

**B TECH**  
**(SEM VI) THEORY EXAMINATION 2017-18**  
**DIGITAL COMMUNICATION**

Time: 3 Hours

Total Marks: 100

- Note: 1. Attempt all Sections. If require any missing data; then choose suitably.  
2. Any special paper specific instruction.

## SECTION A

1. Attempt all questions in brief. 2 x 10 = 20

- a. What is base band and pass band signaling?
- b. Define linear time invariant system?
- c. Differentiate between wide sense stationary and strict sense stationary random process?
- d. For error free communication over a channel how channel capacity and entropies are being related?
- e. Compare the probability of error for ASK and BPSK modulation technique?
- f. Define the term processing gain?
- g. Sketch 1110010 waveform by using Manchester and NRZ(L) line coding scheme?
- h. What is slow and fast frequency hopping technique?
- i. How source coding is different to that of channel coding?
- j. What is AWGN channel?

## SECTION B

2. Attempt any three of the following: 10 x 3 = 30

- a. What is differential encoding? With suitable diagram explain DPSK modulator and demodulator?
- b. What is ISI? Explain how ISI can be removed by employing a raised cosine filter?
- c. Write down the characteristics and necessity of source coding in communication system? Consider a source with 03 messages having symbol probabilities 0.5, 0.4, 0.1. Obtain Shannon Fano code and calculate its coding efficiency?
- d. Differentiate between random variable and random process? A random variable has an exponential probability density function given by  $f(x) = ae^{-b|x|}$  where a and b are constant. Find the relationship between a and b?
- e. A rate 1/3 convolutional encoder has generator matrix  $g_1=100, g_2=111, g_3=101$ 
  - i. Sketch the encoder
  - ii. Draw the code tree and trellis
  - iii. If input is 10110 determine the output?
- f. What is coherent and non-coherent reception technique? With a suitable detailed block diagram explain coherent digital receiver?

## SECTION C

3. Attempt any one part of the following: 10 x 1 = 10

- (a) With suitable diagram describe matched filter? Prove that output signal of a matched filter is proportional to a shifted version of the autocorrelation function of the input signal to which filter is matched?
- (b) What is the relevance of M-ary signaling? Explain M-ary PSK modulation

technique and draw its constellation diagram?

4. Attempt any *one* part of the following: 10 x 1 = 10

- (a) Write short note on
- i. Gaussian random variable
  - ii. Power spectral density for wide sense stationary random process
- (b) Explain how spread using CDMA technique can use spectrum communication for providing multipoint connectivity?

5. Attempt any *one* part of the following: 10 x 1 = 10

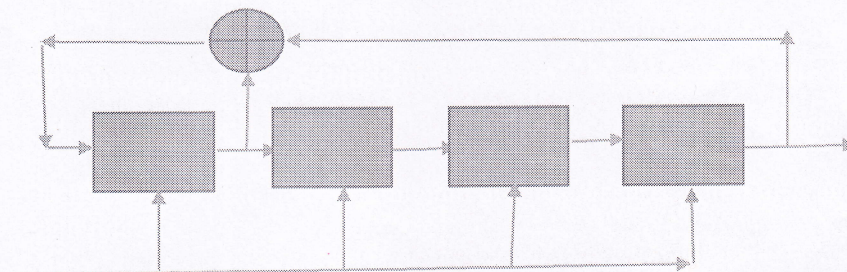
- (a) What is mutual information and how it is related to channel capacity. For a standard voice band communication channel the signal to noise ratio is 30dB and transmission bandwidth is 3KHz. What will be the Shannon limit for information in bits/sec?
- (b) An information source produces 8 different symbols with probability  $1/2, 1/4, 1/8, 1/16, 1/32, 1/64, 1/128, 1/256$  respectively. These symbols are encoded as 000,001,010,011,100,110 and 111 respectively.
- i. What is the amount of information per symbol?
  - ii. What is the probability of occurrence for 0 and 1?
  - iii. What is the efficiency of the obtained code?

6. Attempt any *one* part of the following: 10 x 1 = 10

- (a) Define the entropy? Prove the relationship between different entropies  
 $H(XY) = H(Y/X) + H(X)$
- (b) Design a block code with a minimum distance of three and a message block of eight bits?

7. Attempt any *one* part of the following: 10 x 1 = 10

- (a) What is Minimum Shift Keying Modulation (MSK) technique? Write down the difference between QPSK and MSK?
- (b) A P-N sequence is generated by using a feedback shift register of length four. Find the generated output sequence if the initial contents of the shift register are 1000. If the chip rate is  $10^7$  chip/sec. Calculate the chip and P-N sequence duration and period of output sequence?



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