Time: 3 Hrs.]

[Max. Marks   70
[Min. Pass Marks: 22

TOTAL NO. OF QUESTIONS IN THIS PAPER : 0$

Note: Make suitable assumptions wherever required and clearly mention them.

S.No		Questions	Marks	CO	BL	PI
Q.1	(a)	Define (i) Discrete entropy H (X) and joint entropy H (X,Y) and (ii) Mutual information I(X;Y).	(2)	1	1	1
	(b)	(i)What is the channel capacity of a binary symmetric channel with error probability 0.01?	(2)	1	2	1
	(c)	(i)Derive an expression for the capacity of a band-limited AWGN channel . (ii) Show that I (X;Y) = H (X)+ H (Y) - H (X,Y).	(3)	1	2	1
	(d)	(i)A Communication System has $\frac{S}{N}$=31 and BW=3KHz. Find the allowable percentage reduction in Signal power if BW is increased to 3.5 Khz. (ii) The voice Frequency modulating signal of a PCM System is quantized in 8 levels with following probabilities $\quad p_1 = p_2 = p_3 = p_4 = 0.15 \ and \ p_5 = p_6 = p_7 = p_8 = 0.1$ Calculate Entropy and information rate . Assume $f_m = 3KHz$.	(3) + (4)	1 1	3 4	2 2
		OR				
	(e)	Consider that two sources emit messages $x_1, x_2, x_3 \ and \ y_1, y_2, y_3$ with the joint probabilities p (X, Y) as shown in the matrix form: $$P\left(\frac{X}{Y}\right) = \begin{bmatrix} 0.2 & 0.1 & 0 \\ 0.1 & 0.2 & 0.1 \\ 0 & 0.1 & 0.2 \end{bmatrix}$$ (i)Calculate the entropies of X and Y. (ii) Calculate the joint and conditional entropies, H (X,Y), H (X/Y), H(Y/X) between X and Y (iii) Calculate the average mutual information I(X;Y).	(7)	1	4	1
Q.2	(a)	What is coding efficiency? Show that the coding efficiency is maximum when P(0)=P(1).	(2)	2	1	1
	(b)	What is parity check Matrix and how it is used ?	(2)	2	1	1
	(c)	What is source coding? Define code length & code efficiency. Give the relation between it..	(3)	2	1	1
	(d)	A (7, 4) cyclic code has a generator polynomial $$g(X) = X^3 + X + 1$$ (i)Find all the code words. (ii) Find generator and parity check matrices in systematic form.	(7)	2	3	2
		OR				
	(e)	Consider a (7,4) linear block code whose generator matrix is given 1 0 0 0 : 0 1 1 0 1 0 0 : 1 0 1 0 0 1 0 : 1 1 0 0 0 0 1: 1 1 1 (i)Find the parity check matrix.	(7)	2	3	2

		(ii) Find the minimum distance of the code. (iii) Draw the encoder and syndrome computation circuit.				
Q.3	(a)	Assume six telephone sets connection provided by BSNL company, the connectivity is provided using Mesh Topology. Calculate (i) total number of cables required to provide connectivity among them. (ii) In case of maximum efficiency what will the total number of active links?	(2)	3	3	1
	(b)	What is the required bandwidth of a Low pass channel if we need to send 1 Mbps by using Baseband Transmission. The loss in a cable is (-0.3dB/Km), the signal at the beginning has a power of 2mW, what is the power of the signal at 5Km?	(2)	3	3	2
	(c)	What is the difference between a port address, a logical address and a physical address? Name the layers at which they are used with suitable Frame diagrams.	(3)	3	2	1
	(d)	What is the need for scrambling? What is the result of scrambling the sequence 1100001000000000 using HDB3? (number of non zero pulses after last substitution is even).	(7)	3	3	1
		OR				
	(e)	What are the different causes of signal impairments? How these effects can be reduced?	(7)	3	2	1
Q.4	(a)	Explain Wavelength Division Multiplexing (WDM) and one of its application.	(2)	4	2	1
	(b)	Calculate the data rate for DS0 voice channel.	(2)	4	1	1
	(c)	Assume that a voice channel occupies a bandwidth of 4KHz. It is needed to combine three voice channels into a link with a bandwidth of 12 KHz, from 20 to 32 KHz. Assuming a spectrum for each of the signals, show the configuration in the frequency domain with no guard bands.	(3)	4	3	2
	(d)	Explain Direct-Sequence Spread Spectrum (DSSS) technique.	(7)	4	2	1
		OR				
	(e)	Explain Time Division Multiplexing Technique. Four 1-Kbps connections are multiplexed together. A unit is 1 bit. Find (i) Duration of 1 bit before multiplexing. (ii) The transmission rate of the link.	(7)	4	2,3	1
Q. 5	(a)	Explain the need for switching in case of Public Switched Telephone Network (PSTN).	(2)	5	2	1
	(b)	Why Quadrature Amplitude Modulation (QAM) is used in most of the modern Dial-up Modems?	(2)	5	2	1
	(c)	Calculate the upstream and downstream data rate for Asymmetric Digital Subscriber Line (ADSL).	(3)	5	1	1
	(d)	Give an overview of ISDN architecture.	(7)	5	1	1
		OR				
	(e)	Explain Circuit Switching and Packet Switching used for voice and data communication respectively.	(7)	5	1	1