

Module 3F1, April 2009 – SIGNALS AND SYSTEMS – Answers

- 1 (b)(i) $\frac{Y(z)}{U(z)} = \frac{1-z^{-n}}{1-\beta z^{-n}}$.
 (b) (ii) For $n = 1$ zero at 1 and pole at β . For $n = 2$ zeros at ± 1 and poles at $\pm\sqrt{\beta}$.
- 2 (a) (i) $\frac{1-\beta}{\alpha} < k < \frac{1+\beta}{\alpha}$.
 (ii) $\frac{\beta-1}{\beta-1+k\alpha}$.
 (ii) $\beta = 1, 0 < k < 2$.
 (b) (i) $S_y(\omega) = |H(\omega)|^2$.
- 3 (c) $\Phi_Z(u) = \frac{1}{(1+u^2x_0^2)(1+u^2y_0^2)}$
- 4 (b) $I(Y;X) = -(0.15 + 0.7\beta) \log_2(0.15 + 0.7\beta) - (0.85 - 0.7\beta) \log_2(0.85 - 0.7\beta) + 0.15 \log_2(0.15) + 0.85 \log_2(0.85)$.
 (c) $\beta = 0.5$, capacity of the channel = 0.3902 bits per bit transmitted.

