COURSE SPECIFICATION FORM

Department/School:	**Mathematics**	**Academic Session:**	**2017-18**
Course Title:	Channels	**Course Value:** (UG courses = unit value, PG courses = notional learning hours)	20 credits
Course Code:	MT5441	**Course JACS Code:** (Please contact Data Management for advice)	G100
Availability: (Please state which teaching terms)	Term 1	**Status:**	Mandatory for MCC Optional for MfA Condonable
Pre-requisites:	Undergraduate courses in probability and algebra.	**Co-requisites:**	-
Aims:	To investigate the problems of data compression and information transmission in both noiseless and noisy environments.		
Learning Outcomes:	1. state and derive a range of information-theoretic equalities and inequalities; 2. explain data-compression techniques for ergodic as well as memoryless sources; 3. explain the asymptotic equipartition property of ergodic sources; 4. understand the proof of the noiseless coding theorem; define and use the concept of channel capacity of a noisy channel; explain the noisy channel coding theorem; 5. understand a range of further applications of the theory. 6. Demonstrate independent learning skills		
Course Content:	Entropy: Definition and mathematical properties of entropy, information and mutual information. Noiseless coding: Memoryless sources: proof of the Kraft inequality for uniquely decipherable codes, proof of the optimality of Huffman codes, typical sequences of a memoryless source, the fixed-length coding theorem. Ergodic sources: entropy rate, the asymptotic equipartition property, the noiseless coding theorem for ergodic sources. Lempel-Ziv coding. Noisy coding: Noisy channels, the noisy channel coding theory, channel capacity. Further topics, such as hash codes, or the information-theoretic approach to cryptography and authentication.		
Teaching & Learning Methods:	The total number of notional learning hours associated with this course are 200. 3 hours of lectures per week over 11 weeks. 33 hours in total. 167 hours of private study, including work on the mini-project, problem sheets and examination preparation. This may include discussions with the course leader if the student wishes.		
Key Bibliography:	Codes and Cryptography – D Welsh (Oxford UP 1988), Library reference 001.5436 WEL Elements of Information Theory – T M Cover and J A Thomas (Wiley 1991), Library Reference 001.539 COV Information Theory, Inference, and Learning Algorithms – D J C MacKay (Cambridge UP 2003), Library Reference 001.539 MAC		
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:** 90% Written Exam. Two hour written exam. **Coursework: 10%** Individual unsupervised mini-project		

Updated September 2017

The information contained in this course outline is correct at the time of publication, but may be subject to change as part of the Department's policy of continuous improvement and development. Every effort will be made to notify you of any such changes.