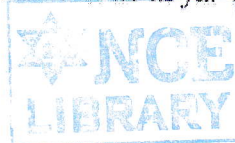


TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2082 Chaitra

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. a) Sketch a proper generic block diagram of a voice communication system between an onboard pilot and an air traffic controller, and briefly explain the needs and functioning of each building block of that system. [5]
- b) Define any ten performance parameters/impairments of digital communication system. [5]
2. a) Determine whether the signal $y(t) = 2x(2t) + 3x(t-3) + 4$ is time invariant or not. [6]
- b) Consider any two signals and convolve them graphically. [6]
3. Derive the time domain and frequency domain expressions of DSB-FC wave of a double-tone (single message-two carriers) AM, and draw their line spectrums. [8]
4. By assuming suitable bit streams, demonstrate how HDB3 and B8ZS line encoders work. [6]
5. Generate a hamming code for 10101100 using even parities, and demonstrate how it corrects a single bit error. [7]
6. Explain the modulation scheme of MSK with appropriate example. [7]
7. Derive the expression for the impulse response of a matched filter for an AWGN channel. [6]
8. Encode " $E = \int_{-\infty}^{+\infty} |x(t)|^2 dt$ " using weighted Huffman encoder and calculate entropy. [9]
9. Write short notes on: (Any Three) [3×5]
 - a) T1 and E1 Hierarchy used in telephony
 - b) FDM vs TDM
 - c) Trellis diagram with example
 - d) PSD of white noise
 - e) Hilbert transform

TRIBHUVAN UNIVERSITY
 INSTITUTE OF ENGINEERING
Examination Control Division
 2082 Kartik

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

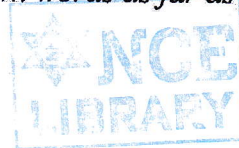
Subject: - Communication Systems (EX 656)

- ✓ 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. Describe the functional digital communication system working in a half-duplex mode and contrast it with an analog communication system. Mention all the communication impairments and performance parameters. [5+3]
 2. Define the power spectral density function and express its relation with the autocorrelation function. Check whether $y(t)=\log\{x(t)\}$ is a linear or non-linear system. [5+5]
 3. Taking examples of any two signals, derive auto-correlation, cross-correlation and convolution graphically. [3+3+3]
 4. a) Draw the timing diagram of Unipolar RZ, Polar NRZ, AMI and B8ZS for a binary sequence of 101100001000000000. [6]
 b) Discuss the limitations of Shannon Hartley Channel capacity theorem. [2]
 5. Derive the expression of a double-tone AM and draw its line spectrums. Consider a sinusoidal signal $m(t) = A \cos \omega_m t$ applied to a delta modulator with step size Δ . Show that the slope overload distortion will occur if $> \frac{\Delta}{\omega_m T_s}$. [5+3]
 6. With suitable examples, introduce how CRC-3 and LBC work to correct a single bit error. [5+5]
 7. Check whether the received code word 110111 as has error or not. Encode "Rain Rain Go To Spain" using Shannon-Fano encoder and calculate the transmission efficiency. Find the codeword if the message is received as "Rain Rain Go Go Spain". [7+2+3]
 8. Write short notes/solutions on: (Any Three) [3×5]
 - a) Constellation diagram of a 32-QAM
 - b) Impulse response of a matched filter for an AWGN channel
 - c) A (7,4) polynomial cyclic Hamming code given by $g(x) = 1 + x + x^3$
 - d) Single bit error correction using Viterbi decoder
 - e) Packet switching vs message switching

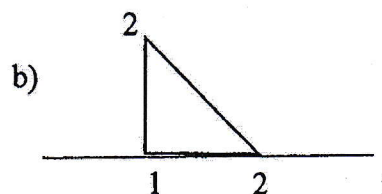
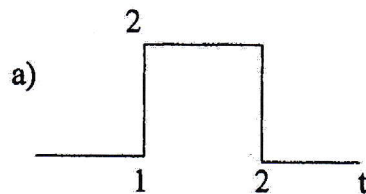
Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEI	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

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.



- Sketch and describe the functional digital communication system working in a duplex mode and contrast it with an analog communication system. Mention its impairments and performance parameters. [5+3]
- Determine whether the following signals are: [4+4]
 - $y(t) = 2t^2x(t) + 3tx(t-4)$ linear or not
 - $y(t) = x^2(t) + x(t+2)$ causal or not
- Derive auto-correlation, cross-correlation and convolution of the following two signals graphically: [3+3+3]



- Consider that the bit sequence 10000000001101 is to be transmitted. Draw the resulting waveform if the sequence is transmitted using Polar RZ, Differential Manchester, HDB3 and B8ZS, and compare their bandwidths. [10]
- Derive the expression for figure of merit for the SSB receiver. Define an efficient constellation diagram of a 32-QAM. [5+3]
- A (6, 3) error control code has the following parity check matrix. [2+4+4]

$$H = \begin{bmatrix} 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$$
 - Determine the generator matrix G
 - Generate a codeword for message 110
 - Check whether the received code word 110111 as has error or not.
- Encode "Engineer Ko Betha Arulai Ke Thaha" using Huffman Encoder and calculate the transmission efficiency. Find the codeword if the message is received as "Engineer Ko Betha Ke Ke". [7+2+3]
- Write short notes on: (Any Three) [3x5]
 - Hilbert transform
 - T1 and E1 hierarchy used in telephony
 - Pre-Emphasis and De-Emphasis
 - Trellis diagram of a message 1010 using a $\frac{1}{2}$ rate 3-state memory block convolutional encoder
 - FDM vs TDM

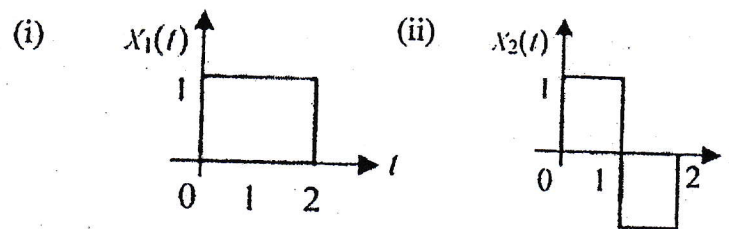
TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2081 Ashwin

Exam.	Back	
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. Define BW, SNR, SQNR, BER, ISI parameters. [5]
2. a) Perform convolution of the following signals, by graphical method. [6]



- b) Construct the signal flow diagram of the system described by the following equation. [4]

$$y(t) + 2 \int y(t)dt + 3 \iint y(t)dt^2 = 4 \int x(t)dt + 5 \iint x(t)dt^2$$
3. Encode 100100000111 using Unipolar RZ, AMI and HDB3 coding schemes. [6]
4. a) Prepare a constellation diagram of 32-QAM. [4]
- b) Illustrate MSK signal for a message of 1011010. [5]
5. With the help of necessary mathematical expressions of Bandwidth and Modulation Index, differentiate between AM and FM. [6]
6. With the help of neat circuit diagram, explain the operation of the square law detector. [6]
7. With suitable assumption for a code word of C(7,4), demonstrate how Hamming Code detects an error. [8]
8. With a suitable example of input bit stream show State Diagram, Code Tree and Trellis Diagram. Demonstrate how a convolutional code corrects a single error. [6+4]
9. Encode 'Phoola Ko Thunga Bahera Gayo Ganga Ko Panima' using Shannon-Fano coding technique and calculate the transmission efficiency. [6+2]
10. Write short notes on: (Any Three) [3×4]
 - a) Hilbert transform and its properties
 - b) Delta modulation
 - c) T1 vs E1 hierarchy
 - d) Band limited white noise vs thermal noise
 - e) Multiplexing vs multiple access

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Ashwin

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

Subject: - Communication System (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. 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 constellation 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]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Ashwin

Exam.	Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Communication System I (EX 652)

- ✓ 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.

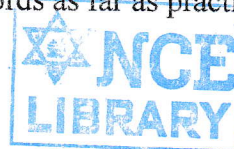
1. What is communication system? Explain the importance of transducers, modulators and channel in Analog communication system with neat and clean diagram. [2+6]
2. What is distortionless transmission? Differentiate energy and power signal. Describe the impulse response of LPF. [2+3+3]
3. What is autocorrelation and cross correlation of a signal? Explain and derive power spectrum density function of a signal. [2+4]
4. What is conventional amplitude modulation? Explain the ring modulator for the generation of double side band amplitude modulation with neat and clear diagram. [2+6]
5. Calculate the power saving for double side band AM signal and single side band AM signal for percentage modulation of 60%. [6]
6. What is superheterodyne AM receiver? Explain the coherent detection and phase error effect of DSB AM. [2+4]
7. What is PLL? Explain the generation of Narrow Band FM using Armstrong method. Why amplitude limiter is used in limiter discriminator method? [2+4+2]
8. Differentiate NBFM and WBFM? Explain the functioning of stereo encoder and decoder in commercial FM with clear diagram. [3+5]
9. A modulated signal is given by $s(t) = 40 \cos(100.1 \times 10^6 \times 2\pi t + 10 \sin(15 \times 10^3 \times 2\pi t))$. Determine (i) practical bandwidth (ii) frequency sensitivity (iii) frequency deviation and d) modulation index. [8]
10. Explain the FDM telephone hierarchy. Describe the filter and oscillator requirement in FDM. [3+3]
11. Write short notes on: [2×4]
 - a) ASK, PSK and FSK
 - b) Properties of Bessel function

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.



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.
 $s(t) = 50\cos(2\pi 10^6 t + 60^\circ) - 15\cos(2\pi 10^6 t - 60^\circ) + 20\sin(4\pi 10^4 t - 190^\circ) + \sin(2\pi 10^4 t + 190^\circ)$. [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 sequence 110011000001 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]

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 $\frac{1}{2}$. Also, draw the code-tree and trellis diagram for the same assuming any three-bit input. [2+4+4]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 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. 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 BPSK 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 $g(x)=1+X+X^3$. [2+5]