TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Chaitra

Exam.	Regular		
Level	BE	**Full Marks**	80
Programme	BEI	**Pass Marks**	32
Year / Part	III / II	**Time**	3 hrs.

Subject: - Communication Systems (*EX 656*)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. What are the reasons for modulation? Write the advantages of digital communication over analog communication. Sketch a generic block diagram of a digital communication for full-duplex mode. [2+3+5]
2. Represent Unit step signal in terms of Signum function. Also, determine whether a Unit step signal is energy or power type or neither of the two. [4+4]
3. Derive the expression for double tone Am. How DSB is different from SSB signal? [6+2]
4. What is the aim of source coding? Encode "Kun Mandir Ma Janchhau Yatri" using Huffman codes and finds its efficiency. [10]
5. Compare Pulse Code Modulation (PCM), Differential Pulse Code Modulation (DPCM) and Delta Modulation. Find the Signal to Quantization Noise ratio (SQNR) of Pulse Code Modulation (PCM). [3+5]
6. Given the binary sequence 1101010111 represent in Unipolar RZ, Bipolar NRZ, Polar NRZ and Manchester encoders. Explain communication impairments with examples. [6+2]
7. What do you mean by optimum detector? Show that the impulse response of the matched filter is reverse delayed version of the input signal. [2+6]
8. Compare TDM and FDM. Show that for voice application. Compare E1 and T1 hierarchies. [3+2+5]
9. Differentiate error-detection and error-correction. Design a convolutional encoder having code-rate of ½. Also, draw the code-tree and trellis diagram for the same assuming any three-bit input. [2+4+4]

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1. Differentiate among noise, interference and distortion. [5]
2. Describe Hilbert Transformation and its properties. Compute the energy and power of unit step signal. [2+5]
3. List out any three properties of autocorrelation(AC) function. Mention the autocorrelation function of white noise. [3+5]
4. a) Why SSB modulation scheme is preferred over DSB, DSB-SC modulation schemes? The total content of an AM signal is 1000w, Determine the power being transmitted if carrier frequency and at each sideband when modulation percentage is 100%. [2+3]
   b) Explain QAM modulation and demodulation with its required diagram. [5]
5. What is the relation between psdf and Autocorrelation function? Explain the Stereo FM encoder and decoder with spectral diagram. [3+7]
6. Explain the aperture effect during flat-topped sampling. Illustrate, the DPCM scheme that overcomes the disadvantages of PCM. A delta modulator system is designed to operate at 5 times the Nyquist rate for a signal having a bandwidth equal to 3kHz bandwidth. Calculate the maximum amplitude of a 2kHz sinusoidal for which the delta modulator does not have slope overload. The given step size is 250 mv. [2+3+4]
7. Represent 100111010 using following encoders. [2+2+2+2]
   a) Polar RZ b) Bipolar NRZ c) AMI d) Manchester
8. What are the significances of multilevel modulation? Explain QPSK with its transformation as well as a receiver block diagram. [2+4]
9. a) Explain BSPSK modulation technique with its relevant diagram and signal space diagram. [5]
   b) Differentiate between FDMA and TDMA. Draw T1 and E1 telephone hierarchy. [3+2]
10. Why convolution coder is better than block coder? Determine systematic and non-systematic code vector for a (7,4) cyclic hamming code for message vector {1011} with generator matrix g(x)=1+X+X3. [2+5]

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2080 Ashwin

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Subject: - Communication System (*EX 656*)

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1. Draw the generic block diagram of Analog communication system for half- duplex mode. Explain the need and disadvantages of modulation. [3+5]
2. Define energy and power signals with example. Write the properties of LTI system. [4+4]
3. Calculate the percentage of power saved in: (i) DSB-SC (ii) SSB-SC as compared to standard AM if the modulation depth is 60%. Describe QAM modulation and prepare constallation diagram of 16-QAM. [2+2+4]
4. Explain the aim of line coding. Encode "Ma Mare Pani Mero Desh Bachi Rahos" using Shannon-Fano codes and calculate its efficiency. [10]
5. Why is non-uniform quantization required? Show that for a voice transmission, the basic data rate using PCM is 64 kbps. [3+3+4]
6. State and explain Shannon-Hartley channel capacity theorem with its implications. Represent 100111010 using Unipolar RZ, Bipolar NRZ, Manchester and AMI encoding technique. [4+6]
7. Explain Pre-amphasis and De-amphasis. [4+4]
8. Briefly explain filter and oscillator requirement in Frequency Division Multiplexing (FDM). Compare packet switching and message switching. [4+4]
9. Construct a (7, 4) binary CRC using a generator polynomial $g(x) = x^3 + x^2 + 1$ with data Vector (1011). Demonstrate how CRC-4 detects two burst errors. [5+5]

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1. What is Harmonic Distortion? Differentiate linear and non-linear distortions. [2+3]
2. Explain Hilbert transform. How is it different from Fourier transform? [4+4]
3. a) What are causal and noncausal signals? Explain distortionless transmission channel with its frequency response. [2+3]
   b) Given $X(t) = A\sin(t)$ for $-\infty < t < \infty$, check power signal or energy signal or neither of them. [3]
4. Describe envelope detection method for the demodulation of DSB-FC AM. Consider a message signal $m(t) = 10\cos(2\pi t)$ and carrier signal $c(t) = 40\cos(100\pi t)$ [3+5]
   a) Find AM wave for 75% modulation.
   b) Draw the spectrums of AM wave.
5. Why FM and PM are called angle modulation? Explain the direct method of demodulation of FM with its relevant diagrams. [3+6]
6. Describe the sampling of bandpass signals. Explain how differential pulse code modulation is different from ordinary pulse code modulation with DPCM quantizer and receiver. [3+7]
7. Define ISI in brief. Explain the ideal solution for ISI. Represent binary sequence 1001001101 in unipolar RZ, polar NRZ, Manchester and AMI codes. [2+3+4]
8. Explain QPSK modulation and compare it with GMPSK. Find the symbol rate, entrophy and information rate if a source provides one of the five symbols per microsecond. If the symbol probabilities are 0.25, 0.25, 0.25, 0.125, 0.0625, 0.0625. [4+6]
9. a) Explain QPSK with waveforms and constellation diagram. [3]
   b) Define T1 and E1 telephone hierarchy. [4]
10. Define Hamming weight and Hamming distance. Assume any 4-bit sequence and explain the convolution encoding process for that sequence. [2+4]

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