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Analog and Digital Communication (CT214)

2nd In-Semester Examination

Closed Books and Closed Notes Examination

Date: 24 March 2017

Time: 2:00 pm to 4:00 pm

Answer all questions

Section A

Please write all answers of this section only in space given in this question paper.

1. What is the full form of PAM, PWM, PPM and PCM modulations? (4 marks)

2. What is the full form of NRZ, RZ and AMI in line codes for PCM system? (3 marks)

3. Name two major sources of noise in a PCM system. (2 marks)

4. Name two compressive laws for nonuniform quantization in PCM system. (2 marks)

5. Give two main advantages for encoding PCM signal in binary codes. (4 marks)
6. What are the two main advantages of Manchester code as compared with unipolar NRZ for encoding PCM signals? (4 marks)
7. What is one disadvantage of Manchester code compared with unipolar (or polar) NRZ for encoding PCM signals? (2 marks)
8. Give 3 reasons for use of phase modulation for generation of FM in indirect FM transmitter. (6 marks)
9. Give two main reasons for bit errors in regenerated PCM signal at regenerative repeater. (4 marks)
10. Give two corrective measures to minimize effect of aliasing in sampling PCM signal. (4 marks)
11. State the main disadvantage of PWM as compared with PPM modulations? (2 marks)
12. State the main disadvantage of PPM as compared with PWM modulations? (2 marks)
13. Name four operating categories in frequency detection. (4 marks)

14. What is the main disadvantage of direct FM for FM modulation? (2 marks)

15. What is the relationship between first null bandwidth B_{PCM} , sampling rate f_s and bits per sample R ? (3 marks)

16. Name 3 types of noise in communication systems. (3 marks)

17. Name 3 factors which determine available noise power. (3 mark)

Section B

Please write all answer of this section only in regular answer book (8 pages long).

1. (a) Draw a block diagram of PCM system for transmitter, transmission path and receiver. Explain important features of sampling, quantization, encoding and regeneration in PCM system. (10 marks)
- (b) Discuss all advantages and disadvantages of PCM system as compared with analog modulations? (5 marks)
- (c) A speech signal has a duration of 20 seconds. It is sampled at 8 KHz and then encoded. Signal-to-quantization noise ratio is required to be 60 dB. Calculate the minimum storage capacity to accommodate this digitized speech. (Assume that the SNR for a sinusoidal modulation is valid for speech quantization here) (5 marks)

2. (a) Define sampling theorem for strictly band-limited signals of finite energy in two equivalent parts regarding description and recovery of signal. (5 marks)
- (b) Derive an expression for output signal-to-noise ratio $(\text{SNR})_o$ of a uniform quantizer. Assume that the input signal is in the range $(-m_{\max}, m_{\max})$, L is total number of levels and R denotes number of bits per sample. Show that $(\text{SNR})_o$ increases exponentially with R . (5 marks)
- (c) Twenty four signals are sampled uniformly and then time division multiplexed. The sampling operation uses flat-top samples with 1.1 microsecond duration. The multiplexing operation includes provision for synchronization by adding extra pulse of sufficient amplitude and of 1.1 microsecond duration. The highest frequency component of each voice signals is 3.4 kHz. (7 marks)
- (i) Assuming a sampling rate of 8 kHz, calculate the spacing between successive pulses of the multiplexed signal.
- (ii) Repeat the calculations when Nyquist rate is used for sampling.
- (d) Discuss in detail concept of TDM using a figure. (3 marks)
3. (a) Describe in detail the concept of direct FM transmitter using VCO circuit and equations. Also, describe the concept of indirect FM using block diagram and equations. (8 marks)
- (b) Describe in detail the concept of FM to AM conversion using a block diagram and equations. Also, discuss in details about balance discriminator, slope detection and frequency-to-voltage characteristic using figures. (8 marks)
- (c) Describe PWM and PPM modulations using suitable waveforms. (4 marks)