



SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203



DEPARTMENT OF MEDICAL ELECTRONICS

QUESTION BANK



V SEMESTER

MD 3563 – Analog and Digital Communication

Regulation – 2023

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UNIT I – ANALOG COMMUNICATION

Introduction to Communication Systems – Electromagnetic Spectrum - Modulation – Types – Need for Modulation. Amplitude Modulation – DSBSC, DSBFC, SSB, VSB – Theory of Frequency and Phase Modulation – Comparison of Analog Communication Systems (AM – FM – PM).

PART A

Q.No	Questions	BT Level	Domain
1	Draw the electromagnetic spectrum and write their frequency ranges.	BTL 1	Remembering
2	State the concept of baseband and passband transmission.	BTL 1	Remembering
3	Outline the need for modulation.	BTL 2	Understanding
4	Define Modulation & Demodulation.	BTL 2	Understanding
5	Draw the components of Communication System.	BTL 1	Remembering
6	A 10 KW amplitude modulated transmitter is modulated sinusoidally to a depth of 50%. Calculate the total power in the modulated wave.	BTL 2	Understanding
7	Write the modulation index for an amplitude modulation.	BTL 1	Remembering
8	Draw the frequency spectrum of VSB and mention its applications.	BTL 2	Understanding
9	Name the types of modulation with its applications.	BTL 1	Remembering
10	In an amplitude modulation system, the carrier frequency is $f_c = 100\text{KHz}$. The maximum frequency of the signal is 5 KHz. Find the lower & upperside bands and bandwidth of the AM signal.	BTL 2	Understanding
11	Sketch the spectrum of AM signal with its components.	BTL 1	Remembering
12	Compare AM with DSBSC & SSBSC.	BTL 2	Understanding
13	Summarize the advantages of SSBSC modulation over AM.	BTL 2	Understanding
14	Draw the circuit diagram of envelope detector.	BTL 1	Remembering
15	Compare AM and FM.	BTL 2	Understanding
16	A 5KHz audio tone is used to modulate a 50 MHz carrier using a frequency deviation of 20 KHz. Calculate modulation index.	BTL 2	Understanding
17	Draw the block diagram of FM signal generator that use phase modulator in it.	BTL 1	Remembering
18	What do mean by narrowband FM?	BTL 2	Understanding
19	Distinguish between FM & PM.	BTL 2	Understanding
20	State Carson's rule of FM bandwidth.	BTL 1	Remembering
21	Write the equation for modulation index in FM.	BTL 2	Understanding
22	State the principle of Superheterodyne receiver.	BTL 1	Remembering
23	Name the methods for detecting FM signals.	BTL 2	Understanding
24	State the disadvantages of FM.	BTL 1	Remembering

PART B

1	Derive the equation of an AM wave. Draw the modulated AM wave	BTL 3	Apply
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	for various modulation index with necessary diagrams. (16)		
2	Derive the expression for DSB-SC AM and calculate its power and efficiency. Explain a method to generate and detect it. (16)	BTL 3	Apply
3	Determine the total power in AM wave modulated by multiple sine waves with necessary steps. (16)	BTL 4	Analyse
4	(i) Illustrate with necessary diagrams the generation of DSBSC using product modulator. (8) (ii) A 1000kHz carrier is simultaneously modulated with 300Hz, 800Hz and 2kHz audio sine waves. Compute the frequencies present in the output. (8)	BTL 3	Apply
5	With necessary illustration, explain the power distribution of AM DSBFC. (16)	BTL 3	Apply
6	Explain the working principle of superheterodyne receiver with neat diagram. (16)	BTL 3	Apply
7	(i) Examine the power conservation of single side band transmission. (6) (ii) For a modulation coefficient $m = 0.2$ and an unmodulated carrier power $P_c = 1000W$, Examine the total sideband power, upper & lower sideband power, modulated carrier power and total transmitted power. (10)	BTL 3	Apply
8	Sketch SSBSC of AM signal and explain in detail. With diagrams. (16)	BTL 3	Apply
9	(i) Write short notes on NBFM with equations. (8) (ii) A 25MHz carrier is modulated by a 400Hz audio sine wave. If the carrier voltage is 4V and the maximum frequency deviation is 10kHz & phase deviation is 25radians. Detect the equation of this modulated wave for FM and PM. If the modulating frequency is now changed to 2kHz, all else remaining constant. Write a new equation for FM & PM. (8)	BTL 4	Analyse
10	(i) A 107.6MHz carrier signal is frequency modulated by a 7kHz sine wave. The resultant FM signal has a frequency deviation of 50kHz. Find the carrier swing of the FM signal, the highest and the lowest frequencies attained by the modulated signal, modulation index of the FM wave. (10) (ii) Outline the relationship between FM and PM. (6)	BTL 3	Apply
11	(i) Examine the phasor diagram of wideband FM and explain about the bandwidth of FM signal. (8) (ii) Differentiate phase modulation and frequency modulation. (8)	BTL 4	Analyse
12	Analyze the indirect method for generating wideband FM signal with necessary diagrams. (16)	BTL 4	Analyse
13	State the principle of Angle Modulation. Derive phase deviation, modulation index, frequency deviation and percent modulation. (16)	BTL 3	Apply
14	(i) For an AM DSBFC transmitter with an unmodulated carrier power $P_c = 100W$ that is modulated simultaneously by three modulating signals with coefficients of modulation $m_1 = 0.2$, $m_2 = 0.4$ and $m_3 = 0.5$. Determine total coefficient of modulation, USB, LSB power and total transmitted power. (10) (ii) Explain Carson's rule and find bandwidth for a 3kHz message signal frequency modulated with modulation index = 5. (6)	BTL 4	Analyse

15	With necessary diagrams, explain the operation of an envelope detector. When does negative clipping takes place? (16)	BTL 4	Analyse
16	Using suitable mathematical analysis prove that FM modulation produces infinite sideband. Derive the expression for frequency modulated output and its frequency spectrum. (16)	BTL 4	Analyse
17	(i) Explain the generation and demodulation of VSB with diagrams. (10) (ii) Mention the applications of VSB. (6)	BTL 4	Analyse

UNIT II – PULSE MODULATION

Low pass sampling theorem – Quantization – Uniform and Non-Uniform - Line coding Techniques – PAM, PCM, DPCM, ADPCM , DM and ADM.

PART A

Q. No	Questions	BT Level	Domain
1	Differentiate pulse modulation and analog modulation.	BTL 2	Understanding
2	State low pass sampling theorem.	BTL 1	Remembering
3	Write about Nyquist sampling rate.	BTL 2	Understanding
4	Define sampling.	BTL 1	Remembering
5	What is quantization?	BTL 1	Remembering
6	Write the quantization range for the decimal value of 3 and 2.	BTL 2	Understanding
7	Outline about quantization error.	BTL 1	Remembering
8	List the advantages and disadvantages of PAM .	BTL 2	Understanding
9	Write the concept of PCM line coding.	BTL 2	Understanding
10	Mention the advantages of PCM.	BTL 2	Understanding
11	Name the different methods of Pulse modulation techniques.	BTL 2	Understanding
12	Define pulse time modulation.	BTL 1	Remembering
13	How PPM is derived from PWM?	BTL 2	Understanding
14	Point out the function of DPCM.	BTL 2	Understanding
15	Outline the concept of delta modulation.	BTL 1	Remembering
16	Why does the steep slope change rapidly in slope overload distortion?	BTL 2	Understanding
17	Point out the features of ADPCM.	BTL 2	Understanding
18	List the function of ADM.	BTL 2	Understanding
19	A bandpass signal has the spectral range that extends from 20 kHz and 82 kHz. Find the acceptable range of sampling frequency.	BTL 2	Understanding
20	What is aperture error?	BTL 1	Remembering
21	State the principle of Adaptive delta modulation	BTL 1	Remembering
22	Find the SNR of PCM system if number of quantisation levels is 2^8 .	BTL 2	Understanding
23	Differentiate between ADPCM and ADM.	BTL 2	Understanding
24	Define aliasing and methods to avoid aliasing.	BTL 1	Remembering

PART B

1	Describe low pass sampling theorem with appropriate diagrams and steps. (16)	BTL 3	Apply
2	Illustrate quantization and the folded binary code with 3-bit PCM code and necessary waveforms. (16)	BTL 4	Analyse
3	Explain in detail about uniform quantization and quantization noise with necessary illustrations. (16)	BTL 3	Apply
4	Describe the generation of PAM and its demodulation with diagrams. (16)	BTL 3	Apply
5	Derive the expression for signal to quantization noise ratio for PCM system that employs linear quantization technique. Assume the input to the PCM system is a	BTL 3	Apply

	sinusoidal signal. (16)		
6	Explain in detail about generation and reconstruction of Pulse Code Modulation with its neat block diagram. (16)	BTL 3	Apply
7	(i) Mention the features of PWM and PPM. (6) (ii) Explain the generation of PWM. State its advantages and disadvantages. (10)	BTL 4	Analyse
8	The information in an analog signal voltage waveform is to be transmitted over a PCM system with an accuracy of $\pm 0.1\%$ (full scale). The analog voltage waveform has a bandwidth of 100Hz and an amplitude range of - 10 to +10V. (i) Find the maximum sampling rate required. (4) (ii) Calculate the number of bits in each PCM word. (4) (iii) Determine the minimum bit required in the PCM signal. (4) (iv) Estimate the minimum absolute channel bandwidth required for the transmission of the PCM signal. (4)	BTL 3	Apply
9	State the principle of ADM. Draw the block diagram of ADM transmitter and receiver and explain with relevant expressions. (16)	BTL 4	Analyse
10	Draw the DPCM transmitter, receiver block diagram and explain in detail. (16)	BTL 3	Apply
11	Examine the Delta modulation transmitter and receiver operation with neat block diagrams and its output waveforms. (16)	BTL 4	Analyse
12	(i) Explain the function of ADPCM in detail with relevant diagrams. (10) (ii) Summarize the advantages, disadvantages and applications of PWM. (6)	BTL 3	Apply
13	(i). Derive the expression for transmission bandwidth of PAM signal . (8) (ii) Write the advantages, disadvantages and applications of PAM. (8)	BTL 3	Apply
14	Analyse PWM signal generator and detector also write the operation for the same. (16)	BTL 4	Analyse
15	Compare pulse modulation methods of PAM, PWM and PPM with diagrams. (16)	BTL 4	Analyse
16	(i). Derive an expression for normalized power of quantization error in PCM system having uniform quantization. (10) (ii). For a PAM transmission of voice signal having maximum frequency $f_m = 4\text{kHz}$, calculate the transmission bandwidth. It is given that the sampling frequency $f_s = 8\text{kHz}$ and the pulse duration $\tau = 0.1 T_s$. (6)	BTL 3	Apply
17	A delta modulator system is designed to operate at five times the Nyquist rate for a signal with 3 kHz bandwidth. Determine the maximum amplitude of a 2 kHz input sinusoid for which the delta modulator does not have slope overload. Quantising step size is 250 mV. Write the necessary equations. (16)	BTL 3	Apply

UNIT III – DIGITAL COMMUNICATION

Memory less Modulation methods – Representation and spectral characteristics - Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) –Phase Shift Keying (PSK) – BPSK – QPSK – Quadrature Amplitude Modulation (8QAM & 16 QAM) – Bandwidth Efficiency – Error Performance – Coherent and Non – Coherent Detection Systems.

PART A

Q.No	Questions	BT Level	Domain
1	Name the three most predominant modulation schemes used in digital radio systems?	BTL 1	Remembering
2	Compare analog modulation and digital modulation.	BTL 2	Understanding
3	Identify the mathematical expression for ASK if the logic input “0” and “1”.	BTL 1	Remembering
4	What is OOK?	BTL 1	Remembering
5	Sketch the ASK signal for the given message signal 101101.	BTL 2	Understanding
6	State the concept of FSK.	BTL 2	Understanding
7	Write the relationship between bit rate and baud for a FSK system.	BTL 1	Remembering
8	Draw the digitally modulated waveforms for the binary data	BTL 1	Remembering

	110101 using ASK, FSK.		
9	Identify the reason why FSK & PSK signals are preferred over ASK signals.	BTL 2	Understanding
10	Difference between ASK and FSK.	BTL 2	Understanding
11	Write the advantages of PSK.	BTL 1	Remembering
12	Draw the BPSK waveform for the given 1011 data.	BTL 2	Understanding
13	Given the input binary sequence 1100100010, represent the waveforms of their phase and quadrature components of a modulated wave obtained by using QPSK.	BTL 2	Understanding
14	Mention the advantage of QPSK.	BTL 1	Remembering
15	Sketch the 8 QAM phase output for the following data 001, 010.	BTL 2	Understanding
16	Outline the need of 2 – to – 4 level converter blocks in the 8 QAM modulator.	BTL 2	Understanding
17	State bandwidth efficiency.	BTL 1	Remembering
18	A binary frequency shift keying system employs two signalling frequencies f_1 and f_2 . The lower frequency f_1 is 1200 Hz and the signalling rate is 500 baud. Find f_2 .	BTL 1	Remembering
19	State the encoding scheme and possible outputs for 16 QAM.	BTL 1	Remembering
20	Define 16 QAM system.	BTL 1	Remembering
21	Sketch signal Constellation diagram for QPSK.	BTL 1	Remembering
22	Differentiate baseband transmission and passband transmission	BTL 2	Understanding
23	Distinguish between coherent and non-coherent modulation schemes	BTL 2	Understanding
24	Point out the digital modulation technique which gives better error probability.	BTL 1	Remembering
PART B			
1	(i)With neat diagrams illustrate the Amplitude Shift Keying. (8) (ii)Compute the peak frequency deviation, minimum bandwidth, and baud for a binary FSK signal with a mark frequency of 49kHz, a space frequency of 51kHz, and an input bit rate of 2kbps. (8)	BTL 3	Apply
2	Explain the block diagram of digital communication systems in detail with necessary diagrams. (16)	BTL 4	Analyse
3	With necessary illustrations explain the concepts of FSK with bit rate, baud rate and bandwidth. (16)	BTL 4	Analyse
4	(i)Describe the working of BFSK transmitter and receiver with necessary equations and block diagram. (8) (ii)Analyse the coherent and non-coherent detection of BFSK receiver with diagrams. (8)	BTL 3	Apply
5	Define BPSK and explain BPSK transmitter and receiver with relevant diagrams. (16)	BTL 3	Apply
6	(i)Examine the truth table and draw the constellation diagram for 8 PSK modulator. (8) (ii)Write a short note on 8 PSK bandwidth considerations with diagrams. (8)	BTL 4	Analyse
7	For a BPSK modulator with a Carrier frequency of 70 MHz and an input bitrate of 10 Mbps, (i)Determine the maximum and minimum upper and lower side frequencies, draw the output spectrum. (8) (ii) Find the minimum Nyquist bandwidth and calculate the baud rate (Assume $f = 5\text{MHz}$). (8)	BTL 3	Apply
8	Draw the QPSK transmitter block diagram and explain the	BTL 4	Analyse

	concepts with relevant expressions. (16)		
9	Sketch the QPSK receiver block diagram and explain each block, BW considerations with relevant expressions and diagrams. (16)	BTL 3	Apply
10	(i) Compare the Quadrature Phase Shift Keying and Binary Phase Shift Keying. (8) (ii) If a digital message input data rate is 8kbps and average energy per bit is 0.01 Unit. Compute the bandwidth required for the transmission of message through BPSK, QPSK, BFSK & 16 PSK. (8)	BTL 4	Analyse
11	Explain 8 PSK modulator and demodulator with neat diagrams. (16)	BTL 3	Apply
12	Mention the significance of QAM and describe the operation of 8 QAM transmitter and receiver using block diagram and truth table. (16)	BTL 4	Analyse
13	(i) For a QPSK modulator with an input data rate equal to 12 Mbps and a carrier frequency of 100 MHz, estimate the following, (a) Minimum double sided Nyquist bandwidth. (3) (b) Baud rate (3) (c) Sketch the output spectrum. (3) (ii) Generate the first 8 bit code input and its respective phase for the 16 PSK. (7)	BTL 3	Apply
14	Describe the working of 16 QAM transmitter with a block diagram and necessary diagrams. (16)	BTL 3	Apply
15	Derive the expression of error probability of QAM system. (16)	BTL 3	Apply
16	Compare the performance of BPSK with that of BFSK with necessary illustrations. (16)	BTL 4	Analyse
17	The bit stream 1011100011 is to be transmitted using DPSK. Determine the encoded sequence and transmitted phase sequence. Draw the necessary diagrams. (16)	BTL 3	Apply

UNIT – IV: NOISE CHARACTERIZATION

Noise sources — Noise figure, noise temperature and noise bandwidth — Noise in cascaded systems. Representation of Narrow band noise –In-phase and quadrature, Envelope and Phase — Noise performance analysis in AM & FM systems — Threshold effect, Pre-emphasis and de-emphasis for FM.

PART A

Q.No	Questions	BT Level	Domain
1	Define Noise in communication systems?	BTL 1	Remembering
2	Write the formula for Noise Figure.	BTL 1	Remembering
3	State the term noise equivalent temperature.	BTL 2	Understanding
4	Mention the types of external noise and its sources.	BTL 2	Understanding
5	Outline about white noise.	BTL 1	Remembering
6	Find the thermal voltage developed across a resistor of 700 Ω . The bandwidth of the measuring instrument is 7 MHz and ambient temperature is 27° C.	BTL 2	Understanding
7	Point out the characteristics of shot noise.	BTL 1	Remembering
8	List the classification of noise.	BTL 2	Understanding
9	What is narrow band noise?	BTL 1	Remembering
10	Find the thermal noise power at 290°K for a bandwidth of	BTL 2	Understanding

	100KHz.		
11	Define Pre-emphasis and De-emphasis.	BTL 1	Remembering
12	Outline about FM threshold effect.	BTL 2	Understanding
13	Draw the cascade connection of amplifiers to determine noise factor.	BTL 2	Understanding
14	Write the equation of Fris's formula to determine noise factor.	BTL 1	Remembering
15	Define output signal to noise ratio with its effects.	BTL 2	Understanding
16	Formulate the expression for Figure of merit of envelope detection.	BTL 2	Understanding
17	State capture effect in FM Systems.	BTL 1	Remembering
18	Identify the methods to improve FM threshold detection.	BTL 2	Understanding
19	Write the equation for transfer function of deemphasis circuit.	BTL 2	Understanding
20	State the expression for signal to noise ratio at the output of the receiver.	BTL 1	Remembering
21	Outline the role of Figure of merit in estimating the performance of a receiver.	BTL 2	Understanding
22	Write the expression of the SNR for a synchronous detector.	BTL 1	Remembering
23	How to achieve threshold reduction in FM receiver.	BTL 2	Understanding
24	Define noise factor.	BTL 1	Remembering
PART B			
1	(i) Explain how various noise are generated in communication system and its effects. (10) (ii) Derive the Power spectral density of white noise. (6)	BTL 3	Apply
2	(i) Define Noise and write short notes on Shot noise, Thermal noise and white noise. (8) (ii) Derive the Figure of Merit for AM detection with coherent detection and steps. (8)	BTL 3	Apply
3	Explain the noise in FM receiver and calculate the figure of merit of a FM system. (16)	BTL 3	Apply
4	(i) Examine the effects of noise in cascaded system. (10) (ii) Derive the Friss Formula for cascaded systems. (6)	BTL 4	Analyse
5	With necessary illustrations obtain the figure of merit of the AM receiver. (16)	BTL 3	Apply
6	Explain the operation of pre-emphasis and de-emphasis in the FM communication system.	BTL 3	Apply
7	(i) Define Friss formula for noise figure. (6) (ii) An amplifier has three stages with gain 5 dB, 20 dB and 12 dB. The noise figure of the stages are 7 dB, 13 dB and 12 dB respectively. Determine the overall noise figure and noise equivalent temperature. (10)	BTL 3	Apply
8	Derive the expression for figure of merit for an FM signal with the assumptions that the noise added in the channel is Additive white Gaussian Noise. (16)	BTL 4	Analyse
9	Examine narrow band noise and mention the properties of quadrature components of narrow band noise with diagrams. (16)	BTL 4	Analyse
10	(i) Outline about thermal noise (6) (ii) Thermal noise from a resistor is measured as 4×10^{-17} W, for a given bandwidth and at a temperature of 20°C . Calculate noise power when temperature is changed to 50°C . (10)	BTL 4	Analyse

11	Explain the function of superheterodyne receiver in detail with necessary diagrams . (16)	BTL 3	Apply
12	(i) Draw and explain AM receiver model. (6) (ii) Derive the expression for signal to noise ratio of SSB-SC receiver. (10)	BTL 4	Analyse
13	Elaborate the noise model of AM System with envelope detection. with necessary diagrams. (16)	BTL 3	Apply
14	Write short notes on : (i) FM threshold effect (8) (ii) FM threshold reduction (8)	BTL 4	Analyse
15	With necessary illustrations compare the performance of AM and FM systems in the presence of noise. (16)	BTL 4	Analyse
16	(i) .Write about any four properties of in-phase and quadrature components of Narrow Band noise. (8) (ii).Calculate the noise voltage at the input of a Television RF amplifier, using a device that has a 200Ω equivalent noise resistance and 300Ω input noise resistance. The bandwidth of the amplifier is 6 MHz and the temperature is 17°C . (8)	BTL 4	Analyse
17	Two resistors $20\text{K}\Omega$ and $50\text{K}\Omega$ are at room temperature. Calculate thermal noise voltage for a bandwidth of 100 KHz. (i) For each resistor (ii) For two resistors in series (iii) For two resistors in parallel (16)	BTL 4	Analyse

UNIT V – SOURCE AND ERROR CONTROL CODING

Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, mutual information, channel capacity, Error Control Coding, linear block codes, cyclic codes – ARQ Techniques.

PART A

Q.No	Questions	BT Level	Domain
1	State entropy.	BTL 1	Remembering
2	Find the entropy of the system for an event that has six possible outcomes with probabilities $1/2, 1/4, 1/8, 1/16, 1/32$?	BTL 1	Remembering
3	Mention the properties of entropy.	BTL 1	Remembering
4	Define prefix coding.	BTL 1	Remembering
5	Write the expression for Kraft-McMillan Inequality.	BTL 2	Understanding
6	Outline about coding efficiency.	BTL 2	Understanding
7	Express the concept of discrete messages.	BTL 2	Understanding
8	What is mutual information?	BTL 2	Understanding
9	List the properties of mutual information.	BTL 1	Remembering
10	What is the channel capacity of a discrete memory less channel?	BTL 1	Remembering
11	Define the Shannon's theorem on information capacity of a channel.	BTL 1	Remembering
12	Given, C_i & C_j are two code vectors in the (n,k) linear block code, justify their sum is also a code vector with an example.	BTL 2	Understanding
13	State linear block codes.	BTL 2	Understanding
14	What is meant by syndrome of a linear block code?	BTL 2	Understanding
15	Identify the need of Information rate.	BTL 2	Understanding
16	Mention the properties of syndrome.	BTL 2	Understanding
17	List out the properties of cyclic codes.	BTL 1	Remembering

18	Find the generator and parity check matrix of (7,4) hamming code.	BTL 1	Remembering
19	Distinguish between cyclic codes and linear codes.	BTL 2	Understanding
20	Find the hamming distance between the following code words $C_1 = \{1000111\}$ and $C_2 = \{0001011\}$.	BTL 2	Understanding
21	Point out how minimum distance of hamming code is calculated.	BTL 1	Remembering
22	How syndrome is calculated in Hamming codes and cyclic codes	BTL 2	Understanding
23	Compare systematic and non-systematic codes	BTL 2	Understanding
24	Write the relation between coding gain and code rate.	BTL 1	Remembering
PART B			
1	Examine the Entropy techniques and its properties in detail. (16)	BTL 3	Apply
2	Consider a discrete memoryless source with source alphabets $S = S_0, S_1, S_2$ and their probabilities $P_0 = 1/4, P_1 = 1/4, P_2 = 1/4$. Estimate the entropy of the source $H(X)$ & $H(X^2)$. Also prove that the entropy of the extended source is equal to n times $H(X)$ i.e., $H(X^2) = 2 * H(X)$. (16)	BTL 3	Apply
3	(i) Examine Mutual information and its properties in detail. (8) (ii) Mention the concept of source coding theorem. (8)	BTL 3	Apply
4	A source generates five messages m_0, m_1, m_2, m_3 and m_4 with probabilities [0.55, 0.15, 0.15, 0.10, 0.05] respectively. The successive messages emitted by the source are statistically independent. Determine the code words for the messages and efficiency using Shannon Fano Algorithm. (16)	BTL 4	Analyse
5	Five source messages are probable to appear as $m_1=0.4, m_2=0.15, m_3=0.15, m_4=0.15$ and $m_5=0.15$. Find coding efficiency for Shannon Fano coding and Huffman coding. (16)	BTL 4	Analyse
6	(i) Calculate the Huffman code for a discrete memoryless source with probability statistics {0.1, 0.1, 0.2, 0.2, 0.4}. (10) (ii) Identify the drawbacks of Huffman coding. (6)	BTL 4	Analyse
7	Express the expression for channel capacity of a continuous channel. Comment on the trade-off between SNR and capacity. (16)	BTL 3	Apply
8	Consider a systematic block code whose parity check equation are $P_1 = m_1 + m_2 + m_4, P_2 = m_1 + m_3 + m_4, P_3 = m_1 + m_2 + m_3, P_4 = m_2 + m_3 + m_4$ Where m_i is the message digits and P_i are the parity digits. (i) Construct the generator matrix and parity check matrix for this code. (8) (ii) Determine how many errors can be detected and corrected? If the received code word is 10101010, find the syndrome. (8)	BTL 3	Apply
9	The parity check matrix of a particular (7,4) linear block code is given by : $[H] = \begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$ (i) Determine the Generator matrix and list all the code vectors. (8)	BTL 3	Apply

	(ii) Compute the minimum distance between code and vector. (8)		
10	(i) Compute syndrome calculator for a (7,4) cyclic code generated by the polynomial $G(x) = X^3 + X + 1$. Test the syndrome for the received vector 1001101. (8) (ii) Draw a cyclic encoder for the same (7,4) cyclic code and obtain the code vector for the message vector 1100. (8)	BTL 3	Apply
11	The source of information A generates the symbols {A0, A1, A2, A3 & A4} with the corresponding probabilities {0.4, 0.3, 0.15, 0.1 and 0.05}. Encoding the source symbols using binary encoder and Shannon-Fano encoder and determine its efficiency. (16)	BTL 4	Analyse
12	A discrete memoryless source S with 5 symbols S1,S2,S3,S4,S5. Construct a Huffman code and also calculate its efficiency if the probability distribution is given as P(S1)=0.4; P(S2)=0.2; P(S3)=0.2; P(S4)=0.1; P(S5)=0.1. (16)	BTL 4	Analyse
13	For the given discrete memoryless source has an alphabet of seven symbols S1,S2,S3,S4,S5 and its respective probabilities of occurrence are 0.25, 0.25, 0.125, 0.125, 0.125, 0.0625 and 0.0625. Determine Huffman code. Estimate η for the coding. (16)	BTL 3	Apply
14	Identify the need for coding and examine the types of error correction codes with necessary steps. (16)	BTL 4	Analyse
15	Draw the diagram of 0.5 rate convolutional encoder with generator polynomial $g^1(D) = 1 + D$, $g^2(D) = 1 + D + D^2$. And analyse the encoder output. (16)	BTL 4	Analyse
16	Model a syndrome calculator for a (7,4) cyclic Hamming code generated by the polynomial $G(p) = p^3 + p + 1$. Calculate the syndrome for $Y = (1 \ 0 \ 0 \ 1 \ 1 \ 0 \ 1)$. (16)	BTL 4	Analyse
17	With a neat sketch, explain the generalised block diagram of decoder for cyclic codes. (16)	BTL 4	Analyse