

The University of Queensland
School of Information Technology & Electrical Engineering

COMS3100/7100 Introduction to Communications
Semester 1, 2011

Tutorial 4

These exercises relate to material in Lectures 10 & 11,

Question 1:

Sketch and label $\phi(t)$ and $f(t)$ for PM and FM when $x(t) = A \Lambda(t/T)$. Take $\phi(-\infty) = 0$ in the FM case.

Question 2:

Repeat **Question 1**, with

$$x(t) = A \cos(\pi t / \tau) \Pi(t / 2\tau)$$

Question 3:

Repeat **Question 1**., with

$$x(t) = \frac{4At}{t^2 - 16},$$

for $t > 4$.

Question 4:

A *frequency-sweep generator* produces a sinusoidal output whose instantaneous frequency increases linearly from f_1 at $t = 0$ to f_2 at $t = T$. Write $\theta_c(t)$ for $0 \leq t \leq T$.

Question 5:

Besides PM and FM, two other possible forms of exponential modulation are phase-integral modulation, with $\phi(t) = K \int x(\lambda) d\lambda$, and phase-acceleration modulation, with

$$f(t) = f_c + K \int x(\lambda) d\lambda$$

Add these to Table 5.1-1 in Carlson and find the maximum values of $\phi(t)$ and $f(t)$ for all four types when $x(t) = \cos(2\pi f_m t)$.

Question 6:

A tone with a frequency $f_m = 5$ kHz and amplitude 1 V is used to frequency modulate a high-frequency carrier with a frequency $f_c = 50$ MHz. If the maximum frequency deviation $f_\Delta = 20$ kHz, calculate the modulation index β .