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20/11/23 (E)

(SE)

National Institute of Technology, Hamirpur (HP)

Name of Examination: BTech/DD (Nov 2023)

Branch : E&CE

Semester : 5th

Course Name : Digital Communication and Systems

Course Code : EC-312

Time: 2 Hours

Maximum Marks : 50

Note: 1) All questions are compulsory.

2) Assume suitable data where necessary, mention assumed data clearly.

Q.No.1.

a. A binary channel with bit rate $R_b = 3600$ bps is available for PCM voice transmission. Find the appropriate values of the sampling rate f_s , the quantization levels and number of binary digits required to transmit this PCM signal. Assume $f_m = 3.2$ KHz. (7)

b. Draw the BFSK transmitter structure, show its signal space representation and comment about probability of error in FSK in comparison with BPSK. (7)

Q.No.2.

a. A matched filter has the frequency response

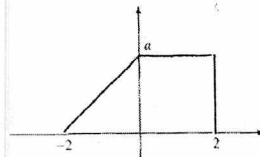
$$H(f) = \frac{1 - e^{-j2\pi f T}}{j2\pi f}$$

Determine the impulse response $h(t)$ corresponding to $H(f)$ and the signal waveform to which the filter characteristic is matched. (7)

b. Derive an expression for signal to thermal noise power in case of Delta Modulation. (7)

Q.No.3.

a. Derive Signal $X(t)$ has a bandwidth of 12,000 Hz, and its amplitude at any time is a random variable whose PDF is shown in Figure. We want to transmit this signal using a uniform PCM system.



i. Show that $a = 1/3$.

ii. Determine the power in $X(t)$.

iii. What is the SQNR in decibels if a PCM system with 32 levels is employed?

iv. What is the minimum required transmission bandwidth in Part iii? (7)

b. What do you understand by QAPSK? Show the signal space representation of 4-bit QAPSK and thus explain that probability of error is less in case of 4-bit QASK than 16-array QPSK. (7)

Q.No.4.

Draw Convolution Encoder for generator polynomials $g_1(x) = 1 + x + x^2$ and $g_2(x) = 1 + x^2$, Draw the State Transition Table and State Diagram of the Convolution Encoder and calculate the resulting output code word for the input polynomial 101011. (8)