TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 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.*

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1. With a suitable example explain Shannon-Hartley channel capacity theorem. Determine whether the given signal $x(t) = e^{-2t}u(t)$ is a power or an energy signal. [3+5]
2. Determine whether the following signals are [3+3]
   a) $y(t) = x^2(t)$ linear or not.
   b) $y(t) = y(t-4) + x(t-4)$ time invariant or not
3. a) Derive the expression of double-tone AM, and define BW and modulation indices. [5]
   b) For the given modulated signal draw line spectrums.
   $s(t)=50\cos(2\pi 10^6 t+60°) -15\cos(2\pi 10^6 t -60°) + 20\sin(4\pi 10^4 t - 190°)+\sin(2\pi 10^4 t+190°)$. [3]
4. a) Explain the Armstrong's method for Frequency Modulation. [4]
   b) Why do we need pre-emphasis and de-emphasis circuits in FM? Explain. [4]
5. Encode the message "Mississippi is missing" using weighted Huffman code and calculate transmission efficiency. [8]
6. Explain the Delta and Adoptive Delta Modulations encoders and decoders with their derivations and diagram. List out their merits and demerits. [6+2]
7. a) Represent the given binary sequence110011000001 in unipolar RZ, Manchester and HDB3 encoders. [6]
   b) Explain the modulation scheme for MSK with appropriate example. [4]
8. Define optimum detector and find the impulse response of optimum detector in the presence of additive white noise.Briefly explain Hilbert Transform. [2+6+2]
9. What is the significance of constellation diagram? Compare E1 and T1 TDM PCM hierarchy. [2+4]
10. Determine the encoded sequence for the following input message
    $(m_0, m_1, m_2, m_3, m_4) = (1\ 0\ 0\ 1\ 1)$ using convolutional encoder having shift registers with three flip flops. Draw state and trellis diagrams. [8]

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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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