25 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Ashwin

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

Subject: - Communication System II *(EX702)*

- ✓ 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. Six messages are transmitted with probabilities 0.3, 0.08, 0.1, 0.15, 0.25 and 0.12 respectively. Obtain their respective shannon-fano and Huffman's codes and code efficiencies. [8]
2. Illustrate and explain the ideal sampling and reconstruction of sampled signal. Find the Nyquist rate and the interval for ½ π Cos(400πt) Cos (1000πt). [6+4]
3. a) Differentiate between uniform quantization and non-uniform quantization. Why is non-uniform quantization done for speech signal? Explain about companding laws. [2+2+2]
   b) Explain why DPCM is preferred over PCM? Explain the working principle of DPCM with necessary transmitter and receiver. [2+4]
4. Briefly explain Shannon Hartley channel capacity theorem its implication and theoretical limits. Show that channel capacity (C) = 1.44 S/N_0, when the channel Band width tends to infinity. [6+4]
5. a) Explain the differences between T1 and E1 digital hierarchy. [4]
   b) With necessary derivations show that in case of PCM, SQNR increases approximately by 6dB for each extra bit used. [6]
6. Represent binary sequence 10110101 in Polar NRZ, unipolar RZ, AMI and Manchester codes. [6]
7. Explain the modulation and demodulation techniques used in QPSK. [8]
8. Derive expression for evaluating error probability of M-ary system. [8]
9. The generator polynomial of a (7,4) cyclic code is $G(p) = P^3+p+1$. Obtain the code vector for the code in non-systematic and systematic form with message vector 0101. [8]

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25 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Communication System II *(EX702)*

- ✓ 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. The source of information symbols {A0, A1, A2, A3 and A4} have corresponding probabilities {0.4, 0.3, 0.15, 0.1 and 0.05}. Encode the source symbols using Huffman encoder and Shannon-Fano encoder and compare their efficiency. [8]
2. Briefly explain the terms "sub-sampling theory" and "operture effect". [2+2]
3. Explain E1 hierarchy of TDM-PCM Telephony. A television signal having a bandwidth of 4.2 MHz is transmitted using binary PCM system. Given that the number of quantization level is 512. Determine: [4+6]
   i) Code word length
   ii) Transmission bandwidth
   iii) Bit rate
   iv) SQNR
4. What is ISI? State two solutions for zero ISI. Explain duo-binary encoding with the use of precoder. [2+6]
5. Draw the timing diagram of Polar NRZ, AMI and Manchester for the following binary sequence 1011000010000000001. [6]
6. What do you mean by optimum detector? Show that the impluse response of the matched filter is reverse delayed version of the input signal. Explain auto correlation function. [2+6+3]
7. What do you mean by Ergodic Stochastic Process? Explain with necessary derivaion passage of wide-sense random signals through a LTI. [2+10]
8. What is detecting gain? Prove that for 100% modulation of (DSB-AM), the detection gain is less than 1. [8]
9. Define Hamming distance and Hamming weight. Explain the operation a 1/3 convolutional encoder. [2+6]
10. Why is non uniform quantization required, explain any one algorithms for implementing non-uniform quantization. [5]

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25 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Ashwin

Exam.	Back		
Level	BE	Full Marks	80
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Year / Part	IV / I	Time	3 hrs.

Subject: - Communication System II *(EX702)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
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1. Distinguish between the Source coding and Channel coding. A discrete memoryless source has an alphabet of five symbols S_0, S_1, S_2, S_3, S_4 with probabilities of 0.55, 0.15, 0.15, 0.1 and 0.05 respectively. Determine the Huffman code for each symbol and calculate high the coding efficiency. [3+2+2]
2. State Sampling theorem in terms of transmitter and receiver. Explain aliasing and aperture effect with remedy solutions. [4+6]
3. a) Derive expression for evaluating signal-to-quantization noise ratio (SQNR) for uniform quantization in terms of number of levels and number of bits per source symbol. [7]
   b) Describe E1 frame and its TDM hierarchy along with signaling rate. [3+3]
4. A continuous signal is band limited to 5 KHz. The signal is quantized in 6 levels of a PCM system with the probabilities $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \frac{1}{32}$ and $\frac{1}{32}$. Calculate the entropy and information rate. [5+5]
5. Explain intersymbol interference (ISI) in baseband digital communication system with derivations. Also explain the ideal and practical solutions of ISI. [4+3+3]
6. Derive the expression for the IR of a matched filter. [8]
7. a) Compute the figure of merit of non coherent FM System and explain the threshold effects. [6+2]
   b) Derive the expression of error probability for coherent detection of Amplitude Shift Keying (ASK). [6]
8. Define Hamming Weight and Hamming Distance. Construct a (7, 4) Cyclic Code using a generator polynomial $g(x) = x^3+x^2+1$ with data vector 1011. [2+6]

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Shrawan

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Communication System II *(EX702)*

- ✓ 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. Explain in brief the functional block diagram and the basic elements of a digital communication system. Explain Shannon-Fano coding, [5+3]
2. State and prove sampling theorem. Define aliasing effect and aperture effect. [5+3]
3. a) Explain working principle of PCM with necessary figures and equations. [5]
   b) A PCM system uses a uniform quantizer followed by a 7 bit binary encoder. The bit rate of the system is equal to $50*10^6$ bits/sec. [3]
      i) What is the maximum message signal bandwidth for which the system operates satisfactorily?
4. Explain the necessity of non-uniform quantization for speech signal. Derive the expression for signal to quantization noise ratio in delta modulation. [2+6]
5. a) Given the binary sequence 1011001010 represent it in Polar NRZ, Polar RZ, Manchester and AMI codes. [4]
   b) What do you understand by intersymbol interference? Explain Duobinary coding technique with precoder and illustrate it using binary input sequence 0010110. [2+5]
6. Prove that the impulse response of the matched filter is reverse delayed version of the input signal. [8]
7. Find the detection gain for SSB-SC demodulation and compare it with DSB-SC. [3+3]
8. Derive the expression for evaluation the gain parameter (SNR_0/SNR_1) of non-coherent FM detector. [8]
9. Derive the general expression for evaluating error probability for binary Ask system and extend it to M-ary. [8]
10. Define Hamming weight and Hamming distance with examples. Validate the code if received code vector code is [100011] given that $H = \begin{bmatrix} 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 \end{bmatrix}$ [3+4]

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25 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Communication System II *(EX702)*

- ✓ 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. If a source emits symbols X_i = {A, B, C, D, E, F} in the BCD format with
   a) Probabilities $P(X_i)$ = {0.3, 0.1, 0.02, 0.15, 0.4, 0.03} at a rate R_s =14.4 Kbaud, find the following: [5]
      i) Information rate
      ii) Coding efficiency both with BCD and Huffman coded signal
   b) Explain Huffman codes with examples. [4]
2. State Nyquist sampling theory. Determine the Nyquist rate and Nyquist interval for a continuous time signal $x(t)=6\cos 50\Pi t+20\sin 300\Pi t-10\cos 100\Pi t$ is to be sampled and quantize using 512 levels. [2+5]
3. Explain E1 digital hierarchy as related to telephony system. Evaluate the expression of SQNR in uniformly quantized PCM system. [4+4]
4. Explain Shannon channel capacity theorem. Write down theoretical limitations of this theorem. [2+3]
5. a) Define Inter Symbol Interference (ISI) in baseband digital communication system. Explain the ideal and practical solution for zero ISI. [2+6]
   b) Represent binary sequence 1001001101 in polar, NRz, polar RZ, Manchester and AMI codes. [4]
6. What do you understand by optimum detection? Show that the impulse response of the optimum detector network is the time shifted replica of the incoming signal. [2+5]
7. Find the error probability in coherent ASK and PSK detections and show that ASK requires double the average signal power than PSK for same error probability. [4+3]
8. Explain the modulator, demodulator and signal space diagram for FSK Modulation. [6]
9. With necessary derivation, compare noise performance of DSB-Am, DSB-SC, SSB-SC. [8]
10. Define Hamming weight and Hamming distance for a code vector x = (0111000) and the parity check matrix H given below. Prove that, the given code is valid. [2+4]

$$H=\begin{bmatrix}1&1&1&0&1&0&0\\1&1&0&1&0&1&1\\1&0&1&1&0&0&1\end{bmatrix}_{3\times 7}$$

11. Write short notes on: (any two) [5]
    i) Noise Equivalent Bandwidth
    ii) M-ary baseband data communication
    iii) Eye Diagram

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25 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Communication System II *(EX702)*

- ✓ 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. If a source emits symbols X_i = {A, B, C, D, E, F} in the BCD format with
   a) Probabilities $P(X_i)$ = {0.3, 0.1, 0.02, 0.15, 0.4, 0.03} at a rate R_s =14.4 Kbaud, find the following: [5]
      i) Information rate
      ii) Coding efficiency both with BCD and Huffman coded signal
   b) Explain Huffman codes with examples. [4]
2. State Nyquist sampling theory. Determine the Nyquist rate and Nyquist interval for a continuous time signal x(t)=6cos50Πt+20sin300Πt-10cos100Πt is to be sampled and quantize using 512 levels. [2+5]
3. Explain E1 digital hierarchy as related to telephony system. Evaluate the expression of SQNR in uniformly quantized PCM system. [4+4]
4. Explain Shannon channel capacity theorem. Write down theoretical limitations of this theorem. [2+3]
5. (a) Define Inter Symbol Interference (ISI) in baseband digital communication system. Explain the ideal and practical solution for zero ISI. [2+6]
   b) Represent binary sequence 1001001101 in polar, NRz, polar RZ, Manchester and AMI codes. [4]
6. What do you understand by optimum detection? Show that the impulse response of the optimum detector network is the time shifted replica of the incoming signal. [2+5]
7. Find the error probability in coherent ASK and PSK detections and show that ASK requires double the average signal power than PSK for same error probability. [4+3]
8. Explain the modulator, demodulator and signal space diagram for FSK Modulation. [6]
9. With necessary derivation, compare noise performance of DSB-Am, DSB-SC, SSB-SC. [8]
10. Define Hamming weight and Hamming distance for a code vector x = (0111000) and the parity check matrix H given below. Prove that, the given code is valid. [2+4]

$$H = \begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}_{3\times 7}$$

11. Write short notes on: (any two) [5]
    i) Noise Equivalent Bandwidth
    ii) M-ary baseband data communication
    iii) Eye Diagram

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25 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Communication System II *(EX702)*

- ✓ 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. Explain the importance of source coding in digital communication system. A discrete memory less source emits four symbols with probabilities P = {0.125, 0.125, 0.25, 0.5}. If the output symbols are encoded using Shannon Fano code, find the Coding efficiency and compare the coding efficiency with that of BCD code. [2+4+2]
2. State Nyquist sampling theory. Determine the Nyquist rate and Nyquist interval for a continuous time signal $x(t)=6\cos 50\Pi t+20\sin 300\Pi t-10\cos 100\Pi t$ is to be sampled and quantize using 512 levels. [2+5]
3. Explain E1 digital hierarchy as related to telephony system. Evaluate the expression of SQNR in uniformly quantized PCM system. [4+4]
4. Why is DPCM superior over PCM? Explain its working principle with necessary figures and equations. [2+5]
5. What is Shannon's channel capacity theorem? Write down theoretical limitations of this theorem. [1+3]
6. State Nyquist Criteria for zero ISI in both time and frequency domain. What are two major difficulties with duo binary encoding method and explain how can they be solved? [3+6]
7. Represent binary sequence 1001001101 in polar, NRz, polar RZ, Manchester and AMI codes. [4]
8. Define moment and central moment of continuous random variable. Show that first central moment is always zero. Determine the noise equivalent bandwidth of RC-LPF and that of ideal LPF of zero frequency response one. Also, find output noise power of this RC-LPF when input is white noise. [5+1]
9. What do you mean by optimum detector? Find the impulse response of optimum detector in the presence of additive white noise. [1+6]
10. Derive the expression for evaluating the gain parameter (SNR_0/SNR_i) of non-coherent FM detector. [8]
11. With necessary assumption, derive the expression for bit error probability for binary ASK system. [6]
12. Define Hamming weight and Hamming distance for a code vector x = (0111000) and the parity check matrix H given below. Prove that, the given code is valid. [2+4]

$$H=\begin{bmatrix}1&1&1&0&1&0&0\\1&1&0&1&0&1&1\\1&0&1&1&0&0&1\end{bmatrix}_{3\times 7}$$

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23 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Ashad

Exam.	Old Back (2065 & Earlier Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Communication System II *(EG732EX)*

- ✓ 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. State Nyguish sampling theory? Why sub-sampling is done in digital communication? Explain the effects of deviation that arises because of practical sampling as compared with ideal sampling. [1+2+3]

2 What do you mean by Pulse Code Modulation? Differentiate between uniform quantization and non-uniform quantization. [3+5]

3 Explain the operation of Differential PCM along with its derivations and diagram. Draw the staircase approximation diagram using delta modulation for the data 1111000010101010. [6+2]

4 An analog signal bandlimited to 10 KHz is sampled at Nyquist rate and quantized in 8 levels with probabilities of 1/4, 1/5, 1/5, 1/10, 1/10, 1/20, 1/20, 1/20 respectively. Calculate the entropy and the information rate. [8]

5 What do you mean by duo-binary encoding? What is its importance? Explain duo-binary encoding with example. [4+4]

6 Draw the spectrum and Auto-correlation function with the necessary derivation for the White Noise passed through the a RC low pass filter. [8]

7 What is the signficance of Noise Equivallent Bandwidth in communication system? Derive the expression for Noise Equivallent Bandwidth for the case of Bandpass filter. [4+4]

8 What is detector gain? Prove that for 100% modulation of DSB-AM, the detector gain is less than 1. [2+6]

9 Why pre-emphasis and deempharis networks are used in FM system? Explain. [8]

10 Write short notes on: [4×2]

a) Colvolution coding

(b) Distortion

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12 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Organization and management *(ME708)*

- ✓ 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 Organization. Explain the importance of Organization in society. [3+5]
2. Define the term Management and explain different levels of Management. [3+5]
3. What do you mean by Joint Stock Company? Explain the advantages and limitations of a Joint Stock Company. [2+6]
4. What do you mean by motivation? Describe Maslow's hierarchy of needs briefly. Can Maslow's theory explain tireless quest of Laxmi Prasad Devkota for excellent literary works? [2+3+3]
5. Explain the process of recruitment and selection of man power in an organization. What do you mean by outsourcing in this context? [6+2]
6. a) Explain different Techniques of Motivation. [4]
   b) Define term contingency approach of Leadership. [4]
7. Define the term Entrepreneurship and explain the characteristics of Entrepreneurship. [3+5]
8. Define Management Information System. Describe briefly various types of Management Information System. [2+6]
9. Silicon Valley is the best example of successful entrepreneurship. Elaborate with your thoughts. [8]
10. Write short notes on: (any two) [2×4]
    a) Computer aided Advertising
    b) Objectives of case study
    c) Satisfaction progression Vs. Frustration Regression Process

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Chaitra

Exam.	Regular		
Level	BE	**Full Marks**	80
Programme	BEX	**Pass Marks**	32
Year / Part	IV / I	**Time**	3 hrs.

Subject: - Communication System II *(EX702)*

- ✓ 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. Elaborate importance of source encoder? Write algorithm for Huffman's coding. [2+3]
2. What are the practical factors to be considered while sampling? Explain. If two band limited signals $X_1[t]$ and $X_2[t]$ have bandwidths of W_1 and W_2 Hertz respectively, estimate the maximum sampling interval required for the signal given by $Y[t] = X_1[t]\, X_2[t]$. [6+2]
3. What are the signalling (bit) rate and bandwidth requirement for the T1 and E1 digital carrier systems? Explain briefly about Differential Pulse Code Modulation (DPCM) encoder. [3+4]
4. Define PMA, PWM and PPM with corresponding waveforms. A Television signal having a bandwidth of 4.8MHz is transmitted using binary PCM system. Given that the number of quantization levels is 512. Determine: [1.5+1+1.5+1.5+1.5]
   i) Code word length
   ii) Transmission bandwidth
   iii) Final bit rate
   iv) Output signal to quantization noise ratio
5. Derive the expression for evaluating signal to quantization noise ratio (SQNR) for Delta modulation. [6]
6. Represent binary sequence 1011001010 in Polar NRZ, Polar RZ, Manchester and AMI codes. [4]
7. Explain the Modulator, Demodulator and Signal Space Diagram for QPSK modulation with relevant derivations. [8]
8. Differentiate between message and information? A discrete source is emitting one of 5 possible symbols per 10 Microsec. The probabilities are $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}$ and $\frac{1}{16}$. Find (a) Symbol rate (b) Source entropy (c) Information rate [2+3]
9. Explain the approximation of the matched filter for a rectangular pulse using an Ideal low pass filter with variable bandwidth. [6]
10. Derive the expression for evaluating error probability in binary communication system? What is threshold effect in FM? How it can be minimized? [7+3]
11. The generator polynomial of a (7,4) cyclic code is $g(x) = 1+x+x^3$. Find the code for the message vector 1011 in a non-syste matic and systematic form. [6]
12. Write short notes on:
    a) Linear prediction theory/coding [6]
    b) White noise and its psdf [2]

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Chitra

Exam.	**Old Back (2065 & Earlier Batch)**		
Level	BE	**Full Marks**	80
Programme	BEX	**Pass Marks**	32
Year / Part	IV / I	**Time**	3 hrs.

Subject: - Communication System II *(EG732EX)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
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1. State and prove sampling theorem with relevant derivation. [8]

2. Prove that for every extra bit used in representatin of quantization level the SQNR of uniform quantization will increase by 6 db. [8]

3. Differentiate between FDM and TDM. Explain about the T1 telephony hierarchy. [4+4]

4. An analog signal bandlimited to 4 Khz is sampled at Nyquist rate. The samples are quantized into 4 levels. Each level represent one symbols. Thus there are 4 symbols. The probabilities of occurrence of these 4 levels are P(x1)=P(x4)=1/8 and P(x2)=P(x3)=3/8. Obtain information rate of the source. [8]

5. Explain about the Nyquist pulse shaping criterion for zero Inter-symbol Interference of baseband digital communication. [8]

6. What is the signficance of Noise Equivallent Bandwidth in communication system? Derive the expression for Noise Equivallent Bandwidth for the case of Bandpass filter. [4+4]

7. Derive the expression for impulse response of a matched filter. Why matched filter is preferred in pulse digital communication system? [6+2]

8. Prove that for 100% modulation of DSB-AM, the detector gain is less than 1. [8]

9. Explain about the threshold effect in detection of Frequency Modulation using limter discriminator detector. [8]

10. What is the speciality of Binary Cyclic codes in linear block coding? Explain its properties. [8]

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4/9

24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Ashad

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Communication System II *(EX702)*

- ✓ 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 source coding? Develop Huffman coding of a 5 symbol source with probabilities: $S_0 = 0.3$, $S_1 = 0.25$, $S_2 = 0.2$, $S_3 = 0.15$, $S_4 = 0.1$. And also calculate Coding efficiency. [1+3+1]
2. a) With mathematical derivation show that original band limited signal band limited signal can be reconstructed from its samples taken at Nyquist rate. [5]
   b) What is aliasing effect and how it can be minimized? [3]
3. a) Find the signal to quantization noise ratio in Uniform Quantization in term of no of bits per source sample. [8]
   b) Explain functional block diagram of the PCM system. Find the signaling rate of the T_1 system and draw its frame diagram. [3+3]
4. a) Define Information and Entropy. Calculate the upper limit of the channel capacity as the bandwidth of the channel B tends to infinity. [2+4]

   OR

   State Nyquist pulse shaping criteria for Zero ISI. Discuss any one pulse shaping method of ISI reduction.

   b) A discrete source emits one of 6 possible symbols per 10μs in statistically independent manner. The symbol probabilities are ¼, ¼, ¼, 1/8, 1/16 and 1/16 respectively. Calculate symbol rate, entropy and information rate. [6]
5. a) What is DPSK and how it can be implemented? [4]
   b) What is modem? Discuss the modes of operation of modems. [4]
6. a) Define noise equivalent bandwidth. Find mean and AC function at the output when a WSSP signal is passed through the LTI system. [3+5]
   b) Realize the matched filter with relevant mathematical support. [4]
7. a) What is capture effect? Calculate the gain parameter in DSB-FC with envelop detection. [2+5]
   b) Compare AM and FM in terms of power efficiency, brand width efficiency and system complexity. Calculate the error probability of coherent ASK. [3+4]
8. a) Define Hamming Weight and Humming Distance. [2]
   b) What is binary Cyclic Code? Construct a (7,4) Cyclic Code using a generator polynomial $g(x) = x^3+x^2+1$ with data vector 1011. [1+4]

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Communication System II *(EX702)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
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- ✓ *Assume suitable data if necessary.*

1. What are the advantages of Digital Communication System as compared to analog communication system? Elaborate the importance of Source and channel encoders in Digital communication system. [2+3]
2. What do you mean by aperture effect in Sampling? How can it be corrected? A band pass signal with the spectrum in the range of (80-115) KHz is to be digitized, Calculate minimum sampling frequency required for the signal. [5+3]
3. Explain the E1 digital hierarchy. A speech signal with maximum frequency of 4 KHz and maximum amplitude of ± 1.1 V is applied to a PCM system with its bit rate of 32 Kbps. Calculate the SQNR and number of bits per sample. [4+3]
4. What do you mean by companding. Why is it necessary? Explain different types of companding methods. [3+4]
5. A signal of bandwidth 4.5 KHz is sampled at the double rate given by Nyquist, the signal is quantized in 8 levels, the probability of occurrence of the level are 0.1, 0.15, 0.15, 0.05, 0.2, 0.05, 0.18, 0.12. Find the minimum no of bits per sample and information rate. [4]
6. What is ISI? Explain two practical methods of minimizing ISI. [2+6]
7. Explain FSK modulation with its modulator, demodulator and signal space diagrams. [8]
8. What do you mean by random process? Explain White noise with its PSDF and Auto correlation function. [4]
9. Derive the expression for error probability for binary PAM system and extend it to M-ary system. [6+2]
10. Explain the threshold effect in non coherent detection of FM signal. How can it be corrected? [4+3]
11. Derive the expression of error probability for coherent detection of Amplitude Shift Keying (ASK). [6]
12. Write notes on: [2]
    a) The eye diagram
    b) Syndrome calculation in linear systematic block code.

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Communication System II *(EX702)*

- ✓ 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 advantages of Digital Communication System as compared to analog communication system? Elaborate the importance of Source and channel encoders in Digital communication system. [2+3]
2. What do you mean by aperture effect in Sampling? How can it be corrected? A band pass signal with the spectrum in the range of (80-115) KHz is to be digitized, Calculate minimum sampling frequency required for the signal. [5+3]
3. Explain the E1 digital hierarchy. A speech signal with maximum frequency of 4 KHz and maximum amplitude of ± 1.1 V is applied to a PCM system with its bit rate of 32 Kbps. Calculate the SQNR and number of bits per sample. [4+3]
4. What do you mean by companding. Why is it necessary? Explain different types of companding methods. [3+4]
5. A signal of bandwidth 4.5 KHz is sampled at the double rate given by Nyquist, the signal is quantized in 8 levels, the probability of occurrence of the level are 0.1, 0.15, 0.15, 0.05, 0.2, 0.05, 0.18, 0.12. Find the minimum no of bits per sample and information rate. [4]
6. What is ISI? Explain two practical methods of minimizing ISI. [2+6]
7. Explain FSK modulation with its modulator, demodulator and signal space diagrams. [8]
8. What do you mean by random process? Explain White noise with its PSDF and Auto correlation function. [4]
9. Derive the expression for error probability for binary PAM system and extend it to M-ary system. [6+2]
10. Explain the threshold effect in non coherent detection of FM signal. How can it be corrected? [4+3]
11. Derive the expression of error probability for coherent detection of Amplitude Shift Keying (ASK). [6]
12. Write notes on: [8]
    a) The eye diagram
    b) Syndrome calculation in linear systematic block code.

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2068 Baishakh

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Communication System II

- ✓ 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. State and explain merits of digital communication systems. Discuss the significance of channel encoder and channel modulator in DCS. (4+6)
2. Explain any two issues (considerations) that have to be taken care of while sampling continuous time signals. A earthquake data recorder traces the signals that changes its polarity a maximum of thirty times each 10 sec. Estimate the Nyquist sampling frequency and the data rate if this signal is to be converted into a 10 bit PCM signal. (6+4)
3. Define quantization. A signal having the dynamic range of ± 5 V is to be uniformly quantized to 128 representation levels. Estimate the required step size, the power of quantization noise produced and the maximum signal to quantization noise ratio that can be achieved. (4+6)
4. Differentiate between information and entropy. Derive the expression for the entropy of a source that emits M non-equiprobable symbols in statistically independent manner. (4+6)
5. Derive the mathematical expression of the signal at the input of the receiver of a baseband digital communication system and based on that expression, define Inter-Symbol Interference (ISI). State and explain Nyquist Pulse shaping criteria for zero ISI. (6+4)
6. Define bit error probability and bit error rate. Derive the expression for evaluating bit error probability for a binary channel with additive Gaussian noise. (4+6)
7. Derive the general expression for the impulse response of a matched filter when the shape of the signal to be detected is z(t). (10)
8. Write notes on (5+5)
   a. Performance evaluation of DCS using Eye diagram
   b. Cyclic codes

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2068 Chaitra

Exam.	**Regular / Back**		
Level	BE	**Full Marks**	80
Programme	BEX	**Pass Marks**	32
Year / Part	IV / I	**Time**	3 hrs.

Subject: - Communication System II

- ✓ 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 basic building blocks of a digital communication system? Explain each block briefly. State, with examples, the advantages and disadvantages of digital communication system. [2+4+4]
2. State sampling theorem. Illustrate that the original bandlimited signal x(t) with frequency spectrum X(f) can be reconstructed from its samples taken at Nyquist or higher rate. [4+6]
3. Define quantization and indicate its use in communication. Prove that the maximum signal to quantization noise ratio (SQNR) for liner quantization is limited by (4.8+6n) dB, where 'n' is the number of bits used to represent each quantized sample value. [4+6]
4. Define information and entropy. A source that emits one of 5 different symbols per micro-second in a statistically independent manner with the probabilities 0.3, 0.25, 0.2, 0.125 and 0.125 respectively. Calculate the entropy and the information rate of the source. [4+6]
5. Verify that the output of a Linear Time Invariant system is also a wide sense stationary process (WSSP) if the input to it is a WSSP. [10]
6. State Shannon-Hartley channel capacity theory. Discuss its implications with examples. A communication channel with additive white Gaussian noise and power spectral density of 10^{-10} W/Hz over the entire frequency range has the permissible bandwidth of 16 kHz. The minimum required input signal power to the receiver is 0.45 mW. Estimate the capacity of this channel. [2+4+4]
7. Derive the general expression for evaluating error probability in binary baseband system with PAM. Compare binary and M-ary systems in terms of data speed, required channel bandwidth and error probability. [6+4]
8. Write notes on: [5+5]
   a) Threshold effect in WBFM
   b) Syndrome calculations in linear block coding

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2067 Ashadh

Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Communication System II

- ✓ 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. Compare digital and analog communication systems. Draw functional block diagram of DCS and explain the significance of channel encoder and source encoder. (4+6)

2. State and explain Nyquist sampling theorem. A signal $x(t) = 10 \cos(2\pi 2000 t) + 4 \cos(2\pi 3000 t)$ is to be sampled and quantized using 256 levels, calculate the minimum sampling frequency and sampling period. (6+4)

3. Derive the expression for evaluating signal to quantization noise ratio (SQNR) for uniform quantization in terms of number of quantization levels and number of bits per source sample. (10)

4. Explain the basic principle of TDM. Discuss T1 and E1 hierarchy of TDM-PCM telephony. (4+3+3)

5. Define information and entropy. Relate the message, the entropy and the information. (6+4)

6. Derive the expression for evaluating error probability in binary baseband system with additive Gaussian noise in the channel. (10)

7. Derive the expression for the impulse response of a matched filter when the input excitation is z(t). (10)

8. Write brief notes on: (5+5)

   a. Noise equivalent bandwidth
   b. Convolutional coding

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23 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2066 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Communication System II

- ✓ 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.*

chap 1 { 1. State and explain Nyquist sampling theorem. A bandlimted bandpass signal centered at 40 MHz and having total bandwidth of 60 KHz is to be sampled, calculate the minimum sampling frequency. chapt. 1 [6+4]

chap 2 { 2. Find the expression for evaluating SQNR for the case of uniform quantization. Discuss any one of companding techniques used in non-uniform quantization. chapt. 2 [6+4]

chap 3 { 3. State and explain Shannon's channel capacity theorem for binary channel. Derive the expressions for theoretical limits of this theorem. chap 3 [6+4]

chap 4 { 4. Define white noise? Find its autocorrelation function. Explain RC filtering of white noise with necessary derivation. chap 4 [2+2+6]

5. Derive the expression for evaluating error probability for the case of binary symmetric channel with additive white noise. chap 5 [10]

6. Derive the expression for impulse response of matched filter. chap 4 [10]

chap 6 { 7. A (7, 4) non systematic cyclic code generator polynomial has the form $g(x) = 1 + x^2$. Find the code words for message blocks (1101) and (0010). chap 6 [5+5]

8. Write notes on: [5+5]

(a) Convolution Coding chap 6

chap 3 { (b) Eye Diagram chap 3

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chap 1 – 10 Marks
2 – 10 "
3 – 15 "
4 – 20 "
5 – 10 "
6 – 15 "

21 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2065 Shrawan

Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Communication System II

- ✓ 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. State sampling theorem. What are aliasing and aperture effects in sampling? Find the expression for signal to quantization noise ratio (SQNR) in PCM. [1+2+5]
2. Define entropy. Derive the expression for evaluating the entropy of source emitting symbols in statistically independent manner. A discrete source emits three symbols with probabilities 1/3, 1/6 and 1/2. Find source entropy. [1+3+4]
3. Define Inter Symbol Interference (ISI). State Nyquist pulse shaping criteria for zero ISI. Briefly explain Duo-binary encoding method. [2+2+4]
4. Derive the expression for the impulse response of a matched filter. [8]
5. Prove that the output of the LTI system is wide sense stationary process (WSSP) if its input is WSSP. [8]
6. Derive the expression for error probability for M-ary system. [8]
7. Derive the expression for evaluating the gain parameter (SNR_0/SNR_1) of FM detector. [8]
8. Compare PCM and differential PCM. [3+5]

   A linear delta modulator is designed to operate on speech signals limited to 3.4 KHz. The specifications of the modulator are as follows:

   * Sampling rate = $10.f_N$, where f_N is the Nyquist rate of the speech signal.
   * Step size $\Delta = 100$ mV

   The modulator is tested with a 1 Khz sinusoidal signal. Determine the maximum amplitude of this test signal required to avoid slope overload.
9. The generator polynomial of a (7,4) cyclic code is $g(x) = 1 + x + x^3$. Find the code vector for the message vector 1011 in non-systematic and systematic form. [8]
10. Write notes on: [4+4]

    a) Eye diagram
    b) Linear prediction theory

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