1. **Department, number and title of course:** Electrical Engineering and Computer Sciences: EECS 121, Introduction to Digital Communication Systems

2. **Catalog Description:** (4 units) Introduction to the basic principles of the design and analysis of modern digital communication systems. Topics include source coding, channel coding, baseband and passband modulation techniques, receiver design, and channel equalization. Applications to the design of digital telephone modems, compact disks, and digital wireless communication systems. Concepts illustrated by a sequence of MATLAB exercises.

3. **Prerequisites:** EECS 120, 126.

4. **Textbooks and/or other required material:**

5. **Course objectives:** The students should be capable of choosing an appropriate modulation system for a given application, do a comparative analysis of the noise performance of different modulation systems, and design appropriate receiver structures to achieve given design goals. Students learn some of the most important data compression algorithms used in practice. Students learn some of the most fundamental error control coding and decoding schemes used in practice.

6. **Topics covered:**
   - **Review of Basic Probability and Random Processes**
   - **Source Coding**
     - Huffman and Lempel-Ziv codes
     - Quantization
     - Speech and waveform coding
   - **Baseband Transmission over Flat Gaussian Channels**
     - Pulse modulation techniques
     - Optimum receiver design
     - Performance analysis
   - **Baseband Transmission over Linear-Filtered Bandlimited Channels**
     - Signal design for bandlimited channels
     - Equalization and synchronization
   - **Digital Transmission via Carrier Modulation**
     - Carrier amplitude, phase and frequency modulation, quadrature amplitude modulation
     - Transmission on fading multipath wireless channels
   - **Channel Coding**
     - The promises of coding: entropy and channel capacity
     - Channel coding techniques

7. **Class/laboratory schedule:** Three one-hour lectures and one-hour discussion per week.

8. **Contribution of course meeting the professional component:** This course covers engineering topics. It is approximately 75% science and 25% design.

9. **Relationship of course to program objectives:** This course requires students to apply their knowledge of mathematics and science to engineering. It strengthens students’ abilities to identify, formulate and solve engineering problems. Students learn to apply modern skills, engineering tools and techniques to engineering problems.

10. **Prepared by:** Professor Venkat Anantharam, 23 March 2006.