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Reg. No. : ....

Name : ....

Sixth Semester B.Tech. Degree Examination, June 2015
(2008 Scheme)
08.604 : DIGITAL COMMUNICATION (T)

Time: 3 Hours Max. Marks: 100

PART – A

Answer **all** questions. **Each** question carries **4** marks.

1. Explain aliasing in digital communication.

2. Obtain the Nyquist rate and Nyquist interval for the following signals :

   a) $x(t) = \text{sinc}(400t)$

   b) $x(t) = \sin(200\pi t)\cdot\cos(400\pi t)$.

3. Define aperture effect. Calculate the amplitude distortion due to aperture effect for a flat top sampled system, which samples a signal of maximum frequency 2 Hz with 6 Hz sampling frequency. The duration of pulse is 0.2 sec.

4. Differentiate between DPCM and ADPCM.

5. Explain the properties of matched filters.

6. A signal, $s(t, a) = \begin{cases} as(t), & 0 \le t \le T \\ 0, & \text{elsewhere} \end{cases}$ where s(t) is completely known and the amplitude a is unknown. Find the maximum likelihood estimate of a in the presence of white Gaussian noise of zero mean and power spectral density No/2. What are the mean and variance of this estimate ?

7. Draw the signal space diagram of coherent QPSK system.

8. Explain how PN sequences are generated.

9. The direct frequency spread spectrum communication system has the following parameters. Data sequence bit duration = 8.096 μs, PN chip duration = 2 μs, E_b/No = 10 for an average probability of error less than 10^{-6}. Calculate the processing gain and jamming margin.

10. Binary data are transmitted over a microwave link at the rate of 10^7 bits per second and the power spectral density of the noise at the receiver input in 10^{-12} watts/Hz. Find the average carrier power required to maintain an average probability of error $P_e \leq 10^{-4}$ for coherent binary FSK. What is the required channel bandwidth ? **(10×4=40 Marks)**

PART – B

Answer **any two** questions from **each** Module. **Each** question carries **10** marks.

Module – I

11. a) Explain differential PCM.

    b) Derive the expression for SNR of a PCM system.

12. Explain the working of a ADPCM transmitter and receiver.

13. Derive the Nyquist criterion for distortionless transmission.

Module – II

14. Derive an expression for probability of error for BFSK. Explain the working of BFSK transmitter and receiver.

15. Consider the QPSK signal described by the signal constellation

$$\left\{\sqrt{E}\angle 0, -\sqrt{E}\angle\pi, \sqrt{E}\angle\pi/2, -\sqrt{E}\angle -\pi/2\right\}.$$

a) Sketch the waveforms for the inphase and quadrature components of this QPSK signal produced by the input binary sequence 1100100010.

b) Sketch the waveform of the QPSK signal for the binary sequence in Part (a), assuming that the carrier frequency is an integral multiple of the symbol rate $1/T$.

16. State the maximum aposteriori probability rule and describe how probability rule is applied in a maximum likelihood receiver.

Module – III

17. Explain maximum length codes and Gold codes. How they are generated ?

18. Derive the expression for processing gain of MFSK. A fast frequency hopping MFSK system has the following parameters. Number of bits per MFSK symbol = 8, number of hops per MFSK symbol = 8. Calculate the processing gain.

19. Write short notes on :

a) Diversity techniques

b) RAKE Receiver. **(10×6=60 Marks)**

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