SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF INFORMATION TECHNOLOGY

QUESTION BANK

III SEMESTER- SECOND YEAR

1908303- ANALOG AND DIGITAL COMMUNICATION

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DEPARTMENT OF INFORMATION TECHNOLOGY

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SUBJECT : 1908303 - ANALOG AND DIGITAL COMMUNICATION

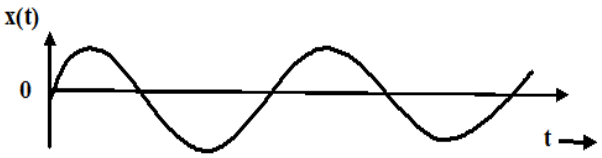
SEM / YEAR : III SEMESTER/ SECOND YEAR

UNIT -I ANALOG COMMUNICATION

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

PART – A

Q. No	Questions	Competence	BT Level
1.	**What is** the need for modulation?	Remembering	BTL1
2.	**Define** amplitude modulation.	Remembering	BTL1
3.	**Define** modulation index.**(OR) Define** the Degree of modulation in AM	Remembering	BTL1
4.	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
5.	**Plan** the bandwidth which is needed to transmit voice signal of 4kHz, use AM.	Creating	BTL6
6.	The output voltage of a transmitter is given by $500(1+0.4\sin 3140t)\sin 6.28\times10^7 t$. **Find** the carrier frequency and modulating frequency.	Applying	BTL3
7.	In an amplitude modulation system, the carrier frequency is f_c= 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.	A carrier of 10MHz frequency and peak value of 10 V is amplitude modulated by a 5 KHz sine wave of 6 V amplitude. **Find** the modulation index.	Evaluating	BTL5
9.	**Define** amplitude and angle modulation.	Understanding	BTL2
10.	**Write down** the mathematical expression for angle modulated wave.	Remembering	BTL1
11.	**Plot** the FM waveform for the given message using a sine wave carrier.	Understanding	BTL2

			
12.	**Differentiate** between narrow band and wide band FM signal.	Analysing	BTL4
13.	**Draw** the phasor diagram of narrow band FM.	Applying	BTL3
14.	**What** is the relationship between PM and FM?	Analysing	BTL4
15.	**Find** the modulating frequency and maximum deviation of the PM wave represented by $v(t) = 12\sin(6x10^8t + 5\cos 1250t)$.	Applying	BTL3
16.	**Design** the bandwidth of FM signal if the frequency deviation of the modulator is 25kHz per Volt?	Creating	BTL6
17.	**Distinguish** between frequency and phase modulation.	Analysing	BTL4
18.	**State** the advantages of FM modulation.	Understanding	BTL2
19.	**Describe** Carson's rule.	Understanding	BTL2
20.	**Draw** the Schematic of generating FM signal using Phase Modulator.	Remembering	BTL1
21.	**What** is the **purpose** of limiter in FM receiver?	Understanding	BTL2
22.	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
23.	**How** the pre-emphasis and de-emphasis circuit improve the performance of FM?	Remembering	BTL1
24.	In an FM wave, frequency deviation is 25 kHz. **What** maximum phase deviation does this represent if the modulating signal has 100Hz frequency?	Analysing	BTL4

PART – B

Q. No		**Questions**		**Competence**	**BT Level**
1.	With the help of mathematical expression **explain** about amplitude modulation, its generation and detection.		13	Understanding	BTL2
2.	**(i)**	**Develop** the expression for instantaneous voltage of AM wave.	06	Applying	BTL3
	(ii)	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		
3.	**(i)**	The output modulated wave of a standard AM transmitter is represented $S(t) = 500(1+0.4\sin 3140t)\cos(6.28x10^7)t$. 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
	(ii)	**Derive** efficiency ή of standard AM and show that for a single tone AM, $ή_{max}$ =33.3% at m=1.	07		
4.	An audio frequency signal 10 sin (2×3.14× 500)t is used to amplitude modulate a carrier of 50 sin($5\times3.14\times10^5$)t. **Calculate and Analyse** (i) Modulation index		02	Analysing	BTL4

	(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 03 03 03		
5.	**(i)**	**Compare** the performance of AM, DSB-SC system in terms of BW, power, frequency spectrum, phasor diagram and efficiency.	07	Applying	BTL3
	(ii)	**Explain** how an AM wave is demodulated using envelope detector and derive the expression for RC time constant.	06		
6.	One input of an AM modulator is a 500 kHz carrier with peak amplitude of 20 Vp. The second input is a 10 kHz modulating signal that is of sufficient amplitude to cause a peak change in the output wave of ±7.5 V. **Determine** the following: i)Lower and upper side frequencies ii)Modulation index iii)The peak amplitude of the modulated carrier, the upper and lower side frequencies iv)Maximum and minimum amplitudes of the AM envelope v)The expression for the modulated AM wave.		 02 02 04 02 03	Applying	BTL3
7.	**Explain** the operation of Super heterodyne receiver with neat block diagram.		13	Understanding	BTL2
8.	**(i)**	**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
	(ii)	**Describe** the frequency modulation and phase modulation and their inter-relationship.	09		
9.	**(i)**	**Derive** for carrier power and transmitter power in AM in terms of modulation index.	06	Remembering	BTL1
	(ii)	**Describe** the average power required for an angle modulated wave with mathematical expression.	07		
10.	**(i)**	**Draw** the phasor diagram of wide band FM and explain about the bandwidth of FM Signal.	07	Remembering	BTL1
	(ii)	**Explain** the difference between phase modulation and frequency modulation	06		
11.	**(i)**	**Obtain** the mathematical expression for power and efficiency of an AM.	06	Evaluating	BTL5
	(ii)	**Derive** the mathematical expression for FM system using Bessel function**.**	07		
12.	**Discuss** about generation of FM by direct method and write its characteristics of FM signal.		13	Understanding	BTL2
13.	**Draw** the block diagram of Armstrong indirect FM transmitter and describe its operation.		13	Remembering	BTL1
14.	**(i)**	**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

	(ii)	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		
15.	**Discuss** about demodulators which demodulate the FM wave.		13	Remembering	BTL1
16.	**(i)**	**Compare** wide band and narrow band FM system.	06	Understanding	BTL2
	(ii)	**Explain** the detection of FM using PLL detector.	07		
17.	**Compare** AM, FM and PM.		13	Analysing	BTL4

PART – C

Q. No		Questions		Competence	BT Level
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. **Determin**e 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 04 03	Evaluating	BTL5
2.	**(i)**	For an AM DSBFC transmitter with an unmodulated carrier power P_c=100 W that is modulated simultaneously by three modulating signals with coefficients of modulation m_1= 0.2, m_2= 0.4, m_3=0.5, **determine**: 1)Total coefficient of modulation 2)Upper and lower sideband power 3)Total transmitted power	08	Evaluating	BTL5
	(ii)	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.	07	Evaluating	BTL5
3.	**Design** a FM broadcasting station by identifying the blocks involved in that. Discuss the generation, theory involved in the WBFM and NBFM.		15	Creating	BTL6
4.	**(i)**	A FM radio link has a frequency deviation of 30kHz.The modulating frequency is 3kHz.**Find** the bandwidth needed for the link.	03	Creating	BTL6
	(ii)	An angle modulated signal has the form $v(t)=100\cos[2\pi f_c t+4\sin 2000\pi t]$ where f_c=10MHz. **Find** : (a) The Average transmitted power (b) Peak phase deviation (c) Peak frequency deviation (d) Is this FM or a PM signal? Explain	 02 03 03 04		

5.	**(i)**	Consider an angle modulated signal $x(t) = 3\cos[2\pi\times10^6 t + 2\sin(2\pi\times10^3 t)]$. **Find** its (1) Instantaneous frequency at time t=0.25 ms and t=0.5 ms (2) Maximum phase deviation (3) Maximum frequency deviation	09	Evaluating	BTL5
	(ii)	**Determine** the peak frequency deviation and modulation index (m) for an FM modulator with a deviation sensitivity K_1=5 kHz/V and a modulating signal V(t)=2 cos(2π×2000t).	06		

UNIT -II PULSE COMMUNICATION

Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) - Comparison of various Pulse Communication System (PAM – PTM – PCM).

PART – A

Q. No	Questions	Competence	BT Level
1.	**What** is digital pulse modulation?	Understanding	BTL2
2.	**State** the sampling theorem for band limited signal of finite energy.	Applying	BTL3
3.	**Differentiate** natural and flat top sampling	Analysing	BTL4
4.	**Infer** about Quantization process.	Evaluating	BTL5
5.	**What** is quantization error?	Remembering	BTL1
6.	**Define** Nyquist theorem.	Remembering	BTL1
7.	**Prepare** the Nyquist rate for analog input frequency of a) 4kHz b) 10kHz.	Creating	BTL6
8.	**Define** Aliasing and Aperture effect.	Remembering	BTL1
9.	For the signal m (t) = 3 cos 500 *3.14t + 4 sin 1000*3.14 t, **Determine** the Nyquist sampling rate.	Evaluating	BTL5
10.	**Infer** about PAM.	Understanding	BTL2
11.	**Define** quantization error?	Understanding	BTL2
12.	**Why** do we encounter aperture effect in PAM? How will you rectify it?	Analysing	BTL4
13.	**Develop** the PWM and PPM waveforms.	Creating	BTL6
14.	**Identify** the steps in pulse code modulation	Remembering	BTL1
15.	In PCM, **why** flat top sampling is preferred over natural sampling?	Analysing	BTL4
16.	**How** many bits are required to represent a sample in a PCM system with 32 quantisation levels?	Applying	BTL3
17.	**Illustrate** the regenerative repeaters	Applying	BTL3
18.	**What** is the necessity of companding?	Remembering	BTL1
19.	**Illustrate** about companding	Applying	BTL3
20.	**Define** overload distortion.	Understanding	BTL2
21.	**What** is nonuniform or nonlinear encoding?	Understanding	BTL2

22.	**List** the advantages of PCM.		Remembering	BTL1
23.	Mention **how** PPM is derived from PWM		Analysing	BTL4
24.	**Interpret** the advantages of PWM?		Evaluating	BTL5
	PART – B			
Q. No	**Questions**		**Competence**	**BT Level**
1.	**Explain** in detail the Nyquist criterion for distortion less transmission of baseband PAM signal.	13	Applying	BTL3
2.	**Discuss** about the generation and demodulation of PAM signal with necessary waveforms.	13	Understanding	BTL2
3.	**Explain** quantization process in detail and derive the expression for output signal to noise ratio of uniform quantizer.	13	Analysing	BTL4
4.	**(i)** **What** are the types of sampling? Explain the operation of the sample and hold circuit.	07	Understanding	BTL2
	(ii) **Describe** the generation and demodulation of PPM signal with necessary waveforms.	06		
5.	**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.	13	Remembering	BTL1
6.	**Explain** about various operations performed in the transmitter and receiver of PCM system.	13	Applying	BTL3
7.	**What** is companding? Explain in detail Analog and digital companding.	13	Remembering	BTL1
8.	**Compare** the various Pulse modulation techniques	13	Analysing	BTL4
9.	**(i)** 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.	03	Evaluating	BTL5
	(ii) An audio signal, S(t)= 3 cos (2×3.14×500 t) is quantized using 10bit PCM. **Determine** the signal to quantization noise ratio.	10		
10.	**Explain** the generation of PCM signal with a block diagram.	13	Remembering	BTL1
11.	**Analyse 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	Analysing	BTL4
12.	For a PCM system with the following parameters, **determine** (i) Minimum sampling rate (ii) Minimum number of bits used in the PCM code (iii) Resolution and (iv) Quantization error Maximum analog input frequency = 4 KHz Maximum decoded voltage at the receiver = ± 2.55 V Minimum dynamic range = 46 dB.	03 03 03 04	Evaluating	BTL5

13.	**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.		13	Creating	BTL6
14.	**What** is DPCM? Explain its principle with neat block diagram.		13	Understanding	BTL2
15.	**(i)**	**Derive** the expression for signal to noise ratio in a 3 bit PCM coding.	07	Understanding	BTL2
	(ii)	With suitable block diagram **explain** the operation of digitally companded PCM system.	06		
16.	**(i)**	**Draw** the block diagram for simplex PCM transmission system and explain its operation.	08	Remembering	BTL1
	(ii)	**Explain** the working of differential pulse code modulation.	05		
17.	**(i)**	**Draw** the schematic of PCM and explain the sampling and quantization blocks in detail.	10	Applying	BTL3
	(ii)	A PCM scheme transmits the signal at a rate 64 kbps. If it uses 8 bits/sample, **calculate** the sampling rate and minimum frequency that can be present in its input to reconstruct the same without any error.	03		

PART – C

Q.No	**Questions**			**Competence**	**BT Level**
1.	**(i)**	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
	(ii)	**How** aliasing effects can be overcome.	06		
	(iii)	**How** is the PCM different from PAM?	06		
2.	**Explain** in detail the Delta modulation transmitter and Receiver.		15	Creating	BTL6
3.	**Describe** the operation of DPCM system with a relevant diagram.		15	Evaluating	BTL5
4.	**Illustrate** the concepts of PWM in detail.		15	Creating	BTL6
5.	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 100 Hz and an amplitude range of -10 to +10 volts. **Determine** (i) The maximum sampling rate required. (ii) The number of bits in each PCM word. (iii) The minimum bit required in the PCM signal. (iv) The minimum absolute channel bandwidth required for the transmission of the PCM signal.		 03 04 04 04	Evaluating	BTL5

UNIT –III DIGITAL COMMUNICATION

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK)–Phase Shift Keying (PSK) – BPSK – QPSK - 8PSK.Comparison of various Digital Communication System (ASK – FSK – PSK).

PART A

Q. N0	**Questions**	**Competence**	**BT Level**
1.	**Define** Digital Modulation and list out the types of Digital modulation.	Remembering	BTL1

2.	**State Baud** rate and Bit rate.	Remembering	BTL1
3.	**Define** Bandwidth efficiency	Remembering	BTL1
4.	**Sketch** the digitally modulated waveforms for the binary data 1011001 using ASK and FSK.	Creating	BTL6
5.	**Define** peak frequency deviation for FSK.	Understanding	BTL2
6.	**Write down** the expression for peak frequency deviation of FSK.	Applying	BTL3
7.	**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
8.	**Why** is FSK and PSK signals are preferred over ASK signals?	Analysing	BTL4
9.	**Describe** the constellation diagram of ASK, FSK signal.	Understanding	BTL2
10.	**Draw** the FSK and PSK waveforms of the bit stream 101.	Remembering	BTL1
11.	**Draw** the constellation diagram of PSK, QPSK signal.	Applying	BTL3
12.	For an 8PSK system, the operating with an information bit rate of 24 kbps, **determine** bandwidth efficiency.	Evaluating	BTL5
13.	For 16 PSK and a transmission system with a 10kHZ bandwidth. **Find** the maximum bit rate.	Evaluating	BTL5
14.	**Draw** the BPSK signal for the given input bit stream 101010.	Applying	BTL3
15.	**Sketch** the QPSK signal for the binary sequence 11001100 .	Creating	BTL6
16.	**Compare** the average power requirements of QPSK and BPSK.	Analysing	BTL4
17.	**Differentiate** between BPSK from QPSK.	Analysing	BTL4
18.	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
19.	**What** do you meant by I,Q& C Channels?	Remembering	BTL1
20.	**Distinguish** between standard FSK and MSK.	Analysing	BTL4
21.	**What** is DPSK?	Understanding	BTL2
22.	**What** is M-ary encoding?	Understanding	BTL2
23.	**Give** any two applications of DPSK.	Understanding	BTL2
24.	**What** is Eye-pattern?	Remembering	BTL1

PART B

Q. NO		**Questions**		**Competence**	**BT Level**
1.	**(i)**	**Explain** the working principle of ASK with block diagram	10	Remembering	BTL1
	(ii)	**Calculate** Baud rate and Bit rate for ASK	03		

2.		**Describe** the generation and detection of binary FSK signal with necessary diagram and equation.	13	Understanding	BTL2
3.		**Draw** and explain the operations of FSK modulator and explain about coherent and Non-coherent demodulators.	13	Remembering	BTL1
4.		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.	13	Understanding	BTL2
5.	**(i)**	**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.	03	Applying	BTL3
	(ii)	**Explain** about DPSK.	10		
6.	**(i)**	**Write** short notes on the spectrum and bandwidth of FSK.	08	Understanding	BTL2
	(ii)	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		
7.	**(i)**	**Explain** the working of BPSK transmitter and receiver with necessary equation and block diagram.	06	Analysing	BTL4
	(ii)	**Differentiate** coherent and non-Coherent detection	02		
	(iii)	**Compare** the various digital communication systems.	05		
8.		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 (Assume f= 5MHz)	13	Applying	BTL3
9.		**Explain** the generation and reception of binary phase shift keying signal with necessary block diagram.	13	Evaluating	BTL5
10.		**Draw** the constellation diagram of QPSK modulation and explain QPSK modulation and QPSK demodulation.	13	Remembering	BTL1
11.	**(i)**	**Draw** the ASK, FSK and BPSK wave forms for the bit stream 10110001	06	Applying	BTL3
	(ii)	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		
12.	**(i)**	For a QPSK modulator with an input data rate equal to 10Mbps and a carrier frequency of 70MHz, **find** the minimum double sided Nyquist bandwidth and baud.	07	Analysing	BTL4
	(ii)	**Compare** QPSK and BPSK.	06		
13.		**Design** bandwidth efficiency of M-ary PSK and compare it with other M-ary PSK schemes.	13	Creating	BTL6
14.		**Draw** the QPSK and 8-PSK wave forms for the bit stream 1001110001010101 Note: If needed discard the bits to a minimum extend.	13	Remembering	BTL1

15.	**(i)**	**Explain** the relationship between the minimum bandwidth required for a QPSK system and the bit rate.	07	Understanding	BTL2
	(ii)	**Summarize** about the operation of 8 PSK system.	06		
16.	**(i)**	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, and QPSK.	06	Evaluating	BTL5
	(ii)	**Determine** the baud, minimum bandwidth and bandwidth efficiency for an 8-PSK system operating with an information bit rate of 24kbps.	07		
17.	**Compare** and contrast the various Digital Communication systems.		13	Analysing	BTL4

PART – C

Q. NO		**Questions**		**Competence**	**BT Level**
1.	**Draw** the block diagram of FSK receiver and explain the operation. Determine the following : (i) peak frequency deviation (ii) minimum bandwidth (iii) Baud for FSK signal with a mark frequency of 49 kHz, space frequency of 51 kHz, and input bit rate of 2 kbps.		15	Evaluating	BTL5
2.	**(i)**	**Compare t**he various digital modulation schemes	08	Creating	BTL6
	(ii)	**List** out its merits over PSK,	07		
3.	With relevant expression and figure, **describe** QPSK transmitter, QPSK receiver and bandwidth consideration of QPSK.		15	Evaluating	BTL5
4.	**(i)**	In a digital CW communication system, the bit rate of a bipolar NRZ data sequence is 1 Mbps and carrier frequency is 100 MHz. **find** the symbol rate of transmission and the bandwidth requirement of the communications channel in the following cases of different techniques used. (i) BPSK system (ii) QPSK system (iii) 16-ary PSK system	10	Creating	BTL6
	(ii)	**Compare** the bit error performance for PSK, DPSK and FSK.	05		
5.	**(i)**	A data bit sequence consists of the following strings of bits 10111010.**Develop** and draw the nature of wave form transmitted by BPSK transmitter	06	Evaluating	BTL5
	(ii)	**Illustrate** the concept of generation and demodulation of PPM with block diagram.	09		

UNIT –IV DATA COMMUNICATION

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	Questions	Competence	BT 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.	**Interpret** about USRT, USART.	Evaluating	BTL5
7.	**Determine** the odd and even parity bits for the ASCII character R whose Hex code is 52.	Evaluating	BTL5
8.	**Define** DTE, DCE.	Remembering	BTL1
9.	**Interpret** about any two function of UART.	Applying	BTL3
10.	**Illustrate** about Synchronous serial data	Understanding	BTL2
11.	**Illustrate** ESA.	Applying	BTL3
12.	**Discuss** about the responsibilities of IAB.	Creating	BTL6
13.	**List** out the components of communication circuits.	Applying	BTL3
14.	**Classify** the types of transmission medium	Analysing	BTL4
15.	**Give** the problems with Boudot code	Creating	BTL6
16.	**Infer** the ASCII code.	Understanding	BTL2
17.	**Differentiate** the synchronous and Asynchronous modems.	Analysing	BTL4
18.	**Write** the some commands for modem control.	Remembering	BTL1
19.	**Illustrate** about the error control	Applying	BTL3
20.	**Define** burst error.	Remembering	BTL1
21.	**Point** out the redundancy check types.	Remembering	BTL1
22.	**Classify** the different types of data communication codes.	Analysing	BTL4
23.	**What** is meant by data communication equipment	Remembering	BTL1
24.	**Determine** the noise margins for an RS-232 interface with driver signal voltages of ±6 V	Evaluating	BTL5

PART –B

Q. No		Questions		Competence	BT Level
1.		**Explain** the data communication network architecture protocols and standards in details.	13	Understanding	BTL2
2.		**Briefly** explain about the OSI-reference models	13	Remembering	BTL1
3.		**Analyse** about the network topologies in data communication.	13	Analysing	BTL4
4.		**Asses** the functions of synchronous and asynchronous transmissions.	13	Evaluating	BTL5
5.	**(i)**	**Interpret** in detail about the Standards Organizations for Data Communication.	7	Applying	BTL3
	(ii)	**Explain** the concept of Data communication circuits using a basic block diagram.	6		
6.	**(i)**	**Discuss** in detail about the standards organization for Data communication	06	Understanding	BTL2

	(ii)	**Describe** the following data communication codes: Baudot, ASCII and EBCDIC.	07		
7.	**(i)**	**Explain** the working of a simplified two-station data communication circuits. Explain the various data transmission modes.	08	Evaluating	BTL5
	(ii)	Briefly **write** on standard organisations for data communication.	05		
8.	**Illustrate** the principles of different types of modems.		13	Applying	BTL3
9.	**(i)**	**Explain** the working of two station data communication circuit with a block diagram.	07	Creating	BTL6
	(ii)	**Discuss** the various data communication codes and its significance.	06		
10.	**(i)**	**Describe** the following data communications code :Baudot, ASCII and EBCDIC	06	Remembering	BTL1
	(ii)	**Draw** the block diagram of Data Communication system and explain	07		
11.	**Discuss** the various data communication codes and its significance.		13	Understanding	BTL2
12.	**(i)**	**Describe** the two method of error correction in data communication.	07	Applying	BTL3
	(ii)	**Demonstrate** the working of two station data communication circuit with a block diagram	06		
13.	**List** out the various data communication codes that are popularly employed. Also analyse the merits and demerits of them.		13	Analysing	BTL4
14.	**Explain** the data communication hardware with neat block diagram and explain all devices.		13	Remembering	BTL1
15.	**Infer** about the following :			Analysing	BTL4
	(i)	Data communications hardware.	07		
	(ii)	Serial and parallel interface	06		
16.	**Explain** in details the RS-232 interface.		13	Understanding	BTL2
17.	**Discuss** about the serial and parallel interfaces with suitable example.		13	Remembering	BTL1
	PART –C				
1.	**Name** the types of errors detection methods and explain with examples.		15	Evaluating	BTL5
2.	**(i)**	**Explain** elaborately error correction methods.	08	Creating	BTL6
	(ii)	**Explain** UART with its line control unit interface diagram.	07		
3.	**Evaluate** the RS-232 interface performance with logic level and noise margin diagram.		15	Evaluating	BTL5
4.	**Explain** the concept of Data communication circuits using a basic block diagram.		15	Creating	BTL6
5.	**(i)**	**Evaluate** the BCS for the following data and CRC-generating polynomials: Data $G(x)=x^{10}+ x^9+ x^7+ x^5+ x^3+ x^2+ x^1+ x^0$	07	Evaluating	BTL5
	(ii)	**Draw** the block diagram version of the BCS generator for the data $G(x)=x^{10}+ x^9+ x^7+ x^5+ x^3+ x^2+ x^1+ x^0$ and the CRC generating polynomials. List the content of the shift registers after every data shift.	08		
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. case study - Cellular Concept-1G,2G,3G,4G					
PART –A					

Q. No	Questions	Competence	BT Level
1.	**Define** Entropy.	Remembering	BTL1
2.	**Write** down the expression for entropy	Understanding	BTL2
3.	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	Evaluating	BTL5
4.	**Find** the entropy of the source $X=\{x_1,x_2\}$ with the equal message probabilities.	Creating	BTL6
5.	**Point out** the properties of mutual information.	Analysing	BTL4
6.	**Define** channel capacity of a discrete memory less channel	Remembering	BTL1
7.	**Interpret** about FEC	Applying	BTL3
8.	**What** is error control code?	Understanding	BTL2
9.	**Demonstrate** about linear block codes?	Applying	BTL3
10.	**Conclude 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.	Evaluating	BTL5
11.	**Show that** C= {000,001,101} is not a linear code.	Applying	BTL3
12.	**Give** the error correcting capability of a linear block code.	Remembering	BTL1
13.	**When** a binary code is said to be cyclic code?	Analysing	BTL4
14.	**Point out** the properties of cyclic codes.	Analysing	BTL4
15.	**What** is prefix coding?	Understanding	BTL2
16.	**Illustrate** about code redundancy	Applying	BTL3
17.	**How** can the information capacity of the channel can be improved?	Analysing	BTL4
18.	**What is meant by** code variance	Understanding	BTL2
19.	**Define** syndrome	Remembering	BTL1
20.	**What** is Hamming code?	Understanding	BTL2
21.	**Evaluate** the hamming weight of 10110 and the hamming distance between 1010 and 0000.	Evaluating	BTL5
22.	**Check** and modify LBC (6,3) for hamming, when d_{min} is 4.	Creating	BTL6
23.	**What** are the various handovers carried out in GSM?	Remembering	BTL1
24.	**List** the advantage of cell splitting concept?	Remembering	BTL1

PART –B

Q. No		Questions		Competence	BT Level
1.	(i)	**State** the Source coding theorem and explain.	06	Remembering	BTL1
	(ii)	**Describe** the properties of mutual information	07		
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 messages	04 04	Analysing	BTL4

	emitted by the source are statistically independent. Determine code words for the message using Shannon Fano Algorithm and Huffman. **Compare** their efficiency.	05		
3.	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
4.	**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	Applying	BTL3
5.	**(i)** **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
	(ii) **Describe** the concepts of channel capacity	03		
6.	**State** the relationship between mutual information and channel capacity and also derive the expression for mutual information.	13	Remembering	BTL1
7.	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	Applying	BTL3
8.	**Analyse** and construct an Encoder for (7,4) Linear block code and also construct a suitable syndrome decoder for the same and explain.	13	Analysing	BTL4
9.	For a (6,3) systematic linear block code, the three parity-check bits c_4,c_5 and c_6 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 06 04	Evaluating	BTL5
10.	**(i)** **Write** short notes on Linear block code.	07	Understanding	BTL2
	(ii) **Summarize** the detection of error with the help of syndrome and vector error.	06		
11.	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	Analysing	BTL4
12.	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

13.	**(i)**	**Design** 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	Creating	BTL6
	(ii)	**Design** a cyclic encoder for the same (7,4) cyclic code and obtain code vector for the message vector 1100.	06		
14.	**Explain** the concept of code generation and decoding of convolutional code.		13	Remembering	BTL1
15.	**Write short notes** on Cellular Concept-1G,2G,3G,4G.		13	Understanding	BTL2
16.	**Describe** the architecture of GSM with a neat diagram.		13	Remembering	BTL1
17.	**Explain** the concept of cellular topology and cell fundamentals with examples.		13	Understanding	BTL2

PART –C

Q. No	**Questions**			**Competence**	**BT Level**
1.	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}. **Encode** the source symbols using binary encoder and Shannon-Fano encoder and compare its efficiency.		15	Evaluating	BTL5
2.	**(i)**	A voice grade telephone channel has a band width of 3400 Hz. If the Signal to Noise Ratio (SNR) on the channel is 30 dB, **determine** the capacity of the channel. If the above channel is to be used to transmit 4.8 kbps of data determine the minimum SNR required on the channel.	07	Evaluating	BTL5
	(ii)	A black and white TV picture consists of about 2×10^6 picture elements with 16 different brightness levels, with equal probabilities. If pictures are repeated at the rate of 32 per second, calculate the average rate of information conveyed by this TV picture source. If SNR is 30 dB, **what** is the maximum bandwidth required to support the transmission of the resultant video signal.	08		
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	BTL6
4.	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) **Find** the generator matrix G (ii) List all the code vectors. (iii) What is the minimum distance between code vectors? (iv) How many errors can be detected? How many errors can be corrected?		15	Evaluating	BTL5
5.	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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