(d) If a signal to interference ratio of 15 dB is required for satisfactory forward channel performance of a cellular system, what is the cluster size that should be used for maximum capacity if the path loss exponent is 4?

(e) Prove that the cross correlation of any two OVSF codes of length 8 (say) is zero.

(f) Draw the block diagram of OFDM under AWGN channel conditions.

(g) Give two examples of singular value decomposition (SVD).

(h) What is MIMO? Give its mathematical model for two transmit antennas and three receive antennas in the presence of MIMO channel.

(i) Specify the chip rates, modulation schemes used in cdma2000 and WCDMA technologies.

(j) List out the family of 4G systems and specify their data rates.

**PART – B**

(Answer all five units, 5 X 10 = 50 Marks)

**UNIT – I**

2 Derive the expression for the probability of error of a wireless communication system.

**OR**

3 Prove that the optimum SNR of an antenna diversity system $(\mathrm{SNR})_{\mathrm{opt}} = \frac{\|\vec{h}\|^2 \mathrm{P}}{\sigma_n^2}$ where $\vec{h}$ is the impulse response of a wireless channel, $\mathrm{P}$ is the signal power and $\sigma_n^2$ is variance of thermal noise.

**UNIT – II**

4 (a) With suitable sketch, illustrate the cellular reuse concept.

(b) A wireless channel has two multi-paths with power delay profile of 0 dB (at 0 sec.) and 0 dB (at 1μs). Find out the rms delay spread and coherence bandwidth of the channel.

**OR**

5 (a) Discuss about different handoff strategies with suitable sketches.

(b) Determine the 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 10 m travel distance if the carrier frequency is 2 GHz and the vehicle speed is 50 m/s? How long would it take to make these measurements assuming that they could be made in real time from a moving vehicle? What is the Doppler spread of the channel?

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**UNIT – III**

6 Generate an m-sequence of length 31, with valid taps of (5, 2) using linear feedback shift registers. Also find its auto correlation function for different time lags.

**OR**

7 (a) What is PAPR in an OFDM system, and what are its effects in the system's performance? Explain.

(b) Draw the auto correlation function of a PN code 1 1 1 -1 -1 1 -1 with respect to time shift from -10$\tau$ to +10$\tau$ where $\tau$ is the chip time.

**UNIT – IV**

8 (a) What are the different special cases of MIMO wireless system? Give an example for each case.

(b) Consider a MIMO system with number of receive antennas as 3. If the noise variance $\sigma_n^2$ = -3dB by considering iid noise elements, what is the noise covariance matrix?

**OR**

9 Derive the expression for estimated transmitted signal vector at a MIMO zero-forcing receiver by considering number of receive antennas are greater than the number of transmit antennas

**UNIT – V**

10 (a) List out the families of 3G and 4G wireless and give some salient features of them.

(b) What are the important technical specifications of GSM?

**OR**

11 Write notes on Wireless standards:

(a) WiMAX.

(b) GPRS.

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