

## COE 342, Term 012

### Data & Computer Communications

#### Programming Assignment #3

Due Date: Monday 13/05/02

- Q.1.** Given the binary data [0 1 0 1 1 0 0 1] transmitted at a rate of 1 Mbps. It is required to transmit it using analog signals by modulating a carrier with a frequency of  $f_c=2$  MHz. The carrier signal used is  $\cos(2\pi f_c t)$ . Plot the binary data, the modulated signal and its frequency spectrum for each of the following modulation techniques:
- (i) Amplitude Shift Keying.
  - (ii) Frequency Shift Keying. Assume that binary 1 is transmitted using  $f_1=1$  MHz and binary 0 is transmitted using  $f_2=3$  MHz.
  - (iii) Phase Shift Keying. Assume that binary 1 is transmitted using a phase shift of  $\pi$ , and binary 0 is transmitted using a phase shift of 0.
- Q.2.** Given the signal  $x(t) = \frac{4}{\pi} \times [\sin(2\pi f t) + \frac{1}{3} \sin(2\pi 3 f t) + \frac{1}{5} \sin(2\pi 5 f t) + \frac{1}{7} \sin(2\pi 7 f t)]$ , with a frequency  $f=1$  MHz. It is required to transmit this signal using a carrier frequency  $f_c=20$  MHz. Assume that the carrier used is  $\cos(2\pi f_c t)$ . Plot the signal, the modulated signal and its frequency spectrum for each of the modulation techniques given below. Show the signals for two periods.
- (i) Amplitude modulation using modulation index of 0.7, i.e.  
 $AM(t) = [1 + 0.7x(t)]\cos(2\pi f_c t)$
  - (ii) Double-Side Band Suppressed Carrier using modulation index of 0.7, i.e.  
 $DSBSC(t) = [0.7x(t)]\cos(2\pi f_c t)$
  - (iii) Phase Modulation using a phase modulation index of 1.
  - (iv) Frequency Modulation using a frequency modulation index of  $2\pi f_o$ .

*Show the Matlab code used and the plots generated. Show only the necessary parts in the frequency spectrum of signals to make it as clear as possible.*