COURSE SPECIFICATION FORM

for new course proposals and course amendments

Department/School:	**Mathematics**	**Academic Session:**	**2017-18**
Course Title:	Theory of Error-Correcting Codes	**Course Value:** (UG courses = unit value, PG courses = notional learning hours)	0.5 unit
Course Code:	MT4610	**Course JACS Code:** (Please contact Data Management for advice)	G100
Availability: (Please state which teaching terms)	Term 2	**Status:**	Optional Condonable
Pre-requisites:	MT1820 or MT2800	**Co-requisites:**	-
Co-ordinator:	-		
Course Staff:	-		
Aims:	To provide an introduction to the theory of error correcting codes employing the methods of elementary enumeration, linear algebra and finite fields.		
Learning Outcomes:	1. calculate the probability of error of the necessity of retransmission for a binary symmetric channel with given cross-over probability, with and without coding; 2. prove and apply various bounds on the number of possible code words in a code of given length and minimal distance; 3. use MOLSs and Hadamard matrices to construct large linear codes of certain parameters; 4. reduce a linear code to standard form, finding a parity check matrix, building standard array and syndrome decoding tables, including for partial decoding; 5. demonstrate a breadth of understanding appropriate for an M-level course.		
Course Content:	Basic theory of coding: Words, codes, errors, t-error detection and t-error correction. The Hamming distance in the space Vn(q) of n-tuples over an alphabet of q symbols (with emphasis on (Z2)n). Probability calculations. The main coding theory problem: Construction of small binary codes. Rate of a code. Equivalence of codes. The Hamming, Singleton, Gilbert-Varshamov and Plotkin bounds. Puncturing a code. Perfect codes. Hadamard codes and Levenshtein's theorem. Codes based on mutually orthogonal latin squares (MOLS). Linear Codes: Linear codes as linear subspaces of V(n.q). Generator and parity check matrices, standard array and syndrome decoding, incomplete decoding. Dual of a code. Hamming codes.		
Teaching & Learning Methods:	The total number of notional learning hours associated with this course are 150 hours. 3 hours of lectures per week over 11 weeks. 33 hours total. 117 hours of private study, including work on problem sheets and examination preparation. This may include discussions with the course leader if the student wishes.		
Key Bibliography:	A First Course in Coding Theory −□R Hill (OUP). 001.539 HIL Coding Theory – a First Course −□S Ling and C Xing (Cambridge UP 2004) 001.539 LIN		
Formative Assessment & Feedback:	Formative assignments in the form of 8 problem sheets. The students will receive feedback as written comments on their attempts.		
Summative Assessment:	**Exam:** 100% Written exam. A two hour paper. **Coursework:**		

Updated September 2017