**Dhirubhai Ambani Institute of Information & Communication Technology, Gandhinagar**

**Digital Communication (CT214)**

**End-Semester Examination**

**Closed Books and Closed Notes Examination**

**Date: 17 July 2015 Time: 1.5 Hour**

**Answer all questions.**

1. (a) What are advantages and disadvantages of PCM system as compared with analog modulations? (5 marks)

(b) For a full load sinusoidal modulating signal, derive an expression for signal-to-noise-ratio in dB (SNRo) in terms of terms of number of bits per sample (R). If the number of levels L is equal to (i) 128, (ii) 256 and (iii) 1024, calculate R and SNRo.

(8 marks)

(c) Given the data stream 1101001, sketch the transmitted sequence of pulses for each of the following line codes:

1. Unipolar nonreturn to zero
2. Polar nonreturn to zero
3. Unipolar return to zero
4. Bipolar return to zero
5. Manchester code (5 marks)

(d) What is the first null bandwidth of a PCM signal? n is the number of bits in PCM word and fs is the sampling rate. (2 marks)

1. (a) Define amount of information, entropy and information rate. (5 marks)

(b) Define Shannon’s theorem. M is the number of messages, R is the information rate and C is the channel capacity. (3 marks)

(c) One of possible messages Q1 to Q5 having probabilities ½, ¼, 1/8, 1/16 and 1/16, respectively, is transmitted. Calculate average information per message. If message rate is 1500 message per second, fine information rate. If the channel capacity is 2500 bits/second, what will be the probability of error for transmission over communication channel? (6 marks)

(d) A communication system consists of three possible messages. The probability of message 1 is p and probability of message 2 is also p. Calculate entropy for values of p=0, .25, .33, .5 and 1. Plot entropy as a function of p. (6 marks)

1. (a) What is the full form of OOK, ASK, BFSK, BPSK, QPSK and QAM modulations? Draw waveforms for OOK, BFSK and BPSK modulations for binary signal of 1011001. (6 marks)

(b) Explain QPSK modulation using circuit, waveforms, modulator states and phase diagram with the aid of suitable figures and tables. Also, explain demodulator circuit for QPSK modulation with the aid of a figure.. (6 marks)

(c) Define bandwidth efficiency. If the minimum bandwidth required to propagate a 10 Mbps transmission rate for BPSK, QPSK and 8-PSK and 16-QAM modulations are 10, 5, 3.33 and 2.5 MHz, respectively. Calculate bandwidth efficiencies for BPSK, QPSK , 8-PSK and 16-QAM modulations. (4 marks)

(d) Explain basic time-division multiplexing system. Also, explain Bell T1 PCM format for bit rate of 1.544 Mbps. (4 marks)