SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF MEDICAL ELECTRONICS

QUESTION BANK

V SEMESTER

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Regulation – 2019

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UNIT I – ANALOG COMMUNICATION

Amplitude Modulation – AM, DSBSC, SSBSC, VSB –Angle modulation – PM and FM – Super heterodyne receivers.

PART A

Q.No	Questions	BT Level	Domain
1	Draw the major segments of electromagnetic spectrum and give their frequency ranges.	**BTL 1**	**Remembering**
2	Analyse the concept of baseband and passband transmission.	**BTL 4**	**Analyse**
3	Justify the need for modulation.	**BTL 4**	**Analyse**
4	Express Modulation & Demodulation.	**BTL 2**	**Understanding**
5	Define bandwidth efficiency.	**BTL 1**	**Remembering**
6	A 400 W carrier is modulated to a depth of 75%. Calculate the total power in the modulated wave.	**BTL 3**	**Apply**
7	Identify the modulation index for an amplitude modulation.	**BTL 1**	**Remembering**
8	If a 10V carrier is amplitude modulated by two different frequencies with amplitudes 2V & 3V respectively. Find the value of modulation index.	**BTL 3**	**Apply**
9	Consider an AM signal $x(t)$ = 2 cos($2\pi f_c t$) +0.5 cos(2 $\pi f_m t$) . cos($2\pi f_c t$). Compute the modulation index used to generate the signal.	**BTL 3**	**Apply**
10	In an amplitude modulation system, the carrier frequency is f_c = $100KHz$.The maximum frequency of the signal is 5 KHz. Estimate the lower & upperside bands and bandwidth of the AM signal.	**BTL 3**	**Apply**
11	Propose the spectrum of AM signal and explain.	**BTL 4**	**Analyse**
12	Compare AM with DSBSC & SSBSC.	**BTL 4**	**Analyse**
13	Summarize the advantages of SSBSC modulation.	**BTL 2**	**Understanding**
14	Classify amplitude and angle modulation.	**BTL 4**	**Analyse**
15	Express the bandwidth of the FM signal if the frequency sensitivity of the modulator is 25 kHz per volt.	**BTL 2**	**Understanding**
16	Show the AM & FM signals produced by a single tone signal.	**BTL 3**	**Apply**
17	Draw the block diagram of FM signal generator that use phase modulator in it.	**BTL 1**	**Remembering**
18	The maximum frequency deviation in an FM is 10KHz and the signal frequency is 10KHz. Estimate the bandwidth using Carson's rule and themodulation index.	**BTL 3**	**Apply**
19	Distinguish between FM & PM.	**BTL 4**	**Analyse**
20	Memorize Carson's rule.	**BTL 1**	**Remembering**
21	Estimate modulation index in AM.	**BTL 2**	**Understanding**
22	State the principle of Superheterodyne receiver.	**BTL 1**	**Remembering**
23	Predict the frequency parameters of AM receiver.	**BTL 2**	**Understanding**
24	What is double spotting?	**BTL 1**	**Remembering**

	PART B		
1	Define amplitude modulation and describe it in detail with suitable diagrams. (13)	**BTL 2**	**Understanding**
2	Illustrate the concept of coefficient modulation to model the percent modulation an AM DSBFC envelope. (13)	**BTL 2**	**Understanding**
3	Categorize the concept of AM power distribution with relevant expressions. (13)	**BTL 4**	**Analyse**
4	(i)Illustrate the AM voltage distribution with mathematical equations andvoltage spectrum of AM DSBFC. (7) (ii)A 1000kHz carrier is simultaneously modulated with 300Hz, 800Hz and 2kHz audio sine waves. Select the frequencies present in the output. (6)	**BTL 2** **BTL 3**	**Understanding** **Apply**
5	Interpret the power distribution of AM DSBFC. (13)	**BTL 2**	**Understanding**
6	Determine the following for DSBSC (i) Bandwidth (2) (ii) Time domain representation (5) (iii) Frequency spectrum Waveform (3) (iv) Advantages, Disadvantages and Applications (3)	**BTL 1**	**Remembering**
7	(i)Examine the power conservation of single side band transmission. (4) (ii)For a modulation coefficient m = 0.2 and an unmodulated carrier power P_c = 1000W, Examine the total sideband power, upper & lower side band power, modulated carrier power and total transmitted power. (9)	**BTL 2** **BTL 3**	**Understanding** **Apply**
8	Sketch SSBSC and explain in detail. (13)	**BTL 1**	**Remembering**
9	(i)Inspect the function of VSB. (7) (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 & phasedeviation is 25radians. Detect the equation of this modulated wave for FM and PM. If the modulating frequency is now changed to 2kHz, all else remainingconstant. Write a new equation for FM & PM. (6)	**BTL 4** **BTL 3**	**Analyse** **Apply**
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 carrierswing of the FM signal, the highest and the lowest frequencies attained by themodulated signal, modulation index of the FM wave. (7) (ii)Identify the relationship between the instantaneous carrier frequency and modulating signal for FM. (6)	**BTL 3** **BTL 2**	**Apply** **Understanding**
11	(i)Discriminate the phasor diagram of wideband FM and explain about thebandwidth of FM signal. (7) (ii)Differentiate phase modulation and frequency modulation. (6)	**BTL 4**	**Analyse**
12	Analyze the indirect method for generating wideband FM signal. (13)	**BTL 4**	**Analyse**
13	State the principle of Angle Modulation. Derive phase deviation, modulation index, frequency deviation and percent modulation. (13)	**BTL 1**	**Remembering**
14	(i)Predict the frequency analysis of angle modulated wave. (9) (ii)Summarize the Bandwidth requirements for angle modulated waves. (4)	**BTL 2**	**Understanding**
15	Discuss the generation of DSB SC Waves. (13)	**BTL 2**	**Understanding**
16	Explain the methods for generation of SSB modulated waves. (13)	**BTL 1**	**Remembering**

17	Point out the methods for generation and detection of VSB modulated waves. (13)	**BTL 4**	**Analyse**
	PART C		
1	(i)For an AM DSBFC transmitter with an unmodulated carrier power P_C=100W that is modulated simultaneously by three modulating signals withcoefficients 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. (12) (ii)Explain Carson's rule to validate the bandwidth occupied by a 3kHz message signal frequency modulated with modulation index = 5. (3)	**BTL 3**	**Apply**
2	(i)A 400W carrier is amplitude modulated to a depth of 100%. Calculate thetotal power in case of the AM and DSBSC techniques. Formulate how much power saving in watts is achieved for DSBSC? If the depth of modulation is changed to 75%, then how much power in W is required for transmitting theDSBSC wave? Invent the power required for DSBSC in both cases and comment on the reason for change in the power levels. (7) (ii)For an AM DSBFC wave with peak unmodulated carrier voltage V_C=10V, a load resistance R_L = 10 Ω and a modulation coefficient m = 1. a.Predict the Power of carrier, upper and lower side band and Total power ofmodulate wave. (4) b.Estimate the total sideband power and draw the power spectrum. (4)	**BTL 3**	**Apply**
3	Describe the super heterodyne receiver block diagram and originate the working principle for the same. (15)	**BTL 1**	**Remembering**
4	Compare the analog communication systems with appropriate waveforms. (15)	**BTL 2**	**Understanding**
5	(i)Discuss on Pilot Carrier SSB system with a neat block diagram. (7) (ii) Compare AM techniques DSBSC, SSB and VSB. (8)	**BTL 2** **BTL 4**	**Understanding** **Analyse**

UNIT II – PULSE MODULATION

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

PART A

Q.No	Questions	BT Level	Domain
1	Differentiate pulse modulation and analog modulation.	**BTL 4**	**Analyse**
2	Classify the main idea of low pass sampling theorem.	**BTL 4**	**Analyse**
3	Express Nyquist sampling rate.	**BTL 2**	**Understanding**
4	Define sampling.	**BTL 1**	**Remembering**
5	What is quantization?	**BTL 1**	**Remembering**
6	Assess the quantization range for the decimal value of 3 and 2.	**BTL 3**	**Apply**
7	Quote quantization error.	**BTL 1**	**Remembering**
8	Infer why PAM is needed.	**BTL 4**	**Analyse**
9	Identify the concept of PCM line coding.	**BTL 4**	**Analyse**
10	Summarise the advantages of PCM.	**BTL 2**	**Understanding**
11	Classify 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	Examine the function of DPCM.	**BTL 2**	**Understanding**
15	Outline the concept of delta modulation.	**BTL 1**	**Remembering**
16	Compile the steep slope rapid change in slope overload distortion.	**BTL 3**	**Apply**
17	Paraphrase the concept of ADPCM.	**BTL 2**	**Understanding**
18	Predict 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 3**	**Apply**
20	Interpret aperture error.	**BTL 3**	**Apply**
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 3**	**Apply**
23	Difference between ADPCM and ADM.	**BTL 4**	**Analyse**
24	A message has zero mean value and a peak value of 10 V. It is to be quantised using a step size of 0.1 V with one level coinciding to 0 V, Find number of bits required for encoding the quantised signal.	**BTL 3**	**Apply**
	PART B		
1	Describe low pass sampling theorem with appropriate diagrams. (13)	**BTL 1**	**Remembering**
2	Illustrate quantization and the folded binary code with 3-bit PCM code and necessary waveforms. (13)	**BTL 2**	**Understanding**
3	Explain the following (i) Dynamic range (11) (ii) Coding efficiency (2)	**BTL 1**	**Remembering**
4	Memorize the generation of PAM and its demodulation. (13)	**BTL 1**	**Remembering**
5	(i)Interpret the advantages and disadvantages of digital transmission. (9) (ii)Express Nyquist interval and aliasing. (4)	**BTL 2** **BTL 3**	**Understanding** **Apply**
6	Explain in detail about Pulse Code Modulation with its neat block diagram. (13)	**BTL 2**	**Understanding**
7	(i)Categorize the function of PWM and PPM. (4) (ii) Discriminate the input and output waveforms for the PWM, PPM PAM and PCM. (9)	**BTL 4**	**Analyse**
8	(i)Draw the sample and hold circuit used in PCM sampling. (3) (ii)For the drawn sample and hold circuit estimate the largest value capacitor that can be used. Use and output impedance for Z_1 of 10Ω, an on resistance for Q_1 of 10Ω, an acquisition time of 10μs, a maximum peak-to-peak input voltage of 10V, a maximum output current from Z_1 of 10mA, and an accuracy of 1%. (10)	**BTL 2** **BTL 3**	**Understanding** **Apply**
9	Classify the types of PCM sampling and conclude its operation with appropriate diagrams. (13)	**BTL 4**	**Analyse**
10	Draw the DPCM transmitter, receiver block diagram and explain it. (13)	**BTL 1**	**Remembering**
11	Examine the Delta modulation transmitter and receiver operation with neat block diagrams and its output waveforms. (13)	**BTL 2**	**Understanding**
12	(i)Illustrate the function of ADPCM in detail with relevant diagrams. (10) (ii)Summarize the advantages of PWM. (3)	**BTL 2**	**Understanding**
13	(i)Why flat top PAM is widely used? (4) (ii)Write the advantages, disadvantages and applications of PCM. (9)	**BTL 1**	**Remembering**
14	Analyse PWM signal generator and detector also write the operation for the same. (13)	**BTL 4**	**Analyse**
15	Compare digital pulse modulation methods of PCM, DM, ADM and DPCM. (13)	**BTL 4**	**Analyse**

16	(i) In a binary PCM system the output signal to quantization noise ratio isto be held to a minimum of 40dB. First calculate the number of binary digits per word, necessary to meet this requirement and then find the actualvalue of the output signal to quantization noise ratio (7) For a PAM transmission of voice signal having maximum frequency f_m = 4kHz, calculate the transmission bandwidth. It is given that the sampling frequency f_S = 8kHz 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. Dervive the formula that you use. (13)	**BTL 3**	**Apply**
	PART C		
1	Compare PAM, PWM, PPM and PCM in detail. (15)	**BTL 4**	**Analyse**
2	State the principle of ADM. Draw the block diagram of ADM transmitter and receiver and explain with relevant expressions. (15)	**BTL 1**	**Remembering**
3	Analog waveform information is with maximum frequency $f_m = 3kHz$ is to be transmitted over an M-ary PAM system, where the number of pulse levels M=16. The quantization distortions specified not to exceed ± 1% of the peak to peak analog signal. (i)Estimate the minimum number of bits per sample or bits per PCM workthat should be used in digitizing the analog waveform. (4) (ii)Deduct the minimum required sampling rate and what is the resultingbit transmission rate. (4) (iii)Compose the PAM pulse or symbol transmission rate. (4) (iv) If the transmission bandwidth equals 12kHz. Evaluate the bandwidthefficiency for this system. (3)	**BTL 3**	**Apply**
4	The information in an analog signal voltage waveform is to be transmitted over a PCM system with an accuracy of ± 0.1% (full scale). The analog voltage waveform has a bandwidth of 100Hz and an amplitude range of - 10 to +10V. (i) Predict the maximum sampling rate required. (4) (ii) Invent the number of bits in each PCM word. (4) (iii) Generate the minimum bit required in the PCM signal. (4) (iv)Design the minimum absolute channel bandwidth required for the transmission of the PCM signal. (3)	**BTL 3**	**Apply**
5	Derive an expression for signal to quantisation noise power ration for delta modulation. Assume that no slope overload distortion exists.	**BTL 2**	**Understanding**

UNIT III – DIGITAL COMMUNICATION

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK)–Phase Shift Keying (PSK) – BPSK – QPSK – Quadrature Amplitude Modulation (QAM) – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).

PART A

Q.No	Questions	BT Level	Domain
1	Express the three most predominant modulation schemes used in digital radio systems?	**BTL 2**	**Understanding**

2	Compare analog modulation and digital modulation.	**BTL 4**	**Analyse**
3	Identify the mathematical expression for ASK if the logic input "0" and "1".	**BTL 4**	**Analyse**
4	What is OOK?	**BTL 1**	**Remembering**
5	Illustrate the ASK signal for the given message signal 101101.	**BTL 3**	**Apply**
6	Infer the concept of FSK.	**BTL 2**	**Understanding**
7	Examine the relationship between bit rate and baud for a FSK system.	**BTL 4**	**Analyse**
8	Construct the digitally modulated waveforms for the binary data 110101 using ASK, FSK.	**BTL 3**	**Apply**
9	Identify the reason for FSK & PSK signals are preferred over ASK signals.	**BTL 2**	**Understanding**
10	Difference between ASK and FSK.	**BTL 4**	**Analyse**
11	Write the advantages of PSK.	**BTL 1**	**Remembering**
12	Express the BPSK waveform for the given 1011 data.	**BTL 2**	**Understanding**
13	Given the input binary sequence 1100100010, contrast the waveforms of thein phase and quadrature components of a modulated wave obtained by using QPSK.	**BTL 3**	**Apply**
14	Mention the advantage of QPSK.	**BTL 1**	**Remembering**
15	Predict the 8 QAM phase output for the following data 001, 010.	**BTL 2**	**Understanding**
16	Find the main idea of 2 – to – 4 level converter blocks in the 8 QAM modulator.	**BTL 3**	**Apply**
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. Calculate f_2.	**BTL 3**	**Apply**
19	Estimate the encoding scheme and possible outputs for 16 QAM.	**BTL 3**	**Apply**
20	Define 16 QAM system.	**BTL 1**	**Remembering**
21	Sketch signal Constellation diagram for QPSK	**BTL 1**	**Remembering**
22	Differentiate baseband transmission from passband transmission	**BTL 4**	**Analyse**
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 4**	**Analyse**
	PART B		
1	(i)With neat diagrams illustrate the Amplitude Shift Keying. (7) (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. (6)	**BTL 2** **BTL 3**	**Understanding** **Apply**
2	Point out the concepts of FSK in the time domain with its waveform and truth table. (13)	**BTL 4**	**Analyse**
3	Explain the concepts of FSK with bit rate, baud and bandwidth. (13)	**BTL 4**	**Analyse**
4	(i)Examine the working of BFSK transmitter and receiver with necessaryequations and block diagram. (5) (ii)Analyse the coherent and non-coherent detection of BFSK receiver. (8)	**BTL 1**	**Remembering**
5	Define BPSK and explain BPSK transmitter and receiver with relevant diagrams. (13)	**BTL 1**	**Remembering**
6	(i)Show the truth table and draw the constellation diagram for 8 PSKmodulator. (5)	**BTL 2**	**Understanding**

	(ii)Write a short note on 8 PSK bandwidth considerations. (8)		
7	For a BPSK modulator with a Carrier frequency of 70 MHz and an input bitrate of 10 Mbps, (i)Predict the maximum and minimum upper and lower side frequencies, draw the output spectrum. (7) (ii)How would you summarize the minimum Nyquist bandwidth, and calculate the baud rate (Assume f= 5MHz). (6)	**BTL 2** **BTL 3**	**Understanding** **Apply**
8	Draw the QPSK transmitter block diagram and state the concepts in your own words with relevant expressions. (13)	**BTL 1**	**Remembering**
9	Sketch the QPSK receiver block diagram and explain each block, BW considerations with relevant expressions and figures. (13)	**BTL 1**	**Remembering**
10	(i) Compare the Quadrature Phase Shift Keying and Binary Phase Shift Keying. (6) (ii) If a digital message input data rate is 8kbps and average energy per bit is 0.01 Unit. Infer the bandwidth required for the transmission of message through BPSK, QPSK, BFSK & 16 PSK. (7)	**BTL 4** **BTL 3**	**Analyse** **Apply**
11	Illustrate 8 PSK modulator and demodulator with the diagrams. (13)	**BTL 2**	**Understanding**
12	Classify the significance of QAM and describe the operation of 8 QAM transmitter and receiver using block diagram and truth table. (13)	**BTL 4**	**Analyse**
13	(i) For a QPSK modulator with an input data rate equal to 12 Mbps and acarrier frequency of 100 MHz, estimate the following, (a) Minimum double sided Nyquist bandwidth. (2) (b) Baud rate (2) (c) Sketch the output spectrum. (3) (ii) Generate the first 8 bit code input and its respective phase for the 16 PSK. (6)	**BTL 3**	**Apply**
14	Describe the working of 16 QAM transmitter with a block diagram and necessary diagrams. (13)	**BTL 1**	**Remembering**
15	Derive the expression of error probability of QAM system. (13)	**BTL 2**	**Understanding**
16	Compare the performance of BPSK with that of BFSK. (13)	**BTL 4**	**Analyse**
17	The bit stream 1011100011 is to be transmitted using DPSK. Determine the encoded sequence and transmitted phase sequence. (13)	**BTL 3**	**Apply**
	PART C		
1	Enumerate the block diagram of digital communication systems in detail. (15)	**BTL 1**	**Remembering**
2	(i)Summarize about analog modulation and digital modulation. (5) (ii)Explain the block of digital radio system. (10)	**BTL 2**	**Understanding**
3	(i)A data bit sequence consists of the following string of bits 10 11 10 10. Evaluate and draw the nature of waveform transmitted by BPSK transmitter. (8) (ii)For an 8 PSK modulator with an input data rate equal to 10 Mbps & a carrier frequency of 70 MHz, measure minimum double sided Nyquist bw, Baud rate, Sketch the output spectrum. Judge the results with BPSK & QPSK modulators. (7)	**BTL 3**	**Apply**
4	(i)Compose the expression for the output of linear summer of an 8 QAM transmitter, as a table for all possible tribit input combinations. (8)	**BTL 3**	**Apply**

	(ii)For a quad bit input I, I′,Q & Q′, formulate the amplitude and phase for 16 QAM modulator. (7)		
5	Discriminate the block diagram of QPSK transmitter and receiver with relevant expressions/waveforms. Analyse the pros and cons of the system. (15)	**BTL 4**	**Analyse**

UNIT IV – 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.

PART A

Q.No	Questions	BT Level	Domain
1	State entropy.	**BTL 1**	**Remembering**
2	Interpret 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 3**	**Apply**
3	Mention the properties of entropy.	**BTL 1**	**Remembering**
4	Define prefix coding.	**BTL 1**	**Remembering**
5	Compute the expression for Kraft-McMillan Inequality.	**BTL 3**	**Apply**
6	Examine the main idea of code efficiency.	**BTL 4**	**Analyse**
7	Express the concept of discrete messages.	**BTL 2**	**Understanding**
8	Infer mutual information.	**BTL 2**	**Understanding**
9	Label the properties of mutual information.	**BTL 1**	**Remembering**
10	Interpret the channel capacity of a discrete memory less channel.	**BTL 3**	**Apply**
11	Write in your own words about the Shannon's theorem on information capacity of a channel.	**BTL 1**	**Remembering**
12	Predict C_i & C_j are two code vectors in the (n,k) linear block code, then their sum also a code vector with an example.	**BTL 3**	**Apply**
13	Paraphrase linear block codes.	**BTL 2**	**Understanding**
14	What is meant by syndrome of a linear block code?	**BTL 2**	**Understanding**
15	Identify the main idea of Information rate.	**BTL 2**	**Understanding**
16	Estimate 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 3**	**Apply**
19	Compile the difference between cyclic codes and linear codes.	**BTL 4**	**Analyse**
20	Find the hamming distance between the following code words C_1= {1000111} and C_2 = {0001011}.	**BTL 3**	**Apply**
21	Point out how minimum distance of hamming code is calculated.	**BTL 4**	**Analyse**
22	How syndrome is calculated in Hamming codes and cyclic codes	**BTL 4**	**Analyse**
23	Compare systematic and non-systematic codes	**BTL 4**	**Analyse**
24	Analyse the relation between coding gain and code rate.	**BTL 4**	**Analyse**

PART B

1	List the Entropy techniques and its properties in detail. (13)	**BTL 1**	**Remembering**
2	Consider a discrete memoryless source with source alphabets S = S0, S1, S2 and their probabilities P0 = 1/4, P1 = 1/4, P2 =1/4. Estimate the entropyof 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., $H(X^2) = 2*H(X)$. (13)	**BTL 3**	**Apply**
3	(i)Examine Mutual information and its properties in detail. (7) (ii)Inspect the concept of source coding theorem. (6)	**BTL 1**	**Remembering**

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 and 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. (13)	**BTL 2**	**Understanding**
5	Five source messages are probable to appear as m1=0.4, m2=0.15, m3=0.15, m4=0.15and m5=0.15. Find coding efficiency for Shannon Fanocoding and Huffman coding. (13)	**BTL 2**	**Understanding**
6	(i)Calculate the Huffman code for a discrete memoryless source with probability statistics {0.1,0.1,0.2,0.2,0.4}. (9) (ii)Identify the drawbacks of Huffman coding. (4)	**BTL 3** **BTL 4**	**Apply** **Analyse**
7	Express the expression for channel capacity of a continuous channel. Comment on the trade-off between SNR and capacity. (13)	**BTL 2**	**Understanding**
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. (7) (ii)Show how many errors can be detected and corrected? If the received code word is 10101010, find the syndrome. (6)	**BTL 3**	**Apply**
9	The parity check matrix of a particular (7,4) linear block code is givenby $[H] = \begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$ (i)Observe the Generator matrix and list all the code vectors. (8) (ii) Predict the minimum distance between code and vector. (5)	**BTL 3**	**Apply**
10	(i) Inspect a 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. (7) (ii) Inquire a cyclic encoder for the same (7,4) cyclic code and obtain the code vector for the message vector 1100. (6)	**BTL 3**	**Apply**
11	Sketch and describe the generalized (i)(n,k) cyclic encoder to choose an encoding procedure for an (n,k) cyclic code in systematic form. (7) (ii)Syndrome calculator and properties of syndrome polynomial. (6)	**BTL 1**	**Remembering**
12	A discrete memoryless source S with 5 symbols S_1, S_2, S_3, S_4, S_5, construct a Huffman and also calculate its efficiency if the probability distribution is given as $P(S_1)=0.4$; $P(S_2)=0.2$; $P(S_3)=0.2$; $P(S_4)=0.1$; $P(S_5)=0.1$. (13)	**BTL 2**	**Understanding**
13	Summarize the concepts of linear block codes. (13)	**BTL 2**	**Understanding**
14	Identify the need for coding and examine the types of error correction. (13)	**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. (13)	**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). (13)	**BTL 4**	**Analyse**

17	With a neat sketch, explain the generalised block diagram of decoder for cyclic codes. (13)	**BTL 1**	**Remembering**
PART C			
1	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 compare its efficiency. (15)	**BTL 4**	**Analyse**
2	Elaborate the Shannon's second theorem of channel coding theorem. (15)	**BTL 2**	**Understanding**
3	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 Shannon Fano code and Huffman code. Estimate η for the above mentioned. (15)	**BTL 3**	**Apply**
4	Enumerate the steps involved for finding the resultant of Shannon Fano codeand Huffman code with a suitable example problem. (15)	**BTL 1**	**Remembering**
5	For a systematic linear block code, the three parity check digits, c_4, c_5 and c_6 are given by $c_4 = d_1+d_2+d_3$, $c_5 = d_1 + d_2$, $c_6 = d_1+d_3$ (i) Construct Generator matrix. (2) (ii) Construct code generated by this matrix. (3) (iii) Determine error correcting capability. (2) (iv) Prepare a suitable decoding table. (4) (v) Decode the received words 101100 and 000110. (4)	**BTL 3**	**Apply**

UNIT V – MULTI-USER RADIO COMMUNICATION

Global System for Mobile Communications (GSM) - Cellular Concept and Frequency Reuse - Channel Assignment and Handover Techniques - Overview of Multiple Access Schemes.

PART A

Q.No	Questions	BT Level	Domain
1	Mention the types of handovers carried out in GSM.	**BTL 1**	**Remembering**
2	In the AMPS system, the system bandwidth is 12.5 MHz, the channel spacing is 30 kHz, and the edge guard spacing is 10 kHz. The number of channels allocated for control signalling is 21. Find the number of channels available for message transmission.	**BTL 3**	**Apply**
3	Find the number of channels per cluster for a cellular telephone area comprised of 10 clusters with seven cells in each cluster and 10 channels in each cell.	**BTL 3**	**Apply**
4	Express the concept of network subsystem.	**BTL 2**	**Understanding**
5	Infer the need of guard bands in FDMA.	**BTL 4**	**Analyse**
6	Distinguish the advantages 2G over 1G.	**BTL 4**	**Analyse**
7	List the importance of cellular concept.	**BTL 1**	**Remembering**
8	Compute the expression for system capacity using frequency reuse.	**BTL 3**	**Apply**
9	Label the advantages of frequency reuse concept.	**BTL 1**	**Remembering**
10	Paraphrase the term frequency reuse factor in a cellular communication system.	**BTL 2**	**Understanding**

11	Determine the formula for spectral efficiency of FDMA.	**BTL 3**	**Apply**
12	Outline footprint in cellular systems.	**BTL 2**	**Understanding**
13	Point out the pros why hexagons are employed to model coverage areas of mobile communication?	**BTL 4**	**Analyse**
14	Interpret the concept of Handoff.	**BTL 2**	**Understanding**
15	Classify the types of channel assignment.	**BTL 4**	**Analyse**
16	Estimate the methods used for handoffs.	**BTL 2**	**Understanding**
17	Analyse the concept of channel assignment.	**BTL 4**	**Analyse**
18	List the applications of multiple access methods.	**BTL 1**	**Remembering**
19	Examine the need of guard bands in multiple access methods.	**BTL 4**	**Analyse**
20	Formulate the expression for number of channels used in FDMA system.	**BTL 3**	**Apply**
21	Find the number of cells in a cluster when j = 2 and i =3.	**BTL 3**	**Apply**
22	What do you mean by Frequency Division Multiplexing	**BTL 1**	**Remembering**
23	Define Multiplexing.	**BTL 1**	**Remembering**
24	Compare TDMA and CDMA.	**BTL 4**	**Analyse**
	PART B		
1	(i)Describe in detail about the GSM. (5) (ii)Write the concepts of GSM services and features. (8)	**BTL 1**	**Remembering**
2	Consider a cellular system with a total bandwidth of 30 MHz which uses two 25 kHz simplex channel to provide full duplex voice and control channels. Assuming that the system uses a nine-cell reuse pattern and 1 MHz of the total bandwidth is allocated for control channels. (i) Calculate the total available channels. (5) (ii) Determine the number of control channels. (4) (iii) Determine the number of voice channels per cell. (4)	**BTL 3**	**Apply**
3	Discuss the following GSM radio subsystem with the help of Speech dedicated Control Channel Frame and multiframe structure. (13)	**BTL 2**	**Understanding**
4	(i)What are the types of GSM channel? (3) (ii) Write short notes on Half-Rate TCH and Full-Rate TCH. (10)	**BTL 1**	**Remembering**
5	(i)Express the main idea of GSM Control Channel. (4) (ii)Summarize the main concepts behind the Broadcast channel of GSMControl channels. (9)	**BTL 2**	**Understanding**
6	Examine the frame structure for GSM with necessary diagrams.(13)	**BTL 2**	**Understanding**
7	Memorize in detail about the signal processing in GSM. (13)	**BTL 1**	**Remembering**
8	Paraphrase the Cellular concept in detail. (13)	**BTL 2**	**Understanding**
9	(i)Prioritize the need of frequency reuse in cellular concept? (2) (ii)List the features of frequency reuse. (11)	**BTL 4**	**Analyse**
10	Analyse the channel assignment strategies in detail. (13)	**BTL 4**	**Analyse**
11	Consider a cellular system in which there are a total of 1001 radio channels available for handling traffic. Suppose the area of a cell is 6 km^2 and area of the entire system is 2100 km^2 . (i) Calculate the system capacity if the cluster size is 7. (3) (ii) How many times would the cluster size 4 have to be replicated in order to approximately cover the entire cellular area. (3) (iii) Calculate the system capacity if the cluster size is 4. (3)	**BTL 3**	**Apply**

	(iv) Does decreasing the cluster size increase the system capacity. (4)		
12	Examine and inspect the Co-channel interference and system capacity. (13)	**BTL 4**	**Analyse**
13	If a normal GSM time slot consists of 6 trailing bits, 8.25 guard bits, 26 training bits and two traffic bursts of 58 bits of data. Find the frame efficiency. (13)	**BTL 3**	**Apply**
14	Explain the working principle of the following (i)Multiplexing with block diagram. (4) (ii)Multiple access schemes with block diagram. (9)	**BTL 4**	**Analyse**
15	Enumerate the following GSM Control channels (i)Common Control Channel (7) (ii)Dedicated Control Channel (6)	**BTL 1**	**Remembering**
16	With a neat sketch, write short notes on (i) FDMA (7) (ii) TDMA (6)	**BTL 1**	**Remembering**
17	Find the method of locating co-channel cells in a cellular system with necessary diagram and equations. (13)	**BTL 3**	**Apply**
	PART C		
1	(i) If GSM uses a frame structure where each frame consists of S time slots, and each time slot contains 156.25 bits, and data is transmitted at 270.833 kbps in the channel, find (a) time duration of a bit (b) time duration of a slot (c) time duration of a frame (d) how long must a user occupying a single time slot must wait between twosimultaneous transmissions. (7) (ii) If a normal GSM time slot consists of 6 trailing bits, 8.25 guard bits, 26training bits, and 2 traffic bursts of 58 bits of data, find the frame efficiency. (8)	**BTL 3**	**Apply**
2	Analyse co channel interference and adjacent channel interference in mobile communication. (15)	**BTL 4**	**Analyse**
3	(i) If a total of 33 MHz of bandwidth is allocated to a particular FDD cellulartelephone system which uses two 25 kHz simplex channels to provide full duplex voice and control channels, compute the number of channels available per cell if a system uses (a) 4-cell reuse (b) 7-cell reuse (c) 12-cell reuse If 1 MHz of the allocated spectrum is dedicated to control channels, determinean equitable distribution of control channels and voice channels in each cell for each of the three systems. (7) (ii) If a signal to interference ratio of 15 dB is required for satisfactory forwardchannel performance of a cellular system, what is the frequency reuse factorand cluster size that should be used for maximum capacity if the path loss exponent is (a) n = 4 (b) n= 3. Assume that there are 6 co-channels cells in the first tier, and all of them are at the same distance from the mobile. Use suitable approximations. (8)	**BTL 3**	**Apply**

4	Compile the multiple access schemes used in communication with appropriate diagrams. (15)	**BTL 2**	**Understanding**
5	Sketch the architecture and frame structure of GSM and discuss the salient features and applications of GSM. (15)	**BTL 1**	**Remembering**