VALLIAMMAI ENGINEERING COLLEGE

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF
INFORMATION TECHNOLOGY

QUESTION BANK

III SEMESTER- SECOND YEAR

EC8394 - ANALOG AND DIGITAL COMMUNICATION

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SUBJECT : EC8394 - ANALOG AND DIGITAL COMMUNICATION

SEM / YEAR : III SEMESTER/ SECOND YEAR

UNIT -I ANALOG COMMUNICATION

Introduction to Communication Systems - Modulation – Types - Need for Modulation. Theory of Amplitude Modulation - Evolution and Description of SSB Techniques - Theory of Frequency and Phase Modulation – Comparison of Analog Communication Systems (AM – FM – PM).

PART-A

Q.No	Question	Competence	Level
1	**List** the major segments of electromagnetic spectrum and give their frequency ranges	Remembering	BTL1
2	**What is** the need for modulation?	Remembering	BTL1
3	**Define** amplitude modulation. (OR) **Define** amplitude and angle modulation	Remembering	BTL1
4	**Define** modulation index.	Remembering	BTL1
5	**Illustrate** the Degree of modulation in AM	Applying	BTL3
6	**Compare** AM with DSB-SC and SSB-SC.	Analysing	BTL4
7	In an amplitude modulation system, the carrier frequency is $fc = 100kHz$. The maximum frequency of the signal is 5 kHz. **Calculate** the lower & upper side bands and bandwidth of the AM signal.	Applying	BTL3
8	Summarize the advantages of SSBSC modulation.	Understanding	BTL2
9	Consider an AM signal $x(t)=2\cos(2\pi f_c t) +0.5\cos(2\pi f_c t).\cos(2\pi f_m t)$. **Find** the modulation index used to generate the signal.	Evaluating	BTL5
10	**Plan** the bandwidth which is needed to transmit voice signal of 4kHz, use AM.	Creating	BTL6
11	**Draw** the spectrum of AM /FM signal.	Applying	BTL3
12	Illustrate AM and FM signals produced by a single tone signal	Applying	BTL3
13	**Write down** the mathematical expression for angle modulated wave.	Remembering	BTL1
14	What is the **purpose** of limiter in FM receiver?	Analysing	BTL4
15	**Design** the bandwidth of FM signal if the frequency deviation of the modulator is 25kHz per Volt?	Creating	BTL6

Q.No	Question	Competence	Level
16	**Differentiate** between narrow band and wide band FM signal.	Analysing	BTL4
17	**Distinguish** between FM and PM.(OR)**Differentiate** frequency and phase modulation	Understanding	BTL2
18	**Describe** Carson's rule.	Understanding	BTL2
19	**Draw** the Schematic of generating FM signal using Phase Modulator	Applying	BTL3
20	The maximum frequency deviation in an FM is 10kHz and the signal frequency is 10kHz. **Estimate** the bandwidth using Carson's rule and the modulation index.	Evaluating	BTL5

UNIT -I [PART-B]

Q.No		Question	Mark	Competence	Level
1	a	**Illustrate** the expression for instantaneous voltage of AM wave	06	Understanding	BTL2
	b	In modulation by several sine waves simultaneously, in AM, the bandwidth required is twice the highest modulating frequency. **Prove** this concept using appropriate expression.	07	Applying	BTL3
2	a	The output modulated wave of a standard AM transmitter is represented $S(t) = 500(1+0.4\sin 3140t)\cos(6.28 \times 10^7)t$. This Voltage is fed to a load of 600Ω. **Analyse** the following (a) Modulating Frequency (b)Carrier Frequency (c) Mean power output	02+ 02+ 02	Analysing	BTL4
	b	**Derive** efficiency ή of standard AM and show that for a single tone AM, $\acute{\eta}_{max} = 33.3\%$ at m=1.	07	Analysing	BTL4
3	-	With the help of mathematical expression explain about amplitude modulation, its generation and detection.	13	Understanding	BTL2
4	-	With the help of neat block diagram **explain** about the generation of SSBSC wave and demodulation.	13	Remembering	BTL1
5	a	**Calculate** the percentage power saving when the carrier and one of the sideband are suppressed in an AM wave modulated to a depth of (i)100 % (ii) 50 %	02+ 02	Evaluating	BTL5
	b	**Describe** the frequency modulation and phase modulation and their inter-relationship.	09	Evaluating	BTL5
6	a	**Draw** the phasor diagram of wide band FM and explain about the bandwidth of FM Signal.	07	Remembering	BTL1
	b	**Explain** the difference between phase modulation and frequency modulation	06	Remembering	BTL1
7	a	**Derive** for carrier power and transmitter power in AM in terms of modulation index.	06	Remembering	BTL1
	b	**Describe** the average power required for an angle modulated wave with mathematical expression.	07	Remembering	BTL1
8	-	**Compare** AM, FM and PM.	13	Analysing	BTL4
9	-	**Discuss** the various SSB techniques	13	Understanding	BTL2

Q.No		Question	Mark	Competence	Level
10	a	**Derive** the expression for the instantaneous voltage of SSB wave.	09	Remembering	BTL1
	b	The phase deviation constant in a phase modulation system is K = 0.01 rad/v. **Calculate** the maximum phase deviation when a modulating signal of 10 V is applied?	04	Applying	BTL3
11	a	Consider an angle modulated signal $X(t)=100\cos(2\pi f_c t+ 5 \sin(2\pi f_m t))$ assume PM and FM is 1kHz. **Compute** i) the phase modulation index (ii) approximate bandwidth of PM when FM is halved (iii)approximate bandwidth of PM when FM is doubled	1+2+ 2	Applying	BTL3
	b	A 1000 kHz carrier is simultaneously modulated with 300 Hz, 800 Hz and 2 kHz audio sine waves. **Find** the frequencies present in the output.	08	Applying	BTL3
12	a	**Explain** the nature of Single Side Band Spectrum if the modulating signal is $m(t) = \cos2\pi.100t + \cos2\pi.200t$ and carrier is given by $c(t) = \cos 2\pi.10000t$.	06	Evaluating	BTL5
	b	**Describe** the relationship between the instantaneous carrier frequency and the modulating signal for FM **(OR) Discuss** about the indirect method if generating wideband FM signal.	07	Understanding	BTL2
13	-	An audio frequency signal 10 sin (2*3.14* 500)t is used to amplitude modulate a carrier of 50 sin(5*3.14*10^5)t. **Calculate and Analyse** (i) Modulation index (ii) Upper and lower side band frequencies (iii) Peak amplitude and power of side band (iv) Maximum and minimum amplitudes of envelope (v) Transmission efficiency	02 02 03 03 03	Analysing	BTL4
14	a	**Design** an FM modulator operates at carrier signal frequency of 500 KHz with peak amplitude 10 Volts. A modulating frequency of 10 kHz modulates it with the peak frequency deviation of 10 kHz. Determine the following (i) Modulation index. (ii) Minimum BW	03 + 03	Creating	BTL6
	b	A 25 MHz carrier is modulated by a 400 Hz audio sine wave. If the carrier Voltage is 4V and the maximum frequency deviation is 10kHz and phase deviation is 25 radians. **Write the equation** of this modulated wave for (i) FM (ii) PM. If the modulating frequency is now changed to 2kHz, all else remaining constant. Write a new equation for FM and PM.	03+ 02+ 02	Creating	BTL6
UNIT -I [PART-C]					

1	An AM signal has a peak to peak unmodulated carrier voltage is 200V, voice signal range is 300Hz to 3400Hz and a load resistance is 50Ω. The message is modulated critically. Determine the following 1. Carrier Power 2. Power of Side bands 3. Draw the Spectrum of above specification with all components 4.Total power for AM 5.Transmission Bandwidth & Efficiency 6.Select the suitable AM modulation technique for defence and entertainment application and justify your answers	02 +02 02 02 02 04 03	Creating	BTL6

Q.No	Question	Mark	Competence	Level
2	(i) A FM radio link has a frequency deviation of 30kHz.The modulating frequency is 3kHz.Find the bandwidth needed for the link. (ii) An angle modulated signal has the form v(t)=100cos[2πfct+4sin2000πt] where fc=10MHz. Find: (a) The Average transmitted power (b)Peak phase deviation (c) Peak frequency deviation (d) Is this FM or a PM signal? Explain	03 02 03 03 04	Analysing	BTL4
3	**Design** a FM broadcasting station by identifying the blocks involved in that. Discuss the generation, theory involved in the WBFM and NBFM.	15	Analysing	BTL4
4	A 400 W carrier is amplitude modulated to a depth of 100%. Calculate the total power in case of the AM and DSBSC techniques. 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 the DSBSC wave? **Compare** the power required for DSBSC in both cases and comment on the reason for change in the power levels.	05+05+05	Creating	BTL6

UNIT -II PULSE AND DATA COMMUNICATION

Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse Code Modulation (PCM) - Comparison of various Pulse Communication System (PAM – PTM – PCM).
Data Communication: History of Data Communication - Standards Organizations for Data Communication- Data Communication Circuits - Data Communication Codes - Data communication Hardware - serial and parallel interfaces.

[PART-A]

Q.No	Question	Competence	Level
1	**Name** the standards organizations for data communication?	Understanding	BTL2
2	**List out** all data communication codes	Remembering	BTL1
3	**Distinguish** between half duplex and full duplex transmission.	Analysing	BTL4
4	**What** is data modem?	Understanding	BTL2
5	**List out** the layer presented in ISO-OSI reference model	Understanding	BTL2
6	**Define** USRT, USART.	Remembering	BTL1
7	**Determine** the odd and even parity bits for the ASCII character R whose Hex code is 52.	Evaluating	BTL5
8	**State** the sampling theorem for band limited signal of finite energy.	Applying	BTL3
9	**Prepare** the Nyquist rate for analog input frequency of a) 4kHz b) 10kHz.	Creating	BTL6
10	**Define** Aliasing and Aperture effect.	Remembering	BTL1
Q.No	Question	Competence	Level

11	**Infer** about Quantization process.	Evaluating	BTL5
12	**Define** DTE, DCE.	Remembering	BTL1
13	**Give** any two function of UART.	Understanding	BTL2
14	**List** the advantages of PCM.	Remembering	BTL1
15	**Define** Pulse time modulation.	Remembering	BTL1
16	**State** the need for companding in a PCM system.	Applying	BTL3
17	**Illustrate** the regenerative repeaters	Applying	BTL3
18	Mention **how** PPM is derived from PWM	Analysing	BTL4
19	**Why** do we encounter aperture effect in PAM? How will you rectify it?	Analysing	BTL4
20	**What** are the advantages of PWM?	Understanding	BTL2

UNIT -II [PART-B]

Q.no		Question	Mark	Competence	Level
1	a	**Explain** the working of two station data communication circuit with a block diagram (OR) **Explain** the concept of Data communication circuits using a basic block diagram.	07	Understanding	BTL2
	b	**Discuss** the various data communication codes and its significance.	06	Understanding	BTL2
2	a	**Explain** the data communication network architecture protocols and standards in details.	07	Understanding	BTL2
	b	**Describe** the following data communication codes: Baudot, ASCII and EBCDIC.	06	Understanding	BTL2
3	a	**Briefly** explain about the OSI-reference models	07	Remembering	BTL1
	b	**Write short notes** on topologies.	06	Remembering	BTL1
4	-	**Explain** the data communication hardware with neat block diagram and explain all devices.	13	Remembering	BTL1
5	-	**Explain** quantization process in detail and derive the expression for output signal to noise ratio of uniform quantizer. (OR) For an PCM system given : Maximum analog input frequency 4kHz Maximum decoded voltage at the receiver +/- 2.55 Volt. Maximum dynamic range 46 dB. Determine minimum sample rate , minimum number of bits used in the PCM Code, resolution and Quantization error.	13	Analysing	BTL4
6	a	**Discuss** in detail about the standards organization for Data communication	06	Remembering	BTL1
	b	**Explain** the generation of PCM signal with a block diagram.	07	Remembering	BTL1
7	-	**Discuss** about the generation of PAM and its demodulation.	13	Understanding	BTL2
8	-	**Explain** about various operations performed in the transmitter and receiver of PCM system.	13	Applying	BTL3
Q.no		Question	Mark	Competence	Level

9	-	The information in an analog wave form with maximum frequency f_m = 3kHz, is to be transmitted over an M-ary PAM system, where the number of pulse levels is M=16. The quantization distortions specified not to exceed + or -1% of the peak to peak analog signal. (i)What is the minimum number of bits/sample or bits/PCM word that should be used in digitizing the analog waveform? (ii) What is the minimum required sampling rate and what is the resulting bit transmission rate? (iii)What is the PAM pulse or symbol transmission rate?(iv)if the transmission bandwidth equals 12 kHz determine the bandwidth efficiency for this system	13	Evaluating	BTL5
10	-	**Compare** the various Pulse modulation techniques	13	Analysing	BTL4
11	-	**Design** a PCM system with quantization level 8 in the dynamic range of 2V. Determine the quantization error and mean square error for the measured consecutive samples of 1.2V, 1.0V, 0.95V, 1.41V and 1.65V readings.	13	Creating	BTL6
12	-	**Explain** pulse modulation and any one of the pulse modulation method in detail	13	Analysing	BTL4
13	-	**Illustrate** the concepts of PWM in detail.	13	Applying	BTL3
14	-	**Discuss** about the serial and parallel interfaces with suitable example.	13	Remembering	BTL1
		UNIT -II [PART-C]			
1		**Construct** a digital transmission system with suitable diagrams for the following conditions 1.Output as samples with constant width and constant amplitude 2. Output as samples with variable width and constant amplitude. Choose the best method for your own application and justify.	15	Creating	BTL6
2	a	a) A Composite video signal with base band frequency range from zero to 4MHz is transmitted by linear PCM, using 8 bit per sample and sampling rate of 10 MHz i) **Determine** the number of quantization level ii) **Calculate** the transmission bit rate iii) What is the type of noise introduced in this process.	02+ 02+ 01	Evaluating	BTL5
3	a	A base band signal having maximum frequency of 30 kHz is required to be transmitted using a digital audio system with a sampling frequency of 44.1 kHz, **Estimate** the frequency components available at the output	03	Evaluating	BTL5
	b	How aliasing effects can be overcome.	06		
	c	How is the PCM different from PAM?	06		
4		**Design** a PCM system with suitable blocks with the maximum number of bits per sample, minimum sampling rate and bit transmission rate for the following parameters. Information is in an analog waveform with maximum frequency 3 kHz and the number of pulse level is M=16.	15	Creating	BTL6

UNIT –III DIGITAL COMMUNICATION

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK)–Phase Shift Keying (PSK) – BPSK – QPSK – Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).

[PART-A]

Q.No	Question	Competence	Level
1	**Define** Digital Modulation and list out the types of Digital modulation.	Remembering	BTL1
2	**What** is M-ary encoding?	Understanding	BTL2
3	**Define** Baud rate and Bit rate.	Remembering	BTL1
4	**Define** bandwidth efficiency.	Remembering	BTL1
5	**Define** Nyquist theorem.	Remembering	BTL1
6	**Draw** the ASK signal for the given message signal 101101.	Applying	BTL3
7	**Why** is FSK and PSK signals are preferred over ASK signals?	Analysing	BTL4
8	**Sketch** the digitally modulated waveforms for the binary data 110101 using ASK and FSK	Creating	BTL6
9	**Write down** the expression for peak frequency deviation of FSK.	Understanding	BTL2
10	**Determine** the peak frequency deviation for a binary FSK signal with a mask frequency of 49 kHz, a space frequency of 51 kHz.	Evaluating	BTL5
11	**Describe** the constellation diagram of ASK, FSK signal.	Understanding	BTL2
12	**Sketch** the QPSK signal for the binary sequence 11001100	Creating	BTL6
13	**Draw** the constellation diagram of PSK, QPSK signal.	Applying	BTL3
14	For 16 PSK and a transmission system with a 10kHZ bandwidth. Find the maximum bit rate.	Analysing	BTL4
15	**Differentiate** between BPSK from QPSK.	Analysing	BTL4
16	For the given the input binary sequence 100100010, **sketch the waveform** of the in phase and quadrature components of a modulated wave obtained by using QPSK.	Applying	BTL3
17	**What** do you meant by I,Q & C Channels?	Remembering	BTL1
18	What is QAM?	Understanding	BTL2
19	**Draw** phasor diagram for 8-QAM.	Applying	BTL3
20	**Assess** the significance of QAM?	Evaluating	BTL5

UNIT -III [PART-B]

Q.No		Question	Mark	Competence	Level
1	a	**Explain** the working principle of ASK with block diagram	10	Remembering	BTL1
	b	**Calculate** Baud rate and Bit rate for ASK	03	Evaluating	BTL4
2	-	**Draw** the block diagram of FSK system and Explain its working. (OR) **Describe** the generation and detection of binary FSK signal with necessary diagram and equation.	13	Understanding	BTL2
3	a	**Explain** in detail about the operation of QPSK transmitter with necessary diagrams.	09	Analysing	BTL4
	b	**Compare** QPSK and BPSK.	04	Analysing	BTL4
4	a	**Explain** the working of BPSK transmitter and receiver with necessary equation and block diagram.	09	Analysing	BTL4
	b	**Differentiate** coherent and non-Coherent detection	02	Analysing	BTL4
	c	**Compare** the various digital communication systems.	02	Analysing	BTL4
5	-	**Draw** the constellation diagram of QPSK modulation and explain QPSK modulation and QPSK demodulation.	13	Applying	BTL3
6	-	With relevant expression and figure, describe QPSK transmitter, QPSK receiver and bandwidth consideration of QPSK.	13	Understanding	BTL2
7	-	Draw the ASK, FSK and BPSK wave forms for the bit stream 10110001	06	Applying	BTL3
		For QPSK modulator with an input data rate equal to 12 Mbps and a carrier frequency of 100 MHz. **Determine** the following. i).Minimum double sided Nyquist bandwidth ii).Baud Rate and iii). Sketch the output spectrum	03+ 02+ 02		
8	-	Draw and explain the operations of FSK modulator and explain about coherent and Non-coherent demodulators.	13	Understanding	BTL2
9	a	What is the significant of QAM?	03	Remembering	BTL1
	b	**Explain** the operation of 8 QAM transmitter and receiver using a block diagram and truth table.	10	Remembering	BTL1
10	a	**Explain** the method of generation of QAM and the demodulation of the same.	08	Remembering	BTL1
	b	For a BPSK modulator with a Carrier frequency of 70 MHz and an input bit rate of 10 Mbps, determine the maximum and minimum upper and lower side frequencies, draw the output spectrum, determine the minimum Nyquist bandwidth, and calculate the baud	02+ 01+ 01+ 01	Creating	BTL6
11	-	**Design** its bandwidth efficiency and compare it with other M-ary PSK schemes.	13	Creating	BTL6
12	a	**Determine** the following: (i) Peak frequency (ii) Minimum bandwidth (iii) Baud, for FSK signal with a mark frequency of 49 kHz, space frequency of 51kHz, and input bit rate of 2 kbps.	01+ 01+ 01	Evaluating	BTL5
	b	With neat constellation diagram, **explain** the operation of QAM transmitter. List out its merits over PSK	08+ 02	Evaluating	BTL5
13	-	Explain the working of 16 QAM transmitter with a block diagram and necessary diagrams.	13	Remembering	BTL1

Q.No		Question	Mark	Competence	Level
14	a	If a digital message input data rate is 8 kbps and average energy per bit is 0.01 units. **Find the bandwidth** required for transmission of the message through BFSK, BPSK, QPSK.	06	Analysing	BTL4
	b	**Compare t**he various digital modulation schemes	07	Analysing	BTL4
UNIT-III [PART-C]					
1		(i) Summarize about analog modulation and digital modulation. (ii) Explain the block of digital radio system.	8 7	Analysing	BTL4
2		A data bit sequence consists of the following string of bits 10 11 10 10. Analyze and draw the nature of waveform transmitted by BPSK transmitter.	15	Evaluating	BTL5
3		In a digital communication system, the bit rate of a bipolar NRZ data sequence is 1 Mbps and carrier frequency is 100 MHz. Design by determining the symbol rate of transmission and the bandwidth requirement of the communications channel for M- ary PSK System.	15	Creating	BTL6
4		Draw the QPSK and 8-QAM wave forms for the bit stream 1001110001010101 Note: If needed discard the bits to a minimum extend.	15	Analysing	BTL4

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 - ARQ Techniques

[PART-A]

Q.No	Question	Competence	Level
1	An event has six possible outcomes with probabilities 1/2, 1/4,1/8,1/16,1/32,1/32.**Find** the entropy of the system (OR) **Find** the entropy of the source alphabet $\{s_0,s_1,s_2\}$ with respective probabilities {1/4, 1/4, 1/2}. (OR) consider a discrete memory less source with source alphabet (s_0,s_1,s_2) and with their respective probabilities (P0=1/4, P1=11/4, P2=1/2). **Find** the entropy of the source.	Evaluating	BTL5
2	**Define** Entropy.	Remembering	BTL1
3	**Define** FEC	Remembering	BTL1
4	**What** is Hamming code?	Understanding	BTL2
5	**What** is prefix coding?	Understanding	BTL2
6	**Define** code redundancy	Remembering	BTL1
7	**Define** code variance	Remembering	BTL1

8	**Point out** the properties of mutual information. (OR) Define mutual information and mention its properties.	Analysing	BTL4

Q.No	Question	Competence	Level
9	**Define** channel capacity of a discrete memory less channel	Remembering	BTL1
10	Find the entropy of the source X={x_1,x_2} with the equal message probabilities	Applying	BTL3
11	**What** are linear block codes?	Understanding	BTL2
12	**Show that** if C_i, and C_j are two code vectors in the (n,k) linear block code, then their sum is also a code vector with an example.	Applying	BTL3
13	**Show that** C={000,001,101} is not a linear code.	Applying	BTL3
14	**Find** the hamming weight of 10110 and the hamming distance between 1111 and 0000.	Evaluating	BTL5
15	**Give** the error correcting capability of a linear block code.	Analysing	BTL4
16	**Check** and modify LBC (6,3) for hamming, when d_{min} is 4.	Creating	BTL6
17	**Point out** the properties of cyclic codes.	Analysing	BTL4
18	**What** is error control code?	Understanding	BTL2
19	**Define** syndrome	Remembering	BTL1
20	**When** a binary code is said to be cyclic code?	Analysing	BTL4

UNIT -IV [PART-B]

Q.no		Question	Mark	Competence	Level
1	a	**State** the Source coding theorem and explain.	06	Remembering	BTL1
	b	**State** the properties of mutual information	07	Remembering	BTL1
2	-	A Source generates five messages m_o,m_1,m_2,m_3,m_4 with probabilities 0.55,0.15,0.15,0.10 and 0.05 respectively. The successive message emitted by the source is statistically independent. Determine code words for the message using Shannon Fano Algorithm and Huffman. **Compare** their efficiency.	04+ 04+ 05	Analysing	BTL4
3	-	Encode the following messages with their respective probability using basic Huffman algorithm M_1 M_2 M_3 M_4 M_5 M_6 M_7 M_8 1/2 1/8 1/8 1/16 1/16 1/16 1/32 1/32 **Calculate** the efficiency of coding and **comment** on the result.	06+ 07	Understanding	BTL2
4	a	**Give** the Huffman code for a discrete memory less source with probability statistics (0.1, 0.1,0.2,0.2,0.4}	10	Understanding	BTL2
	b	**Describe** the concepts of channel capacity	03	Understanding	BTL2

6	**a**	The generator polynomial of (7,4) cyclic code is given by $G(D)=1+D+D^2$. **Compute** all the non-systematic code words with necessary steps.	13	Understanding	BTL2

Q.no		Question	Mark	Competence	Level
7	-	Construct an Encoder for (7,4) Linear block code and also construct a suitable syndrome decoder for the same and explain.	06+ 07	Creating	BTL6
8	a	**Explain** a syndrome calculator for (7,4) cyclic code generated by the polynomial $g(x)=x^3+x+1$. Calculate the syndrome for received vector 1001101.	07	Analysing	BTL4
	b	**Analyse** about the cyclic encoder for the same (7,4) cyclic code and obtain code vector for the message vector 1100.	06	Analysing	BTL4
9	-	For a (6,3) systematic linear block code, the three parity-check bits c4,c5 and c6 are formed from the following equations: $c_4=d_1+d_3$, $c_5=d_1+d_2+d_3$, $c_6=d_1+d_2$ (i) Write down the generator matrix. (ii) Construct all possible generator matrix. (iii) Suppose that the received word is 01011. Decode this received word by finding the location of the error and the transmitted data bits.	03+0 6+04	Evaluating	BTL5
10	-	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)Find the generator matrix and the parity check matrix for this code (ii)How many errors can be detected and corrected? (iii)If the received code word is 10101010, find the syndrome.	06+ 02+ 05	Evaluating	BTL5
11	-	The generator matrix for a (6,3) block code is given below. **Calculate** all possible the code words $G = \begin{matrix} 1&0&0&1&1&0 \\ 0&1&0&1&0&1 \\ 0&0&1&0&1&1 \end{matrix}$	13	Applying	BTL3
12	-	Five source message are probable to appear as $m_1= 0.4$, $m_2= 0.15$, $m_3= 0.15$, $m_4=0.15$ and $m_5=0.15$. **Evaluate** coding efficiency by using the following algorithms (i) Shannon - Fano (ii) Huffman .	06+ 07	Evaluating	BTL5
13	-	**Draw and explain** the generalized (i) (n,k) cyclic encoder to implement an encoding procedure for a (n,k) cyclic code in systematic form (ii)syndrome calculator and properties of syndrome polynomial.	06+ 07	Remembering	BTL1
14	-	**Write short notes** on ARQ Techniques and discuss its merits & demerits.	13	Understanding	BTL2
UNIT-IV [PART-C]					
1		The generator polynomial of a (15,11) Hamming code is given by $g(a)= 1+x+x^2$. Design encoder and syndrome calculator for this code using systematic form.	06 + 07	Evaluating	BTL5
2		The source of information A generates the symbols { A_0, A_1, A_2, A_3 and A_4} 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	Evaluating	BTL5

Q.no	Question	Mark	Competence	Level
3	Consider a systematic cyclic code (7, 4) with generator polynomial x^3+x^2+1. Determine the following. 1). Generator Matrix 2). Parity Check Matrix 3). Decoding table 4).Verify the received vector 1101101 for error and correct it, if any error.	15	Creating	BTL5
4	The generation polynomial of a (15,11) Hamming code is defined by $g(x)= 1+x+x^4$. Develop the encoder and syndrome calculator for this code, using a systematic form for the code. Generate the code word for the message vector (1111 1111 111) using the developed encoder. Find the output of the designed syndrome calculator for the received code word (1111 1111 1111 111).	15	Creating	BTL6

UNIT -V MULTI-USER RADIO COMMUNICATION

Global System for Mobile Communications (GSM) - Code Division Multiple Access (CDMA) – Cellular Concept and Frequency Reuse - Channel Assignment and Handover Techniques - Overview of Multiple Access Schemes - Satellite Communication - Bluetooth.

[PART-A]

Q.No	Question	Competence	Level
1	**What** is near far effect in a CDMA system? (OR) **Draw** the block diagram of CDMA transmitter and receiver.	Understanding	BTL2
2	**Define** the term frequency reuse factor in a cellular communication system.	Remembering	BTL1
3	**Why** are hexagons employed to model coverage areas of mobile communication?	Analysing	BTL4
4	**Classify** hand off? (OR) **What** are the steps involved in handoff process?	Applying	BTL3
5	**What** is Bluetooth?	Understanding	BTL2
6	**Infer** the various handovers carried out in GSM?	Analysing	BTL4
7	**Mention** the Coverage range of Bluetooth?	Applying	BTL3
8	**Summarize** the challenges in wireless communication.	Evaluating	BTL5
9	**Compare** the function of HLR and VLR.	Analysing	BTL4
10	**Illustrate** the function of MSC.	Applying	BTL3
11	**Discuss** about BSS. (OR) **Describe** about BTS.	Understanding	BTL2
12	**Mention** the three most commonly used multiple accessing schemes.	Applying	BTL3
13	**Define** BSC.	Remembering	BTL1
14	**Criticize** the need for EIR.	Evaluating	BTL5
15	**Define** OMC.	Remembering	BTL1
16	**List** the Services of GSM.	Understanding	BTL2
17	**List out** the data base involved in GSM.	Remembering	BTL1
18	**Formulate** the channel assignment.	Creating	BTL6
19	**What** is FDMA?	Remembering	BTL1
20	**What** are all the essential components of GSM?	Remembering	BTL1

UNIT -V [PART-B]					
Q.no		**Question**	**Mark**	**Competence**	**Level**
1	-	**Explain** the architecture of GSM with a neat diagram.	13	Remembering	BTL1
2	-	**Explain** the function of each block in GSM also the advantages and disadvantages of GSM.	13	Understanding	BTL2
3	**a**	**Describe** the working of global system for mobile communication	06	Analysing	BTL4
	b	**Briefly explain** the concept of frequency reuse and channel assignment	07		
4	-	**Illustrate** the concepts involved in CDMA Techniques. .	13	Applying	BTL3
5	-	**Differentiate** the important functions of between 1G, 2G and 3G cellular networks.	13	Analysing	BTL4
6	-	**Explain** the concept of cellular topology and cell fundamentals with examples.	13	Remembering	BTL1
7	-	**Describe** about the following : i) Orthogonal codes ii) Hand off iii) Channel assignment iv) Cell splitting	03+02+ 04+04	Remembering	BTL1
8		What is need for multiple access techniques? **Explain** the various classifications of multiple access techniques in detail.	10	Analysing	BTL4
		Briefly discuss the process of channel assignment in cellular networks.	03	Understanding	BTL2
9	**a**	**Compare** TDMA, FDMA and CDMA techniques.	13	Evaluating	BTL5
10	-	**Discuss** in detail about cellular concept and frequency reuse.	13	Understanding	BTL2
11	-	**Describe** the concepts of satellite communication.	13	Understanding	BTL2
12	**a**	**Explain** the principle of working of satellite communication with a block diagram.	08	Applying	BTL3
	b	**Briefly** explain about the Bluetooth technology.	05	Applying	BTL3
13	-	**Discuss** in detail about Bluetooth technology. Create your own application with neat diagram.	13	Creating	BTL6
14		**Explain** in detail about the function of each layer in a Bluetooth system.	13	Remembering	BTL1
UNIT -V [PART-C]					
1		**Briefly** discuss how the cellular communication has evolved over different generation of technology.	15	Evaluating	BTL5
2		**Identify** the Multiple Access used in digital cellular system and explain in detail and also mention the technique used in analog cellular system.	15	Evaluating	BTL5
3	**a**	**List** the various application and types of satellites for satellite communication and explain with a real time application.	06+02	Creating	BTL6
	b	Choose on application and recommend the implementation of blue tooth technique and explain its working principle.	7		
4		**Interpret the protocol** architecture of GSM services in detail.	15	Creating	BTL6