ECE 6390: Satellite Communications and Navigation Systems
Solutions to TEST 3 (Fall 2006)

1. **Short Answer Section**

   (a) block

   (b) spread spectrum

   (c) redundancy

   (d) false

   (e) shaping

   (f) Mary-PSK *or* M-QAM

2. **Comparison of Multiple Access Schemes:**

Protocol	Advantage	Drawback
TDMA	predictable, linear power amplifier output	synchronization over long satellite link distances is very difficult
FDMA	well-defined frequency slots easy to multiplex and broadcast	requires back-off of power amplifier to avoid nonlinearities
CDMA	Easy for many uncoordinated users to share the channel; resistance to jamming, interference, and multipath	system is not as straight-up efficient as TDMA and FDMA in terms of spectral efficiency

3. **Link Comparison:**

   (a) 10 MHz, 79 dBW or almost 10 MegaWatts!

   (b) 100 MHz, 45 dBW or almost 32 kWatts

   (c) 2.4 MHz, 28 dBW or about 630 Watts (much better)

   (d) 4.0 MHz, 20.4 dBW or about 100 Watts (the best!)

   (e) Minimum despread C/N of 4.8 for BER of 0.001. Thus, M must be greater than 72.0. The closest realizeable value is $M = 127$, resulting from an m-sequence generator with 7 shift registers.