http://www.makaut.com

Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech(ECE)/SEM-3/MEC-1102A/2010-11

2010-11

SMART ANTENNAS

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer any *five* of the following. 5 × 14 = 70

1. Explain with necessary diagrams the multiple access interference (MAI) in DS-CDMA systems. What is log – normal shadowing ? Obtain an expression for the probability that the received signal level will be below γ in log normal shadowing. What is shadowing margin ? 6 + 3 + 3 + 2

2. What are the key benefits of Smart Antenna ? Develop a baseband complex envelope model of an LES array with necessary expressions for array factor, weight vector, data vector and array manifold. Derive an expression for the Vector Channel Impulse Response and the Spatial Signature.

3 + 6 + 5

3. What are Adaptive Antenna Systems ? Using MMSE and LS criteria, obtain expressions for the weight vector for optimal beam forming, while minimizing the cost function. 4 + 10

4. Design a software radio with a sampling rate of 7·3728 Msps, with a signal centre frequency of 1·8432 MHz The radio should incorporate a FIR filter with down conversion and decimation. What are polyphase filters ? 10 + 4

5. Obtain an expression of total interference in terms of incell interference and out-of-cell interference in a reverse channel of Multi-cell systems with spatial filtering at the base station. What are Reuse factor, Rate set 1 and Rate set 2 in CDMA systems ? 10 + 4

6. Using a vector based approach, obtain an expression for the CINR at the output of the despreader for user K = 0 in terms of interference gain $G_i(M)$. Obtain an expression for the upper bound on the number of users supported in each cell of a CDMA system, in terms of Base Stn. loading factor x and CINR $\bar{y}$, assuming uniform path loss exponents exists throughout the system. 8 + 6

7. What are Spatio-Temporal channel models for smart antennas ? Using the Geometrically Based Single Bounce Elliptical Model (GBSBEM), obtain an expression for the conditional pdf for the Direction of Arrival (DOA). 4 + 10

8. What are adaptive algorithms ? What are the different adaptive algorithms for CDMA ? Why Gram-Schmidt orthogonalisation is required in the multitarget least squares constant modulus algorithm ? Describe the multitarget decision directed algorithm stepwise. 3 + 3 + 4 + 4

9. Describe the least squares De-Spread Re-Spread multitarget array (LS-DRMTA) algorithm stepwise. What are the advantages of LS-DRMTA ? Derive the Least Squares De-Spread Re-Spread multitarget constant modulus (LS-DRMT CMA) algorithm. 4 + 4 + 6

10. Explain the Delay-and-Sum method for the DOA estimation, with necessary diagrams. What are the advantages of the subspace methods for DOA estimation over conventional methods ? Describe the steps of the MUSIC algorithm for DOA estimation. What are the limitations of the MUSIC algorithm ? 4 + 3 + 4 + 3