FIVE-WEEK COURSE ON ERROR-CORRECTING CODES
FOR SPRING SEMESTER 2012
(Dr Michael Purser)

It is assumed that there are three hour-long lectures per week.

Week 1 **Introduction**
Block Codes, Distance, Errors and Probabilities of Detection and Correction
Sphere-packing Bound
Shannon's Theorem
Linear Codes, Weight
Generator Matrix, Null Matrix, Standard Array, Syndromes
Non-binary codes

Week 2 Hamming Codes, Perfect Codes
Varsharmov-Gilbert and Plotkin Bounds
Modulation, FSK, PSK, DPSK
Symbols and Bits, Gray Coding
Noise, SNRs and relation to error-probabilities
Shannon for AWGN
Erasures

Week 3 **Cyclic Codes**, Generating Polynomial, Systematic Codes
Roots and the Null Matrix
Error-detection, Weight Distribution
Feedback Shift Registers
Error-correction with Cyclic Codes, Kasami
Non-binary Cyclic
BCH Codes, Roots of Generating Polynomial and distance
Minimum Polynomials
Error-correction with BCH Codes

Week 4 **RS Codes**
Error-correction with RS Codes
Performance of RS Codes
Convolutional Codes, Trellises
Decoding and Viterbi
Performance Analysis of Convolutional Codes

Week 5 **Trellis Code Modulation (to be supplied)**
Examples with PSK
SNR Gain
Coding for Phase Invariance
Outline of **CDMA**

The above is a rough guide to the contents of the course. It is intended to produce concise notes for the departmental web site, and also for distribution, probably partially hand-written. All annexes referred to in the text will be available in hard copy, but not on the web site.