

1997 Paper 9 Question 11

Information Theory and Coding

The information in continuous but bandlimited signals is *quantised*, in that such continuous signals can be completely represented by a finite set of discrete numbers. Explain this principle in *each* of the following four important contexts or theorems. Be as quantitative as possible:

- (a) The Nyquist Sampling Theorem. [5 marks]
- (b) Logan's Theorem. [5 marks]
- (c) Gabor Wavelet Logons and the Information Diagram. [5 marks]
- (d) The Noisy Channel Coding Theorem (relation between channel bandwidth W , noise power spectral density N_0 , signal power P or signal-to-noise ratio P/N_0W , and channel capacity C in bits/second). [5 marks]