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Sub Code: NEC602
Roll No.

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 x10 = 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 g1= 100, g2=111, g3=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 probability1/2, 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?