Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **B.Tech.**
PCEC4305

6th Semester Back Examination 2017-18
DIGITAL COMMUNICATION TECHNIQUES
BRANCH : ECE, ETC, ITE
Time : 3 Hours
Max Marks : 70
Q.CODE : C277

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1. **Answer the following questions :** **(2 x 10)**

a) What is eye pattern? What is the impact of ISI on eye opening?

b) A binary symmetric channel (BSC) has a transition probability of 1/8. If the binary transmit symbol X is such that P(X=0)=9/10, then what will be the probability of error for an optimum receiver. ?

c) List out the four beneficial attributes of spread spectrum systems

d) The input to a matched filter is given by $s(t) = \begin{cases} 15\sin(4\pi \times 10^6 t), & 0 < t < 10^{-4} sec \\ 0, otherwise \end{cases}$,
Then what will be the peak amplitude of the filter output?

e) Sketch the signal space diagram for a π/4-QPSK signal.

f) In a baseband communication link, frequencies up-to 3500 Hz are used for signaling. Using a raised cosine pulse with 50% excess bandwidth and for no inter-symbol interference, what will be the maximum possible signaling rate in symbol per second?

g) What is WMF and what is its significance?

h) Let $g(t) = e^{-2\pi t^2}$ and h(t) is a filter matched to g(t) . If g(t) is applied as input to h(t), then find the Fourier transform of the output

i) Differentiate between baseband equalizer and pass-band equalizer

j) A communication channel with AWGN operating at a signal to noise ratio SNR >>1, bandwidth B and capacity C_1. If the SNR is tripled keeping B constant, what will be resulting capacity C_2?

Q2. **a)** Derive the discrete components of the power spectral density of a digitally modulated signal with memory. **(5)**

b) Digital information is to be transmitted by carrier modulation through an additive Gaussian noise channel with a bandwidth of 100 kHz and $N_0 = 10^{-10}$ W/Hz. Determine the maximum rate that can be transmitted through the channel for four-phase PSK, binary FSK, and four-frequency orthogonal FSK, which is detected non-coherently. **(5)**

Q3. **a)** A speech signal is sampled at a rate of 8 kHz, and then encoded using 8 bits per sample. The resulting binary data are then transmitted through an AWGN baseband channel via M-level PAM. Determine the bandwidth required for transmission when (i) M = 4 (ii) M = 8 **(5)**

b) A digital communication system consists of a transmission line with 100 digital (regenerative) repeaters. Binary antipodal signals are used for transmitting the information. If the overall end-to-end error probability is 10^{-6}, determine the probability of error for each repeater and the required E_b/N_0 to achieve this performance in AWGN. **(5)**

Q4. **a)** Consider a binary digital communication system with equal likely 0's and 1's. When binary 0 is transmitted the voltage at the detector input can lie between the levels -0.25 V and + 0.25 V with equal probability, but when binary 1 is transmitted the voltage at detector can have any value between 0 and 1 V with equal probability, If the detector has a threshold of 0.2 volt, then find the average bit error probability. **(5)**

b) A discrete-time memory-less Gaussian source with mean 0 and variance σ^2 is to be transmitted over a binary symmetric channel with crossover probability ε. **(5)**

(i) What is the minimum value of the distortion attainable at destination?

(ii) If the channel is discrete-time memory-less additive Gaussian noise with input power P and noise power $\sigma^2 n$, what is the minimum attainable distortion?

(iii) If channel is not memory-less, then what will happen to distortion in transmission over the channel and why?

Q5. **a)** Explain the performance characteristics of DFE and compare it with MLSE. **(5)**

b) A 4-kHz band-pass channel is to be used for transmission of data at a rate of 9600 bits/s. If $\frac{1}{2} N_0 = 10^{-10}$ W/Hz is the spectral density of the additive zero-mean Gaussian noise in the channel, determine the average power that achieves a bit error probability of 10^{-6}. Use a signal pulse with a raised cosine spectrum having a roll-off factor of at least 50 %. **(5)**

Q6. **a)** A rate $\frac{1}{2}$ convolutional code with $d_{free} = 10$ is used to encode a data sequence occurring at a rate of 1000 bits/s. The modulation is binary PSK. The DS spread spectrum sequence has a chip rate of 10 MHz **(5)**

i. Determine the coding gain.

ii. Determine the processing gain.

iii. Determine the interference margin assuming an $\varepsilon_b / J_o = 10$

b) Explain the System for acquisition of an FH signal **(5)**

Q7. Explain the generation of Gold and Kasami sequences with neat block diagram **(10)**

An FH binary orthogonal FSK system employs an m = 15 stage linear feedback shift register that generates a maximum-length sequence. Each state of the shift register selects one of L non-overlapping frequency bands in the hopping pattern. The bit rate is 100 bits/s and the hop rate is one hop per bit. The demodulator employs non-coherent detection.

(a) Determine the hopping bandwidth for this channel.

(b) What is the processing gain?

(c) What is the probability of error in the presence of AWGN?

Q8. **Write short answer on any TWO :** **(5 x 2)**

a) Differentially Encoded PSK Signaling

b) DSSS and FHSS

c) Optimum detector

d) WSS random process